**T.C.**
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**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

# A CONTENT-BASED WEB IMAGE RETRIEVAL SYSTEM FOR PERSON IDENTIFICATION STRUCTURED ON THE SSIM, PSNR AND SNR

**M.Sc. THESIS**

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Rawa Amjad AMIN
SIIRT - 2018

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## ABBREVIATIONS AND SYMBOLS

| **Abbreviations** | **Classification** |
|---|---|
| **SSIM** | : Structural Similarity Index Measure |
| **PSNR** | : Peak Signal Nois Ratio |
| **SNR** | : Signal Nois Ratio |
| **IR** | : Image Retrieval |
| **PI** | : Person Identification |
| **CBIR** | : Content based Image Retrieval |
| **DIP** | : Digital Image Processing |
| **MSE** | : Mean Squared Error |
| **JPEG** | : Joint Photographic Experts Group |
| **HVS** | : Human Visual Framework |
| **MS-SSIM** | : Multi-Scale Structural Similarity Index Measure |
| **IRMA** | : Image Retrieval in Medical Applications |
| **CAD** | : Computer-Aided Design |
| **IDEA** | : A method |

| **SYMBOLS** | **Discribtion** |
|---|---|
| $l$ | : Lumınance |
| C | : Controst |
| S | : Struct |
| $\mu$ | : Mean for Pixel population |
| $\sigma$ | : Standard deviation of X Images |
| L | : A constant |
| K | : A constant |
| $\alpha$ | : SSIM constant parameter |
| $\beta$ | : SSIM constant parameter |
| $\gamma$ | : SSIM constant parameter |
| $\sigma_{xy}$ | : Covariance between X and Y Images |

# ÖZET

## YÜKSEK LİSANS TEZİ

## KİŞİ TANIMA İÇİN SSIM, PSNR ve SNR TABANLI BIR WEB GÖRÜNTÜ ERİŞİM

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Görüntü arama, desteklenmesi gereken en önemli hizmetlerden biridir. Genel olarak, resim veri tabanlarından arama işlemi 2 farklı yaklaşım kullanılmaktadır. İlk yaklaşımda arama işlemi metin meta verisine dayanır, ikinci yaklaşım ise görüntü içeriği bilgisine dayanmaktadır. İkinci yaklaşım, içerik tabanlı görüntü erişim (İTGE) sistemleri olarak adlandırılmaktadır. İTGE sistemler, görüntü veri tabanlarında görüntü işleme konularında araştırma yapmayı, depolama sorunlarından kullanıcı dostu ara yüzlere kadar değişen sorunların ele alınmasını sağlamaktadır. Bu çalışmada, içerik tabanlı bir web görüntü erişim sistemi olan bir bilgisayar görme yöntemi önerilmiştir. Önerilen yöntem ile kişilerin web tabanlı görüntülerinden taranmasını sağlamaktadır. Personel tanıma için bir içerik tabanlı görüntü erişim (PTITGE) sistemi geliştirilmiştir. Bu sistemde yapısal benzerlik indeksi kullanılarak referans bir görüntü veri tabanında sorgulanarak benzer görüntülerin listelenmesi sağlanmıştır. Görüntülerin karşılaştırılması için çalışmada ayrıca PSNR ve SNR metotları kullanılmıştır. Çalışmada kullanılan metotları test etmek için FEI veri tabanı kullanılmıştır. Bu veri tabanı 200 kişiye ait farklı açı ve pozlarda çekilmiş 2800 görüntüden oluşmaktadır. Farklı bay ve bayan örnekler için yapılan sorgulamalarda önerilen yöntemin kişi tanımada başarılı olduğu görülmüştür.

**Anahtar kelimeler**: Kişi tanıma, SSIM, PSNR, SNR, içerik erişim sistemi

## ABSTRACT

**M.Sc. Thesis**

**A CONTENT-BASED WEB IMAGE RETRIEVAL SYSTEM FOR PERSON IDENTIFICATION STRUCTURED ON THE SSIM, PSNR AND SNR**

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Image searching is one of the most important services that need to be supported. In general, 2 different approaches have been applied to allow searching of image collections: one is based on image textual Meta data and the other is based on image content information. Querying by is called content-based image retrieval (CBIR). CBIR systems involve research on databases and image processing, handling problems that vary from storage issues to friendly user interfaces. In this study, a computer vision method, which is a content-based web image retrieval system, is proposed for automatically identifying person. We have developed an image retrieval system named as the (PICBIR=Person identification with content-based image retrieval), which uses structural similarity (SSIM) as the method for retrieving person images, similar to a given set of reference same images in a database. PSNR and SNR are among the methods that have been widely used to study images for the purpose of comparison. The FEI database was used to test the particular methods used in this study. The current database consists of 2800 images that were taken at different positions and exposures of 200 people. It has been evident that the method proposed in the inquiries that was made for different male and female samples is successful in face recognition.



**Keywords:** Content access system Person Identification, SSIM, PSNR, SNR,

## 1.INTRODUCTION

In this section, SSIM, PSNR and SNR methods are given. The advantages and disadvantages of the methods are discussed.

### 1.1. Digital images

Computerized pictures are inclined to an extensive variety of bending particularly amid securing, handling, pressure, stockpiling, transmission and multiplication. Any type of twisting may result to debasement of visual quality. In the event that the pictures is for human review, subjective assessment is the most proper altering technique that measures the nature of the picture. By and by, be that as it may, subjective assessment is normally awkward, tedious and costly. The primary point of inquiring about on target picture quality evaluation is to create quantitative measures that can consequently anticipate nature of the apparent picture. (Wang et al., 2004). Target techniques for evaluating perceptual picture quality generally endeavored to measure the deceivability of blunders. That is the refinement between a reshaped pictures when diverged from reference picture using a grouping of known properties of the human visual system. Digital Image is an image or picture represented digitally, i.e. in groups of combinations bits (0 or 1) also referred to pixels. Digital Image Processing (DIP) is a technology used to manipulate groups of bits (or pixels). Digital processing can be applicable in areas like image quality enhancement, Creation of different perspective and digital extraction of information from images through computer algorithms.

### 1.2. Structural Similarity Index Measure (SSIM)

#### 1.2.1. Definition

Structural similarity index entails establishment of how similar two images are. Basically, it is a full reference metric. That is, it establishes the quality of an image based on initial image that is not compressed (an image without any form of alteration). SSIM is designed in a manner that all inconsistencies that had been bothersome in the human eye perception has been improved, for instance peak signal-to- noise ratio (PSNR) has been improved. Similarly there is improvement on the mean squared error (MSE).

The only difference experienced from other techniques like MSE and PSNR the ability to make an estimate of the total perceived errors. Further, SSIM is categorizes

image degradation under perceptional changes made on geometric information. This is basically the idea that there exist a solid interrelationship between pixels more so when they are partially separated. This phenomenon is critical especially when it comes to carrying transmitting information related to the constructs of the object being visualized.

### 1.2.2. Usage of SSIM

The Structural Similarity Index (SSIM) is a perceptual metric that measures the measure of debasement caused as in the wake of experiencing forms like date pressure and misfortunes that happen while transmitting information. It is a full reference metric that requires two pictures indistinguishable to the underlying caught picture. That is a reference picture and a handled picture. The handled picture is regularly packed. It might, for instance, be gotten by sparing a reference picture as a Joint Photographic Experts Group (JPEG) (at any quality level) at that point understanding it back. SSIM is regularly utilized as a part of video industry, it is additionally broadly utilized as a part of still photography. Any picture might be utilized, including those of imatest test examples, for example, Spilled Coins or Log F-Contrast.

## 1.3. SSIM and Image Structure

Normal pictures are important to people, the physical world shows factual regularities that allow the human visual framework (HVS) to derive valuable elucidations. These regularities convey the visual structure of the physical world and represent the insights of pictures (picture structure). A flag preparing system is looked to dissect picture attributes relatable to what people can translate. This work researches the underlying advances taken while assessing objective visual data to empower expectation and recognizable proof of various picture portrayals limits. Given a picture grouping, whose pictures is at first unrecognizable, the picture is bit by bit refined to incorporate more data in light of the measures attempted. Acknowledgment edge involves a grouping of occasions whereby a spectator precisely recognizes the substance. Arrangements are delivered utilizing two sorts of picture portrayals, that is signal based and visual structure safeguarding.

Signal based portrayals include data as directed by ordinary scientific portrayals of pictures in light of models of low-level HVS handling. It uses premise works as the essential picture segments. Then again, visual structure protecting portrayals adds data

to pictures ascribed to visual structure and endeavor to impersonate more elevated amount HVS preparing by thinking about the scene's articles as the segments of the essential picture. An investigation led to recognize the acknowledgment limit picture whereby a few full-reference perceptual quality appraisal calculations were assessed, in view of their capacity to anticipate the acknowledgment edge of various picture portrayals. The cross-connection part of an adjusted adaptation of the multi-scale basic closeness metric indicated as MS-SSIM, displays a superior general relationship with the flag based and visual structure safe guarding portrayals' normal acknowledgment edges contrasted with the standard MS-SSIM cross-connection segment. These discoveries underscore the centrality of visual structure in acknowledgment and backing of multi-scale picture structure investigation for a simple assessment of visual data (Rouse et al., 2008).

This paper fuses an investigation made by specialists like De Oliveira. The examination was on the substance-based picture recovery framework intended to recover mammography from a substantial medicinal picture database. It is important that this framework be created in light of breast thickness, as stipulated in the four classes characterized by the American College of Radiology. It was incorporated into the database of the Image Retrieval in Medical Applications (IRMA) venture, which arranged pictures concurring from their ground truth. The two-dimensional vital segment investigation assumes a key part in thinks about bosom thickness and surface portrayal. It was possible to effectively represent texture and allowance for dimensional reduction. A help vector machine was utilized to lead the recovery procedure. Normal exactness rates extended between 83%-97% from an informational collection of 5024 pictures (De Oliveira et al., 2010). The outcome demonstrated the capability of the framework, as the primary phase of a PC helped conclusion system.

In this work, the analysts utilized the affiliation mining principle to help two kinds of therapeutic frameworks: the CBIR frameworks and the (CAD) system. For content-based recovery, affiliation lead is utilized to decrease dimensionality of highlight vectors speaking to the picture. Further, it enhances the exactness of comparability inquiries. The affiliation decide based technique that enhances the proposed CBIR frameworks is alluded as Feature determination through Association Rules (FAR) (Ribeiro et al., 2009). To enhance CAD frameworks, we proposed to

utilize the Image Diagnosis Enhancement through Association rules (IDEA) technique. Affiliation administer assumes an incredible part with regards to proposing a moment conclusion on the radiologist or preparatory analysis of another picture. The second supposition which is naturally gotten quickens the diagnosing procedure in the meantime fortifying the speculation that is, expanding the likelihood making the recommended treatment to be fruitful (Ribeiro et al., 2009). Two new calculations were proposed in help of the IDEA technique. They would fill the need of pre-preparing low-level highlights and to propose preparatory analysis identified with the affiliation run the show. A few investigations were led in an offer to approve the proposed techniques. In the long run, it was built up that affiliation lead could effectively be connected to enhance CBIR and CAD frameworks, this was an additional favorable position with regards to enabling strategies that are utilized to help medicinal picture examination in restorative frameworks.

### 1.4. Advantages of SSIM

The principle benefits that accompany utilization of Structural Similarity (SSIM) file is identified with its definition. Fundamentally, it is a methods that evaluates the closeness of two pictures. SSIM record can likewise be named as the standard used to look at between two pictures, at the same time, one of them ought to have an impeccable quality. SSIM is a redesigned type of the worldwide picture quality list.

Auxiliary Similarity Index (SSIM) is a perceptual metric that evaluates picture quality corruption caused by procedures, for example, information pressure or through misfortunes brought about while transmitting information. It is a full reference metric that requires two pictures got from the same caught picture, that is from a reference picture and a prepared picture. The prepared picture is regularly packed. It might, for instance, be gotten by sparing a reference picture as a JPEG (of any quality level) at that point understanding it back. SSIM is for the most part utilized as a part of video industry, yet is for the most part connected in still photography. Any picture might be utilized, including those of Imatest test examples, for example, Spilled Coins or Log F-Contrast.

Colored pictures portray sensible information in the eyes of a human beings compared to greyscale images. Without considering benefits that emanate from using the famous objective image quality procedures, the most experienced disadvantage of

utilizing this measure is the inability of work well with colored images, they only work well when greyscale images are used. A proposal would be made, one that will incorporate quality assessment, further it shall serve the purpose of relating recognized multi scale structural similarity index (MSSIM). An evaluation was also made on the quality of the image by use of experiments that were subject to human use. The evaluation data comprised of 200 images that were to be used for referencing, all of them would be produced by using known color quantization algorithms. Further, it was critical to analyze quality judgments made by individual human in order to obtain the mean opinion score. The proposed image data base would later on be tasted in order to validate the results. After the analysis, it was established that comparing colors had a mending effect on MSSIM in most of the alterations and for evaluating that were quantized in the entire database.

### 1.5. Disadvantages of SSIM

SSIM is a solitary scale form of the SSIM ordering measure, which is for the most part compelling if utilized as a part of the fitting scale. Absolutely "right" scale relies upon both picture determination and the survey separate. Getting it is generally trouble some. We proposed to utilize the accompanying experimental equations in an offer to decide the scale for pictures saw from a run of the mill remove. This were; the SSIM which really measures the perceptual contrast between two comparable pictures. It neglects to judge which among the two pictures is superior to the next. The main method for making the correct surmising is by distinguishing which picture is "unique" and the one subjected to extra procedures, for example, information pressure. SSIM is additionally ascertained in the Imatest picture preparing module, which not at all like the SSIM module, has numerous capacities. For example, it is conceivable to apply regular corruptions (clamor, obscure, flare, and so forth.) on the picture, later on apply flag preparing strategies usually used to improve pictures (tone mapping, un-sharp veil, reciprocal separating, and so on.).

### 1.6. Definition of PSNR and uses of PSNR, Recommendation for Computing PSNR for Color Images

PSNR block serves the purpose of calculating the topmost signal-to-noise ratio in logarithmic unit of sound intensity compared from two images. This ratio serves a

critical purpose. That is measuring the quality between the initial image and the one that has been compressed. The greater the PSNR the more excellence distorted image would be. The two error related measures used to make comparisons between images, they are MSE and the PSNR. MSE is used to establish the squared error acquired between the compacted and the initial image. On the other hand, PSNR characterizes the total amount of peak fault. The value of MSE determines the amount of error established.

Distinctive methodologies exist for figuring the PSNR of a shaded picture. Since the eye is extra ordinarily sense easily any information related to theluma, it makes it possible to process the PSNR of shaded pictures by changing over the photo to a shading space that detaches power (luma) channel. For instance in the YCbCr, The power Y which represents the (luma) in YCbCr looks into the weighted ordinary of R, G, and B. G is given the most weight recollecting noted by the eye through large viably. With this idea, it is definitely not hard to process the PSNR of the luma channel in a manner of speaking.

### 1.7. Advantages of PSNR

Pinnacle motion to-clamor proportion is a term used to depict the proportion of outrageous power rate of a movement and the energy of changing commotion which affects the nature of its portrayal. The fact that most of the signals contain a wide dynamic range, which is comparing the ratio between the possible values of the largest and smallest changeable quantity. In this case, the PSNR is calibrated inform of logarithmic decibel gauge.

Activities that involve image translation or upgrading the excellence of a digital image is always subjective. This means that the preference choice of the method to be used in upgrading depends on the person involved. As a result, it is worth noting the quantitative/empirical actions that weighs on improvement algorithms of the quality of a picture through use of PSNR

Through use of similar test images, it becomes possible to make comparisons between different picture improvement algorithms and finding out the most efficient algorithm. Peak-signal-to-noise ratio is the metric being researched on. The only way of establishing whether an algorithm is by finding out whether the algorithm is capable of

improving the quality of a known image making it look exactly as the original image.1.8. Disadvantages of PSNR.

While processing the MSE of two harmonious portraits, the total value ads up to an infinite value making the summation of PSNR to be vague. The principle constraint of this method is that it functionality relies entirely on examination of digits. Likewise, it neglects to consider abnormalities that may radiate because of ordinary components of people visualization framework. A perfect example of this is the SSIM.

For hued pictures, the MSE is assumed control over all pixels estimations of every individual channel and a normal of every hued channel ascertained. Another option to this is to just play out the PSNR over a changed over luminance or grayscale channel, this is conceivable in light of the fact that the human eye is for the most part four times more vulnerable to luminance changes rather than changes in chrominance. It is the part of the individual making the tests to build up the estimation. Not with standing the way that PSNR is never again seen as a reliable marker of picture quality degradation, it is available as an elective estimation in the Imatest SSIM module.

**1.9. Content based Image Retreviel**

Abbreviated as (CBIR). This method was first introduced in 1992. Kato implemented it to define his experiment on instinctive recovery of pictures from bulkydatabanks. Image retrieval was done based on color and shape. Since then, application of CBIR has been adopted widely in all processes that entails image retrieval from large and complex databases. The extraction process is automatic and the keywords do not have a role in CBIR since this terms are easily understood. As mentioned earlier, retrieval of images is based on color, pixels and their shape. It should be noted that CBIR is different from classic information retrieval systems which were unstructured.1.10. Content Based Image Retrieval Skills

There has been an advancement in numerous CBIR frameworks to solve the puzzle of recovering pictures depending on their picture element, but this has been an obstacle in CBIR technique. Some of the CBIR techniques utilized include:

### 1.10.1. Color

This technique measures the color similarity between what is asked for and what is in the database. The image is examined based on their colors. It is the most widely used technique perhaps due to its ability to be completed regardless of size and orientation of the image.

### 1.10.2. Texture

This technique looks at the optical designs in pictures and how they are distinct. It is a complex concept since it involves modelling of texture into a 2D gray level variation. Images are compared based on the degree of contrast, regularity, coarseness, and directionality. There are other methods used to distinguishing textures. For instance, it could be used in Co-occurrence matrix, the other method is the Laws texture dynamism, and the transformation of the Wavelet.

### 1.10.3. Shape

This CBI system does not allude to the state of a picture, but instead the state of a specific locale being researched. A portion of the shape descriptors included incorporate; Fourier change and Moment invariant.1.11 Applications of Image Retrieval System

The CBIR is applicable in numerous fields more so in architectural and engineering design, crime prevention, facial-recognition textiles Industry etc. Some of the systems that have been developed for this purpose are; Visual SEEk and Web SEEk, Netra, MARS, Vhoto, Pixolution, MIT's Photo book, IBMs QBIC and many others.

## 1.12. Image retrieved

Pedronette and Torresengaged in a research aimed at establishing the effectiveness of measuring the similarity of two images. The main challenging problem was in image retrieval task, an issue that radiated because of trouble of considering the data-set complex (Pedronette et al., 2016). This exploration paper shows an unsupervised complex learning calculation that assignment into account the inborn data-set geometry for characterizing a more powerful separation between pictures. The data-

set structure is displayed regarding a Correlation Graph (CG) and broke down utilizing emphatically associated compotes (SCCs). While the Correlation Graph contentiousness gives an exact yet strict comparability relationship, the unequivocally associated parts investigation extends these connections considering the data set geometry. A vast and thorough test assessment convention was led for various picture recovery assignments. The analysis was led in various data-set including different picture descriptors. Results show that the complex learning calculation can altogether enhance the adequacy of picture recovery frameworks. The exhibited approach yields better outcomes as far as adequacy than different strategy as of late proposed in this exploration work.

### 1.6. Research Aim

During this 21st century, one of the important services we have to consider and support is the image searching. Therefore, this research essay will focus on how the new generation can be able to access the highest quality and level images. In general, we will focus on the most approaches that can be applied to allow image search collections mainly through the object made text and the image contained within the image. The research will establish the most common methods of statistics that can be used to different the quality of an image.

The other important aim of this research is to explain and elaborate the formula of estimating the quality of the scene so as to bring about a measurable signal reaction to the noise ratio. The essay will prove that the research is totally inversely proportional to Mean Squared Error.

### 1.7. Objectives of the Study

The study was conducted to achieve the following objectives;

- To find out the relationship between Web server and uploaded the query images.
- To assess or compare the capability of web browser when the user sends the information on the selected images to the search engine and also assess proficiency with visual impairment.
- The study also targeted to establish image retrieval systems for person identification based on the SSIM, PSNR, SNR, PI and IR.
- To identify the relationship of the system marks the best images selected by the SSIM, PSNR and SNR.

Indexes, similar person, and comprehensive evidence about the person in question is then made easy for the user to access.

### 1.8. Person Identification

In photo management system, the most critical aspect is identification of persons in a photo, there has been a series of meddiassist utilization that facilitates surfing the web, searching for marks of private portraits. In this research we will look into on the skills utilized in establishing the context and contents of a photo. We proposed to utilize the language modelling and other techniques that neared the skills used while using context based personal identification. Further, it would be critical to conduct a detailed study whit use of a private portrait from different people. Initially we will apply a constrained technique to divide the photo in question not forgetting that there are chances that the GPS might be absent. The two method proposed were time location Constraint and identifies the similarity between the collection level annotation and the image level annotation (Vidyapeetham et al., 2015).

## 2. LITERATURE REVIEW

According to Lan (2017) automatic evaluation of image excellence has become progressively important in various applications that utilize digital images. In this research study, the main focus is on the structural similarity (SSIM) index as a quality indicator. This task is usually accomplished with no-reference image quality assessment (NR-IQA) techniques. A typical SSIM based NR-IQR includes four computational operations color to grayscale conversion, they include; Gaussian blur, computation of image gradients with an 8-direction Sobel Operator, and computation of SSIM indices of local windows of the image (Lan et al., 2017). The main reason for this operations is because it involves image convolution and other time consuming computations. NR-IQR is computationally intensive in terms of computation. Parallel computing using multi-core CPUs or many-core GPUs is often used to accelerate intensive computational tasks. This research presents three parallel designs that are crucial when it comes to implementation of SSIM-based NR-IQA methods which helps to accelerate the computations. The first two utilize NVIDIA CUDA to implement all the operations as CUDA kernels, while the third uses Microsoft's Parallel Patterns Library a phenomenon that make it easy to calculate the mean similarity indices of local windows in the image (Lan et al., 2017). Experimental results showed that significant speedup can be achieved against the sequential method if all the three methods were put in practice. However, it is more practical to use texture memory to perform the final task (i.e. similarity computation) because of its substantial enhancement in performance and its ease of scheduling when processing multiple images.

The latest approach for estimating the picture quality was examined by Nasr (2016). His examination harped on the auxiliary similitude record (SSI). This exploration will display a novel calculation in light of the multi-scale auxiliary similitude file for movement identification (MS-SSIM) in recordings. The MS-SSIM approach depends on demonstrating of picture luminance, difference and structure at various scales. The MS-SSIM has turned out to be greatly improved in execution contrasted with the single scale SSI approach. In any case it includes some major disadvantages considering the way that it works at of generally bring down handling speed (Nasr et al., 2016). There are two preferences related with the above exhibited calculation, that is, they both have higher discovery precision and works at a semi ongoing preparing speed.

In an examination led by Dumic (2014) the exploration contemplate presents another full-reference target picture quality measure—IQM2, in light of basic likeness record and steerable pyramid wavelet change. IQM2 is tried utilizing diverse number of introduction pieces and seven subjective databases. Later on, the IQM2 measure is contrasted and twelve generally utilized full-reference target measures (Dumic et al., 2014). Results demonstrate that proposed IQM2 measure, utilizing bit with 2 introductions, gives great relationship the consequences of subjective assessment while keeping computational time lower than other comparable performing target measures.

This examination on appraisal files assume a principal part in investigation of hyperspectral picture (HSI) solid shapes. Keeping in mind the end goal to evaluate the nature of a HSI block, the auxiliary comparability record (SSIM) is generally connected situated in a band-by-band way, as SSIM was initially intended for 2D pictures, and afterward the mean SSIM (Mean SSIM) list over all groups is embraced. Magnesium neglects to suit the ghastly structure which is a remarkable normal for HSI. Henceforth, in this paper, we will propose another and basic multivariate SSIM (MvSSIM) record for HSI, by regarding the pixel range as a multivariate arbitrary vector. MvSSIM keeps up SSIM's capacity to evaluate the spatial basic comparability through relationship between two pictures of a similar band; and adds a capacity to survey the phantom basic closeness by means of covariance among various groups. MvSSIM is very much established on multivariate measurements and can be effectively executed through straightforward example insights including mean vectors, covariance lattices and cross-covariance networks. The test later on demonstrated that MvSSIM was an appropriate quality appraisal record for twisted HSIs with various types of corruptions (Zhu et al., 2018).

An investigation directed by Wu (2014). Included particular efforts committed to enhance new realities and an extraction technique for its up and coming connected applications. In the previous decade, grinding based X-beam stage differentiate imaging has pulled in expanding consideration. In this examination, the scientists talk about the clamor properties of another procurement convention, named the "turn around projection" (RP) strategy, utilizing the mistake spread recipe. We show a quantitative examination of the flag to-commotion proportion of X-beam grinding interferometry all on account of the new strategy. As the real wellsprings of clamor, the commitments from photon insights and mechanical mistakes will be talked about in detail. The outcomes indicated how the framework parameters effect on the extricated ingestion

and refraction pictures could be utilized to improve the framework outline for predicted down to earth applications. For example biomedical imaging and materials science (Wu et al., 2014).

According to Seo et al. (2017), they established that a theoretical maximum achievable signal to noise ratio (SNR) for piezoelectric microphones is identified as a function of microphone volume. This is irrespective of architecture and construction details. For a given piezoelectric material, microphone SNR can be reduced to an expression containing only a dimensionless coupling coefficient and microphone volume. In addition, in a given material, the coupling coefficient has a theoretical upper bound defined by the most favorable deformation geometry. The ability to identify a theoretical maximum SNR as a function of only microphone size is surprising considering the numerous design variables and infinite design freedom afforded in the microphone design stage (Seo et al., 2017)

Ying et al. (2015), examined various segments utilized as a part of signal preparing and correspondence applications, for example, control enhancers and simple to-computerized converters, set up that they are nonlinear and have a limited dynamic-go. The non-linearity related with these gadgets contorts the information, which can debase the general framework execution. Motion to-clamor in addition to contortion proportion (SNDR) is a typical metric used to evaluate execution debasement. One method for moderating nonlinear mutilations is by amplifying the SNDR. In this paper, we break down how to boost the SNDR of the non-linearity in optical remote correspondence (OWC) frameworks. In particular, the exploration will answer the subject of how to ideally pre-mutilate a twofold sided memory-less non linearity that has both a "turn-on" esteem and a most extreme "immersion" esteem (Ying et al., 2015). We will demonstrate that the SNDR-augmenting reaction given the requirements is a twofold sided limiter with a predetermined straight pick up and inclination esteem. Both the pickup and predisposition are elements of the likelihood thickness work (PDF) of the info flag and the commotion control. We will likewise discover a lower bound of the nonlinear framework limit, which is given by the SNDR and an upper bound dictated by powerful flag to-commotion proportion (DSNR). A use of the outcomes thus is to outline pre-mutilation linearization of nonlinear gadgets like light transmitting diodes (LEDs) (Ying et al., 2015).

In the examination investigation of Welvaert and Rosseel (2013), they harped much on Signal-to-commotion proportion, the proportion amongst flag and noise, is an amount entrenched for MRI information yet is as yet subject to a progressing banter about wind up bringing a great deal of perplexity with regards to fMRI information. fMRI information are portrayed by little initiation vacillations in a commotion foundation. Contingent upon how the flag of intrigue and the commotion are recognized, motion to-noise proportion for fMRI information is accounted for to have distinctive definitions. Since every definition accompanies an alternate scale, translating and contrasting sign with clamor proportion esteems for fMRI information can be an unwieldy employment. In this paper, we give a review of existing definitions. Further, the association with actuation recognition power will be investigated. Reference tables and transformation formulae will additionally be given with a specific end goal to make examinations between various fMRI thinks about (Welvaert et al., 2013)

Tafyllou (2011) directed the other research together with a cluster of other scientists. They made an investigation on Sensitivity in BOLD FMRI, they set up that the flag to commotion proportion (SNR) of the time-arrangement (tSNR), which contains variances from warm and physiological noise sources described it. Adjustment of a procurement parameter can influence the tSNR distinctively relying upon the relative greatness of the physiological and warm commotion. In this manner, the information of this proportion is basic for upgrading fMRI acquisitions. In this examination, we will think about picture and time-arrangement SNR from exhibit curls at 3 T with and without parallel imaging (GRAPPA) as an element of picture determination and increasing speed. We utilize the "total unit" SNR technique for Kellman and McVeigh to ascertain the picture SNR (SNR0) in a way that renders it practically identical to Tsnr (Triantafyllou et al., 2011). By so doing, it will make it conceivable to decide warm to physiological noise proportion. Further, it will help us to build up the pseudo-various imitation strategy to measure the picture commotion adjustments because of GRAPPA remaking. The Kruger and Glover commotion demonstrates stipulate that physiological noise standard deviation is relative to flag quality. The data assembled from this marvel was observed to be in accordance with the quickened and non-quickened exhibit curl information. Warm noise commanded the EPI time-arrangement for medium to extensive voxel sizes for single-channel and 12-channel head loop setups, yet physiological commotion ruled the 32-channel exhibit securing even at 1 mm × 1 mm × 3 mm determination. At higher speeding up factors,

picture SNR is lessened and the time-arrangement turns out to be progressively warm noise prevailing. Not with standing, the tSNR lessening is littler than the decrease in picture SNR, an angle that is achieved by the present physiological commotion (Triantafyllou et al., 2011).

A trio that included Iqbal et al. (2017) set up that the current union of remote norms for fuse of spatial measurement in remote frameworks has made spatial range detecting in light of PAPR of the got flag, it was a promising methodology on the grounds that the additional measurement was chiefly abused for stream multiplexing, client multiplexing and spatial assorted variety. Considering such a remote situation for essential clients, for our situation, we propose a calculation for range detecting by optional clients, it accompanies numerous radio wires (Iqbal et al., 2017). The proposed spatial range detecting calculation depends on the PAPR of the spatially got signals. Recreation comes about demonstrated a change in its execution promptly the data with respect to spatial assorted variety of the essential clients was consolidated in the proposed calculation. In addition, through recreations, an enhanced execution was built up all on account of the various expanded plans and parameters like detecting time and examining interim that were consolidated (Iqbal et al., 2017).

Further, the exploration was led by Swanson (2015), the investigation was on control spectra of signs comprising of stationary sinusoids blended with arbitrary commotion, the recurrence and adequacy of an otherworldly pinnacle can be assessed with more prominent exactness than the closest recurrence receptacle of the Fourier change by abusing the unearthly spillage attributes for the specific information window utilized. Systems, for example, direct introduction or an adequacy weighted normal have deficient accuracy because of the nonlinear spillage into adjoining canisters and the reliance on information window write. This paper offers another general calculation exhibited utilizing the Fourier coefficients of the information window to create a capacity which is the proportion of the side-container amplitudes of the window in the recurrence area (Swanson, 2015).

The proportion work enables one to utilize the amplitudes of the nearby receptacles of a ghastly top to accurately appraise the pinnacle recurrence and sufficiency when the recurrence does not lie precisely on a recurrence container (in the middle of the discrete canisters of a Fourier change). Cases are accommodated various prevalent information windows. The proportion capacity can be most effortlessly executed utilizing a disentangled log-proportion work for the window side container

sizes. A factual examination gives a valuable recurrence estimation mistake gauge given the flag to-commotion proportion of the unearthly pinnacle in view of a guess of the proportion of non-zero mean Gaussian factors. The advantages of this procedure are not simply enhanced estimation exactness for adequacy and recurrence, yet in addition permit huge unearthly information documents to be precisely lessened in measure for remote checking of vibration spectra. A case is given of a system for diminishment of otherworldly information document estimate without the loss of vital signs for examination where the record measure is decreased by 88% with just a couple of percent blunder, which is for the most part bound to the foundation clamor in the reproduced range (Swanson, 2015).

As per Wang (2004), objective skills for gaging perceptual portrait worth largely endeavored to ration the perceivability of slip-ups (contrasts) amid a perverted print and a reference print utilizing an assortment of known possessions of the human optical framework. Under the supposition that human visual observation is extraordinarily adjusted for extricating auxiliary data from a scene, we present a probable, fundamental system for quality appraisal in view of the corruption of basic data (Wang et al., 2004). As a precise case of this idea, we formulated a basic likeness file and expression its promise through an organization of natural circumstances, and additionally contrasted with both subjective evaluations and best in class target skills on a catalog of pictures packed with JPEG and JPEG2000 (Wang et at., 2004).

Silvestre (2011), learned about Structural likeness picture quality and dependability. In this examination, he anticipates decide parameters and window measure Signal Processing. The need to get target estimations of the nature of twisted pictures concerning the first is crucial in media and picture handling applications. It is for the most part required that this esteem corresponds well with the human vision framework (HVS). Disregarding the properties and the general utilization of the mean square blunder (MSE) estimation, this has a poor connection with HSV, which has prompted the improvement of strategies, for example, basic likeness (SSIM). This metric enhances the connection as for the great MSE and PSNR (top flag to clamor proportion) (Silvestre, 2011). Be that as it may, its conduct relies upon the qualities allotted to constants and on the window estimate chose. These qualities are generally appointed self-assertively and there have been no examinations on how they influence the SSIM. In this work, we have investigated observationally the most suitable esteems for the diverse constants utilized as a part of the SSIM conditions. We have additionally

investigated the significance of window estimate in the computation of MSSIM, and propose a strategy for deciding the window measure in light of picture multifaceted nature. Utilizing the qualities chose and the window measure characterized, the relationship amongst SSIM and DMOS (differential mean sentiment score) is altogether enhanced by around 17% concerning the qualities generally utilized (Silvestre, 2011).

In another analysis, the unpredictable idea of two-dimensional picture information showed complexities in customary data frameworks outlined entirely for alphanumeric information. Frameworks went for adequately overseeing picture information have for the most part moved toward the issue from two unique perspectives: They either have a strong database section with little picture understanding, or they fill in as a photo storage facility for PC vision applications, with little highlight on the photo recuperation process. A general building for visual information organization systems (VIMS), which unite the characteristics of the two strategies is shown. The framework uses PC vision schedules for both inclusion and recovery and permits simple inquiry by-case particulars. The vision schedules are utilized to portion and assess objects in view of space information portraying the items and their traits. The vision framework would then be able to dole out component esteems to be utilized for closeness measures and picture recovery. A VIMS created for confront picture recovery is exhibited to show these thoughts (Bach et al., 1993).

Fan et al. (2010) built up an examination about Complex wavelet auxiliary closeness (CW-SSIM) file. They proposed it as an effective picture closeness metric that is sufficiently strong in interpretation, scaling and revolution of pictures. However they neglected to examine how it could be utilized as a part of picture order. In this paper, we joined CW-SSIM as apiece work into an irregular woods learning calculation. This prompts a novel picture grouping approach that does not require an element extraction or measurement decrease arrange at the front end. We utilize manually written digit acknowledgment for instance to show our calculation. We thought about the execution of the proposed approach with irregular woods learning in light of different pieces, including the broadly embraced Gaussian and the inward item portions. Exact confirmations demonstrate that the proposed strategy is prevalent in its characterization control. We likewise contrasted our proposed approach and the immediate arbitrary woods strategy without bit and the prevalent piece learning technique bolster vector machine. Our test outcomes in light of both recreated and true information recommend that the proposed approach works better than conventional

techniques without the element choice method. We also utilized statistical data obtained from an article written by Okagbue and other researchers. This information article contained the measurable investigation of Igbo individual names and an example of haphazardly chose names. They were introduced as follows:

A straightforward irregular testing of some Igbo individual names and their separate sexual orientation related with each name.

The dissemination of the vowels, consonants and letters of letter sets of the individual names. The dissemination of name length. The dissemination of beginning and terminal letters of Igbo individual names. The centrality of the information was talked about.

This work shows a substance based semantics and picture recovery framework for semantically sorted progressive picture databases. Every module was outlined with a point of building up a framework that worked nearer to human recognition. Pictures were mapped to a multidimensional component space, where pictures having a place with semantic were bunched and recorded to secure an effective portrayal. This aided in taking care of the current change ability or heterogeneity inside the semantic. Versatile blends of the got portrayals were additionally used by the branch choice and pruning calculations to recognize some nearer semantics and select just a piece of the huge various leveled look space for real pursuit. After it was acquired, the pursuit space was at last used to recover wanted semantics and comparative pictures in their correspondence. The framework would then be assessed as far as exactness of the recovered semantics and accuracy review bends. Tests indicate promising semantics and picture recovery comes about on progressive picture databases. The outcomes revealed with non-progressive yet classified picture databases additionally demonstrate the adequacy of the proposed framework (Pandey et al., 2016).

Li et al. (2017) examined on shading surface recovery is a hot research territory in picture investigation. In this examination paper, we propose a productive shading surface recovery strategy by utilizing copula display in view of Gabor wavelets. At the point when Gabor wavelets are utilized to break down shading picture, three kinds of reliance exist in the decayed sub-groups of Gabor wavelets: Color reliance, Scale reliance and Direction reliance. We later on investigated these conditions and after that caught them by utilizing Gaussian copula work. Four copula plans were produced, and in like manner four KLDs (Kullback-Leibler separations) of the copula plans were

presented for shading surface picture recovery. The assessments of the proposed strategy were performed on a few shading surface databases including two extensive surface databases ALOT and STex (Huang et al., 2017). Test comes about exhibited that the proposed technique would be advised to execution than best in class recovery strategies.

## 3. MATERIALS AND METHODS

### 3.1. Materials

In this study, a well-known FEI database was used (Thomaz and Giraldi, 2010). The FEI database contains the face images of 100 male and 100 female subjects, who are students and staff at FEI aged between 19-70 years old. The appearance, hairstyle and adorns of these subjects are used (Thomaz and Giraldi, 2010). The images were taken between June 2005 and March 2006 in the Artificial Intelligence Laboratory of FEI. These14 different images have different facial expressions which were taken from an upright frontal position of each subject, while their profiles were rotated up to about 180 degrees. This dataset contains a totalof 2800 images, which are 640x640 pixels sized colorful with a homogenous white background, howevere, the scale might vary with about 10%. Some images are illustrated in (Figure 3.1).

**Figure 3. 1**. Examples of FEI database faces

There was detection of facial recognition on all images which were recorded. The faces were cropped using the script developed in Matlab program. The images of the faces are shown in the (Figure 3.2).

**Figure 3. 2**. Examples of FEI database cropped faces

## 3.2. Methods

### 3.2.1. Structural similarity index (SSIM)

SSIM is a quality assessment method for gray level images. This method depends on the combination of luminance, contrast, and the structural comparison of two images. SSIM can be obtained from comparing the local patterns of pixel intensities that have been normalized for luminance with contrast. The SSIM is based on the fact that the structures of the objects in the scene are independent of illumination. Luminance (l), contrast (c), and structure (s) are independently measured in this method (Wang et al., 2004; Qian et al., 2015; Nasr et al., 2016).

### 3.2.2. Structure similarity index (SSIM)

SSIM is a quality assessment method for grey level images. Three different statistics are calculated for two images X and Y which consist of N=axb pixels. $l$ , c and s are calculated using the pixel values of the x and y pictures.

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$$SSIM(x,y) = f(l(x,y),c(x,y),s(x,y)) \quad (1)$$

where $l(x,y)$ is the luminance comparison function;

$$l(x,y) = \frac{2\mu_x\mu_y + c_1}{\mu_x^2 + \mu_y^2 + c_1} \quad (2)$$

where, $c_1 = (K_1 L)^2$, $K_1$ is a small constant ($K_1 << 1$) and $L$ is a dynamic range of pixel values.

$c(x,y)$ is the contrast comparison function:

$$c(x,y) = \frac{2\sigma_x\sigma_y + c_2}{\sigma_x^2 + \sigma_y^2 + c_2}, \quad (3)$$

where, $c_2 = (K_2 L)^2$, $K_2$ is a small constant ($K_2 << 1$) and $L$ is a dynamic range of pixel values.

$s(x,y)$ is the structure comparison function;

$$s(x,y) = \frac{\sigma_{xy} + c_3}{\sigma_x\sigma_y + c_3} \quad (4)$$

Then similarity index is (Wang et al., 2004):

$$SSIM(x,y) = [l(x,y)^{\alpha}.c(x,y)^{\beta}.s(x,y)^{\gamma}] \quad (5)$$

where, $\alpha > 0, \beta > 0$ *and* $\gamma > 0$

If $\alpha = \beta = \gamma = 1$ and $c_3 = c_2/2$, then;

$$SSIM(x,y)\frac{(2\mu_x\mu_y + c_1)(2\sigma_x\sigma_y + c_2)}{(\mu_x^2 + \mu_y^2 + c_1)(\sigma_x^2 + \sigma_y^2 + c_2)}$$

(6)Where $x, y$ are images, $\mu_x$ and $\mu_y$ are the mean intensities, and $\sigma_x$ and $\sigma_y$ are the standard deviation as an estimate of the image contrast (Rouse and Hemami, 2007; Chaofeng and Bovik, 2010; Qian et al., 2014; Zengzhen, 2014).

$$\mu_x = \frac{1}{N}\sum_{i=1}^{N} x_i \quad (7)$$

$$\sigma_x = \sqrt{\frac{1}{N-1}\sum_{i=1}^{N}(x_i - \mu_x)^2} \quad (8)$$

and

$$\sigma_{xy} = \frac{1}{N-1}\sum_{i=1}^{N}(x_i - \mu_x)(y_i - \mu_y) \quad (9)$$

Here $\sigma_{xy}$ specifies the covariance between x and y images. C1, C2 and C3 constant are added to luminance, contrast and structure components to avoid ambiguity. SSIM index has three important features. The first one is SSIM symmetry that is SSIM (x,y)=SSIM(y,x). The second value of SSIM is (-1,1), it can be used a similarity value. Finally, once the SSIM index is x=y, SSIM (x,y)=1

### 3.2.3. Mean SSIM (MSSIM)

The method for calculating the MSSIM for each color band of RGB color images is proposed when the average of SSIM indexes obtained in all types were taken. MSSIM is calculated as follows.

**SSIM values were calculated from R, G, B band in sequences.**

$(SSIM(x_R, y_R), SSIM(x_G, y_G), SSIM(x_B, y_B)$ (Zhu et al., 2018).

$$MSSIM(x, y) = \frac{SSIM(x_R, y_R) + SSIM(x_G, y_G) + SSIM(x_B, y_B)}{3} \quad (10)$$

MSSIM measures the 3-D similarity for each color band, but it cannot measure the 3-D relationship between the bands. It is not possible to evaluate the spectral structural similarity of the bandwidth between the two spectrums in the same spatial location, while evaluation in the band spatial (3-D) structural similarity between the two images of the same band with MS.

### 3.2.4. Peak signal noise ratio (PSNR)

PSNR is a method of measuring the quality of a scene (Chen et al., 2011; Qian et al., 2015). Compressing an image is significantly different than compressing raw binary data. General purpose of compression programs can be used to compress images, but the result was less than optimal. Images have certain statistical properties which can be exploited by encoders specifically designed for them. Also, some of the final details in the image can be sacrificed for the sake of saving a little more bandwidth or storage space. This also means that less compression techniques can be used in this area.

Lossless compression involves compressing data which decompressed to be an exact replica of the original data. This is the case when binary data such as executable documents are compressed. They need to be reproduced decompressed exactly. On the other hand, images (and music too) need not be reproduced 'exactly'. An approximation of the original image is enough for most of the purposes, as long as the error between the original and the compressed image is tolerable.

Two of the error metrics used to compare the various image compression techniques are the Mean Square Error (MSE) and the Peak Signal to Noise Ratio (PSNR). The MSE is the cumulative squared error between the compressed and the original image, whereas PSNR is a measure of the peak error. The mathematical formulas for the two are (Chen et al., 2011; Tanchenko, 2014)

$$MSE = \frac{1}{MN}\sum_{y=1}^{M}\sum_{x=1}^{N}[I(x,y) - I^{'}(x,y)]^2 \tag{11}$$

$$PSNR = 20x\log 10\left[\frac{255}{\sqrt{MSE}}\right] \tag{12}$$

Where I (x, y) is the original image, I'(x, y) is the approximated version (which is actually the decompressed image) and M, N are the dimensions of the images. A lower value for MSE means lesser error, and as seen from the inverse relation between the MSE and PSNR this translates to a high value of PSNR. Logically, a higher value of PSNR is good because it means that the ratio of Signal to Noise is higher. Here the 'signal' is the original image and the 'noise' is the error in reconstruction. So, if you find a compression scheme having a lower MSE and a high PSNR you can recognize that it is a better one (Aldahdooh et al., 2017)

### 3.2.5. Signal Noise Ratio

The signal to noise ratio is inversely proportional to the MSE and it is given by the next equation [7]:

$$SNR = \frac{I(x,y)}{\sqrt{MSE}} \tag{13}$$

Advantage of MSE and SNR is that they are fast and easy to implement in quantifying error signal. The lower value of MSE indicates greater image similarity,

while greater *SNR* value refers to higher image similarity (Eakins et al., 1998; Ying et al., 2007).

### 3.2.6. Proposed Method

To search for images, a user may provide query terms such as keyword image file/link, or click on some image and the system will return images similar to the query. The proposed method is given in (Figure 3.3).

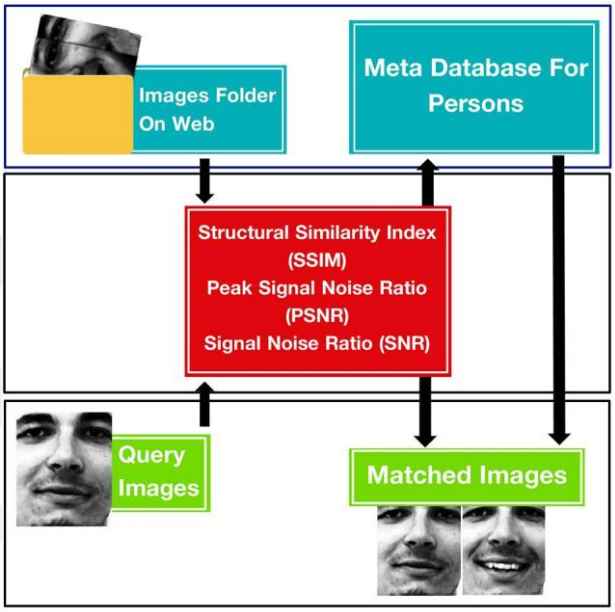



**Figure 3. 3**. Proposed system architecture

The basic operation of the proposed method image retrieval is as follows:

1) An interested user connects to the WWW server providing the search engine with the web browser.

2) After the user has connected to the web server, the user uploads the query images, and then the user can crop the uploaded images for the interested region area. The cropping property is important for performance because it removes other parts of the images, which are not a part of the person image.

3) The user then sends the information on the selected images to the search engine.

4) The system marks the best images selected by the SSIM, PSNR and SNR. Indexes, similar person, and detailed information about the person are then presented to the user.

The web application is writen by C#. SSIM algorithm is coded through ASP.NET.

4. **RESULT**

## 4.1. Developed Web Interface

This work was based on a picture retrieval system; Person recognition with Content Based Image Retrieval (PRCBIR). Around the broad sense of area, we used some algorithms to identify the persons's images. In this research, we are testing of accuracy of persons's pictures through structural similarity index (SSIM), Peak signal to noise ratio(PSNR) and Signal noise ratio (SNR) as the method for retrieval system. Given set of references the persons'similar images have in database.

The elementary application of the suggested method of image retrieval (PICBIR) is as follows:

1) An interested user connects to the WWW server to support the search engine with web browser (Figure 4.1.).

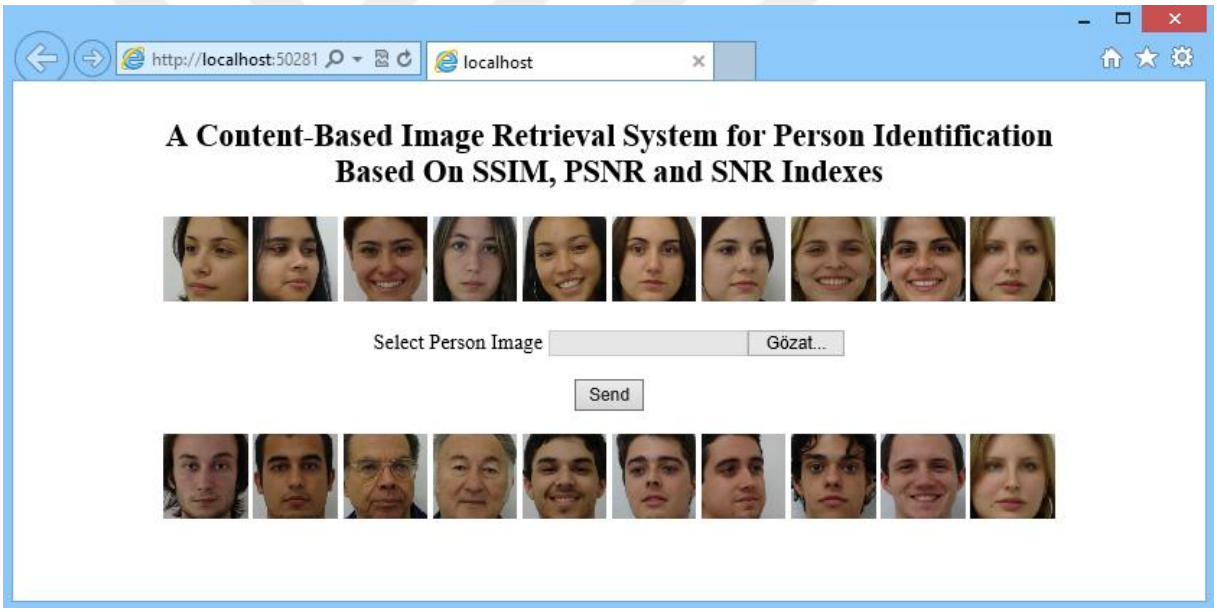



**Figure 4. 1**. Developed web interface login scene

After switching of the above screen, a desired picture selected from the computer and the selected picture is sent to the web application by 'send' button.

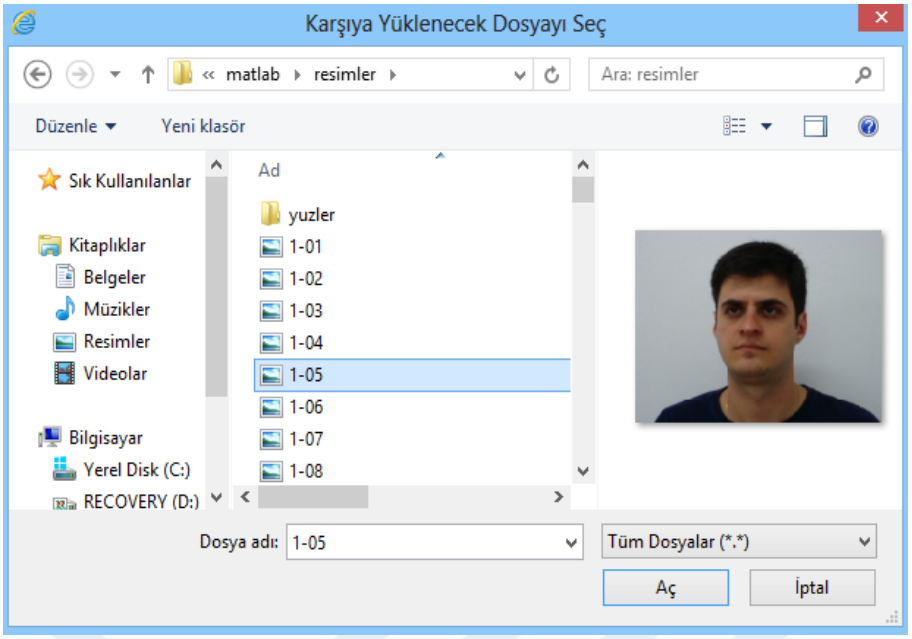



**Figure 4. 2**. Uploading photo to web application

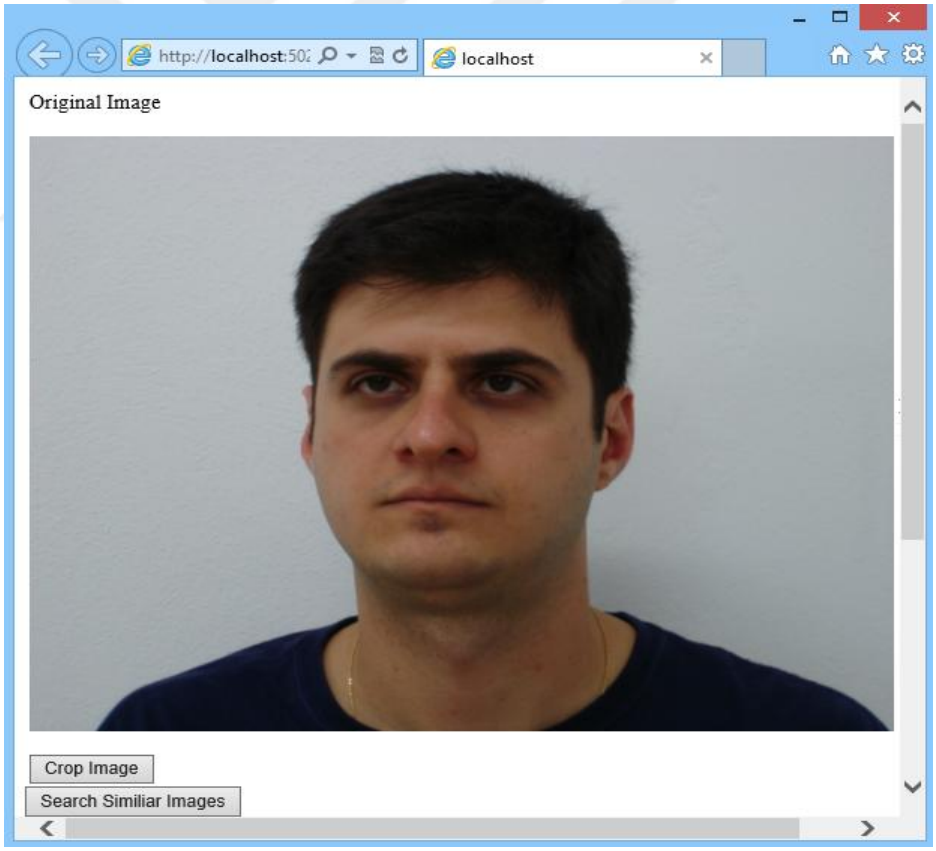



**Figure 4. 3**. Uploaded photo

2) After uploading the picture image, send it to the web page, it may take some time to pre-process the image. The unnecessary area on the picture needs to be cropped at the

preliminary stage for the research results to be successful. In the above figure, we will crop the picture by selecting the required part of the picture using the mouse. After you crop the picture image we can easily move to any direction of the picture.

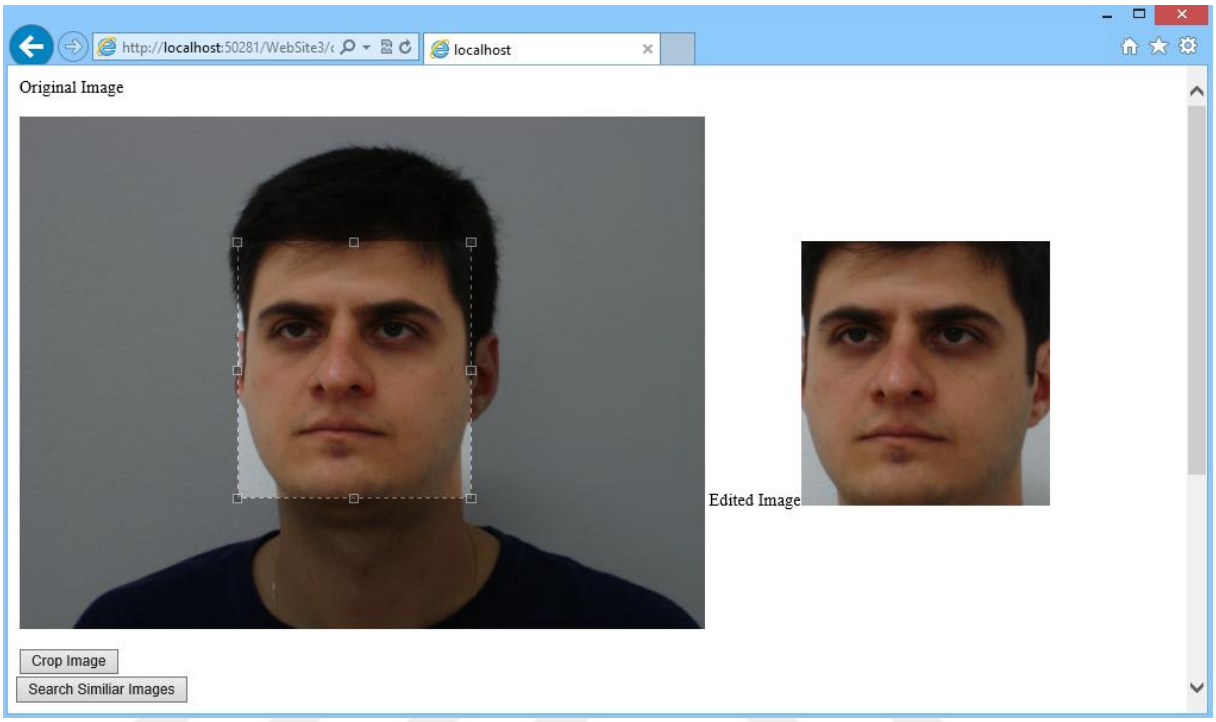



**Figure 4. 4**. Uploading cropped photo

3) After uploading the cropped picture, click on the search button to search for a similar image from the database. The most similar picture will be listed in the nearest place. Personal information about the people is listed with contact name, surname, address and contact information which can be taken from the database.

4) Similar value is calculated using SSIM, PSRN and SRN methods; by using of these methods, eight most similar images will be listed.

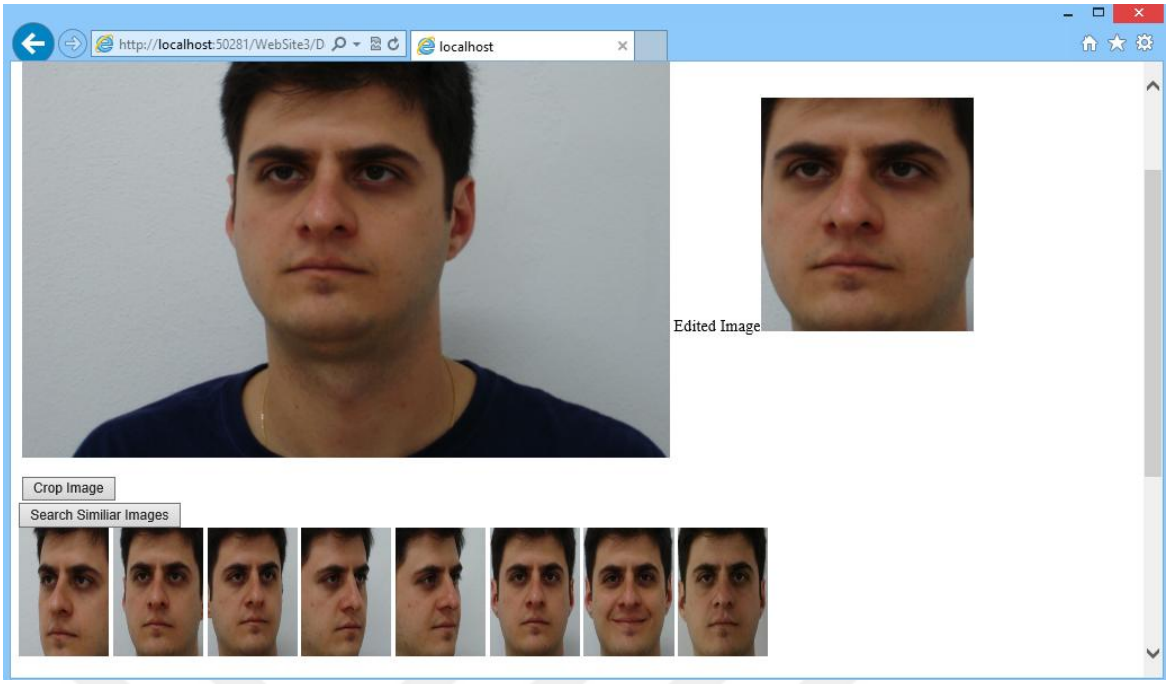


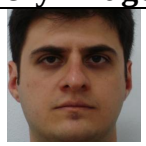
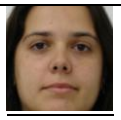
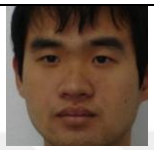
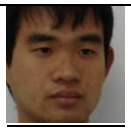
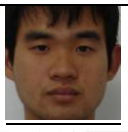
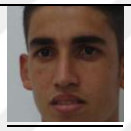
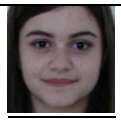
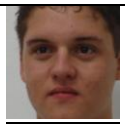

**Figure 4. 5.** Listed Pictures

In the above example, a randomly selected image is scanned from a web-based database and the most similar images to the selected image are scanned. The new queried image is not in the database, the image will found with the help of SSIM method and the most similar images listed with SSIM method.

### 4.2. Experimental Results of SSIM

The PICBIR system was developed for given research results of different peoples. Interrogations were conducted for 5 males and 5 females in this section. In all experiments, images belonging to the same person are found and showed in the database. The SSIM similarity value between the questioned picture and the pictures listed in table 4.1. In different external influences such as lightness, exposure angle, smile or glasses in the picture, the similarity value fall between the questioned pictures and the other pictures. SSIM parameters are taken as ($a = \beta = y = 1$).

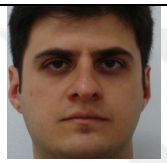
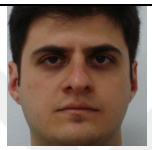
**Table 4. 1.** Experimental results of 10 persons through SSIM

| **Query Image** | **Similiar Images** | | | | |
|---|---|---|---|---|---|
|  Experiment 1 |  0,861 |  0,858 |  0,853 |  0,852 |  0,845 |
|  Experiment 2 |  0,739 |  0,735 |  0,727 |  0,725 |  0,693 |
|  Experiment 3 |  0,917 |  0,914 |  0,896 |  0,896 |  0,775 |
|  Experiment 4 |  0,849 |  0,835 |  0,826 |  0,80 |  0,74 |
|  Experiment 5 |  0,812 |  0,788 |  0,777 |  0,773 |  0,687 |
|  Experiment 6 |  0,818 |  0,812 |  0,811 |  0,808 |  0,783 |
|  Experiment 7 |  0,814 |  0,769 |  0,76 |  0,738 |  0,698 |
|  Experiment 8 |  0,861 |  0,861 |  0,857 |  0,826 |  0,775 |
|  Experiment 9 |  0,702 |  0,701 |  0,691 |  0,550 |  0,489 |
|  Experiment 10 |  0,655 |  0,652 |  0,552 |  0,548 |  0,521 |

### 4.3. Results of Mean SSIM

Comparison of grey level images is done when first images were converted into grey level images then images were compared to the colour images. The method of calculating SSIM is done for each colour band of RGB colour images which is proposed and the averages of SSIM indices are obtained in all types that were taken. The results of SSIM for 6 persons are given in the below table.

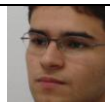
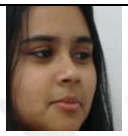
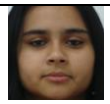
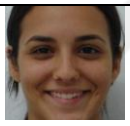
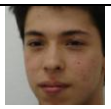
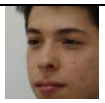
**Table 4. 2**. SSIM and MSSIM results for 3 female and 3 male

| Query Image | Reference Image | SSIM for R band | SSIM for G band | SSIM for B band | MSSIM | SSIM |
|---|---|---|---|---|---|---|
|  Experiment 1 |  | 0.7906 | 0.7874 | 0.7710 | 0.7830 | 0.8217 |
|  Experiment 2 |  | 0.6390 | 0.6485 | 0.6527 | 0.6467 | 0.7846 |
|  Experiment 3 |  | 0.7830 | 0.7972 | 0.7885 | 0.7898 | 0.8846 |
|  Experiment 4 |  | 0.4991 | 0.5091 | 0.5134 | 0.5072 | 0.6549 |
|  Experiment 5 |  | 0.6880 | 0.6902 | 0.6751 | 0.6844 | 0.7868 |
|  Experiment 6 |  | 0.6066 | 0.6085 | 0.5979 | 0.6347 | 0.8112 |

### 4.4. Results of PSNR and SNR

Below, 10 different experiments have been performed for PSNR and SNR methods. The images of 4 males and 4 females were used in these experiments and images were selected from different angles. The values of PSNR and SNR between the query image and other images are given in table 4.3 PSNR value is high when the similarity between the query image and reference image increases. When similarity decreases; the value of PSNR decreases. On the other hand, the SNR value is exactly the opposite, similarity increases while the value of SNR decreases.

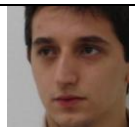
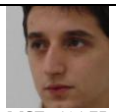
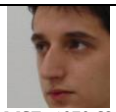
**Table 4. 3.** The experimental results of 10 peoples with SNR and PSNR methods

| **Query Image** | **Similiar Images** | | | | |
|---|---|---|---|---|---|
|  Experiment 1 |  SNR=9.222 PSNR=18.339 |  SNR=9.4042 PSNR=18.521 |  SNR=5.3272 PSNR=14.444 |  SNR=4.6615 PSNR=13.778 |  SNR=4.4756 PSNR=13.592 |
|  Experiment 2 |  SNR=11.221 PSNR=19.508 |  SNR=7.807 PSNR=16.094 |  SNR=6.266 PSNR=14.552 |  SNR=5.759 PSNR=14.045 |  SNR=4.725 PSNR= 13.012 |
|  Experiment 3 |  SNR=10.72 PSNR=47 17.61 |  SNR=7.454 PSNR=914.34 |  SNR=4.918 PSNR=911.80 |  SNR=4.782 PSNR=811.67 |  SNR=4.281 PSNR=211.16 |
|  Experiment 4 |  SNR=12.323 PSNR=0019.42 |  SNR=11.963 PSNR=3219.0 |  SNR=8.17490 PSNR=615.27 |  SNR=5.65594 PSNR=812.76 |  SNR=5.141 PSNR=612.24 |
|  Experiment 5 |  SNR=11.002413 PSNR=19.467 |  SNR=9.171 PSNR=17.636 |  SNR=7.094 PSNR=15.558 |  SNR=6.719 PSNR=15.184 |  SNR=4.589 PSNR=13.053 |
|  Experiment 6 |  SNR=15.049 PSNR=23.473 |  SNR=11.882 PSNR=20.305 |  SNR=8.249 PSNR=16.672 |  SNR=6.730 PSNR=15.153 |  SNR=4.825 PSNR=13.249 |
|  Experiment 7 |  SNR=12.763 PSNR=1522.9 |  SNR=10.473 PSNR=6520.6 |  SNR=10.267 PSNR=9920.4 |  SNR=9.874 PSNR=6201 |  SNR=5.131 PSNR=315.35 |
|  Experiment 8 |  SNR=14.522 PSNR=7422.4 |  SNR=13.094 PSNR=18 20.9 |  SNR=13.077 PSNR=2320.9 |  SNR=11.621 PSNR=2919 |  SNR=8.628 PSNR=116.52 |

## 4.5. Mean-squared error (MSE) criterion

MSE measures mean squared differences between real and ideal pixel values. MSE is commonly used to compare two images for matrix.

**Table 4. 4.** Experimental results of MSE of 5 men and 5 women

| Query Image | Similiar Images | | | | |
|---|---|---|---|---|---|
|  Experiment 1 |  MSE=414.75 |  MSE=1070.69 |  MSE 1152.94 |  MSE 2687.14 |  MSE 2790.19 |
|  Experiment 2 |  MSE=1287.05 |  MSE=1588.61 |  MSE=2566.44 |  MSE=2599.02 |  MSE=2727.8 |
|  Experiment 3 |  MSE=422.31 |  MSE=1207.47 |  MSE=1577.65 |  MSE=1662.77 |  MSE=2803.4 |
|  Experiment 4 |  MSE=371.37 |  MSE=482.86 |  MSE=455.71 |  MSE=505.67 |  MSE=920.36 |
|  Experiment 5 |  MSE=740.78 |  MSE=809.31 |  MSE=815.72 |  MSE=843.21 |  MSE=852.57 |
|  Experiment 6 |  MSE=2070.32 |  MSE=2219.03 |  MSE=2399.62 |  MSE=3167.70 |  MSE=3284.4 |
|  Experiment 7 |  MSE=1352.39 |  MSE=1423.89 |  MSE=1553.46 |  MSE=1745.13 |  MSE=1804.9 |
|  Experiment 8 |  MSE=221.52 |  MSE=818.98 |  MSE=1541.77 |  MSE=1577.00 |  MSE=1849.8 |
|  Experiment 9 |  MSE=494.84 |  MSE=1072.05 |  MSE=2011.68 |  MSE=2123.49 |  MSE=2736.1 |
|  Experiment 10 |  MSE=333.41 |  MSE=640.04 |  MSE=1194.71 |  MSE=1655.20 |  MSE=1682.3 |

### 4.6. Examination of SSIM parameters

Exponential parameters and radius parameters of SSIM methods will be examined in this section. In case of different values of these parameters, changes of SSIM value is explained.

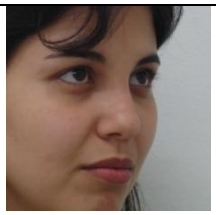
#### 4.6.1. Comparisons of exponential parameters

In the following two experiments, the exponential parameters $a, \beta$ *and* $y$ of the SSIM methods are examined. Two trials between male and female images were compared. The parameters measure the order of the SSIM similarity and measure the effects of the luminance, contrast and structure components. In the experiment, the SSIM similarity value between two images (Query and Reference Images) of the same person is examined to different values of exponential parameters. Results of male image in Table 4.5 and the result of the female image in 4.6 are given below. In both tables, it is seen that the value of SSIM effects of luminance component of the SSIM similarity value is higher than that of the contrast and structure components. A variation of the luminance value has much more effect on the low frequency components. The effect of changes to the contrast and structure components is less noticeable.

**Table 4. 5.** Experiment of SSIM parameters for male

|  **Query Image** | |  **Reference Image** | |
|---|---|---|---|
| $\alpha$ | β | $\gamma$ | **SSIM Value** |
| 1 | 1 | 1 | 0.8785 |
| 1 | 1 | 2 | 0.8384 |
| 1 | 1 | 3 | 0.8056 |
| 1 | 2 | 1 | 0.8692 |
| 1 | 2 | 2 | 0.8311 |
| 1 | 2 | 3 | 0.7997 |
| 1 | 3 | 1 | 0.8618 |
| 1 | 3 | 2 | 0.8250 |
| 1 | 3 | 3 | 0.7945 |
| 2 | 1 | 1 | 0.8681 |
| 2 | 1 | 2 | 0.8295 |
| 2 | 1 | 3 | 0.7977 |
| 2 | 2 | 1 | 0.8595 |
| 2 | 2 | 2 | 0.8226 |
| 2 | 2 | 3 | 0.7921 |
| 2 | 3 | 1 | 0.8524 |
| 2 | 3 | 2 | 0.8168 |
| 2 | 3 | 3 | 0.7871 |
| 3 | 1 | 1 | 0.8590 |
| 3 | 1 | 2 | 0.8214 |
| 3 | 1 | 3 | 0.7905 |
| 3 | 2 | 1 | 0.8508 |
| 3 | 2 | 2 | 0.8149 |
| 3 | 2 | 3 | 0.7851 |
| 3 | 3 | 1 | 0.8440 |
| 3 | 3 | 2 | 0.8093 |
| 3 | 3 | 3 | 0.7802 |

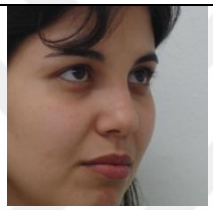
**Table 4. 6**. Experiment of SSIM parameters for female

|  **Query Image** | |  **Reference Image** | |
|---|---|---|---|
| $\alpha$ | β | $\gamma$ | **SSIM Value** |
| 1 | 1 | 1 | 0.5761 |
| 1 | 1 | 2 | 0.5217 |
| 1 | 1 | 3 | 0.4821 |
| 1 | 2 | 1 | 0.5535 |
| 1 | 2 | 2 | 0.5058 |
| 1 | 2 | 3 | 0.4710 |
| 1 | 3 | 1 | 0.5389 |
| 1 | 3 | 2 | 0.4950 |
| 1 | 3 | 3 | 0.4628 |
| 2 | 1 | 1 | 0.5441 |
| 2 | 1 | 2 | 0.4977 |
| 2 | 1 | 3 | 0.4633 |
| 2 | 2 | 1 | 0.5267 |
| 2 | 2 | 2 | 0.4851 |
| 2 | 2 | 3 | 0.4542 |
| 2 | 3 | 1 | 0.5148 |
| 2 | 3 | 2 | 0.4761 |
| 2 | 3 | 3 | 0.4473 |
| 3 | 1 | 1 | 0.5245 |
| 3 | 1 | 2 | 0.4827 |
| 3 | 1 | 3 | 0.4513 |
| 3 | 2 | 1 | 0.5101 |
| 3 | 2 | 2 | 0.4720 |
| 3 | 2 | 3 | 0.4435 |
| 3 | 3 | 1 | 0.4998 |
| 3 | 3 | 2 | 0.4641 |
| 3 | 3 | 3 | 0.4372 |

### 4.6.2. Radius Comparison

The comparison of different radius values with SSIM with default value of the radius is 1.5 The radius is expressed as the standard deviation of the isotropic Gaussion function that is used as a positive coefficient. The value is used to weigh the pixel to estimate local statistics in an image. The size of sub images in an image is indicated by radius. It specifies the window size to obtain the similarity value from the local regions of the image. The SSIM results obtained in the case of different radius values are given in the below Table. As the value increases, the value of SSIM decreases. The Table also includes weighted images obtained in the case of an increase in radius. Images can be seen to be different from each other.

**Table 4. 7.** Raduis and SSIM value

|  **Query Image** | |  **Reference Image** |
|---|---|---|
| **Radius** | **SSIM Value** | **Mapped Image** |
| R=1 | 0.6024 |  |
| R=1,5 | 0.5761 |  |
| R=2 | 0.5576 |  |
| R=2,5 | 0.5416 |  |
| R=3 | 0.5285 |  |
| R=3,5 | 0.5164 |  |
| R=4 | 0.5066 |  |

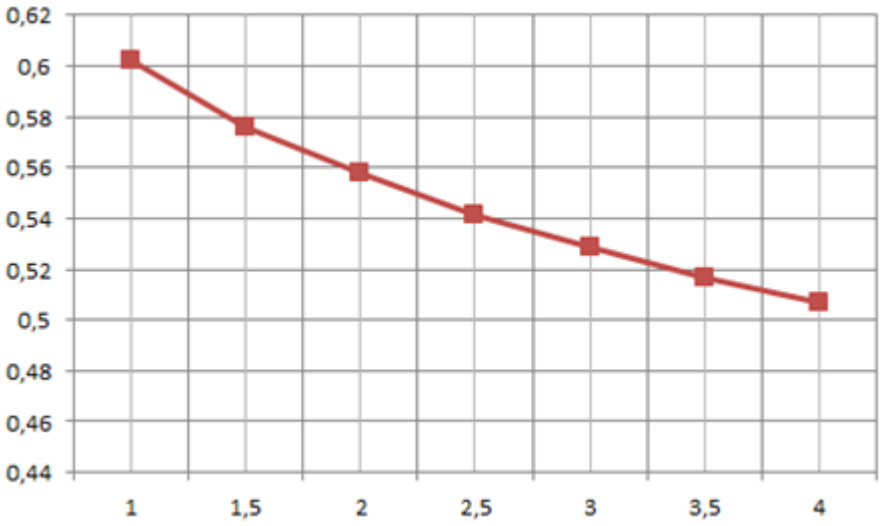



**Figure 4. 6.** Radius and SSIM Value

The performance of the SSIM based image quality evaluation method is better than the PSNR but the evaluation effects of SSIM is poor for severe fuzzy images.

## 5.1. CONCLUSION AND DISCUSSION

Image searching is one of the most important services that need to be supported. In general, 2 different approaches have been applied to allow searching of image collections: one is based on image textual meta data and the other is based on image content information. Querying by visual information is called content-based image retrieval (CBIR). CBIR systems involve research on databases and image processing, handling problems that vary from storage issues to friendly user interfaces. In this paper, we have presented a web-based CBIR approach for person identification using the SSIM, PSNR and SNR indexes. The study was conducted to find out the relationship between different variables. The study was planned under the following objectives: To assess an interested user connects to the WWW server providing the search engine with the web browser. To find out the relationship between Web server and uploaded the query images. To assess or compare the capability of web browser when the users send the information on the selected images to the search engine and also assess proficiency with visual impairment. The main objective of this research, image retrieval system for person identification based on the SSIM, PSNR and SNR To identify the relationship of the system marks best images selected by the SSIM, PSNR and SNR. Indexes, similar person, and comprehensive evidence about the person are then accessible to the user. To assess an interested user connects to the WWW server providing the search engine this researcher developed the different tests for image retrieval system for person identification. We were using five males and five females in this study. We collect our data through WWW server, which providing the research engine with a web browser. With the help of this browser we calculate and asses the value of an image retrieval system of face recognition through SSIM, PSRN and SNR methods.

In this analysis a randomly selected image is scanned from a web based database (Table 4.1). The most similar images of the selected image or person are scanned through web based database. This original needed image which is not in the database is associated with the SSIM method with the images found in the other servers. The most comparable images were listed with SSIM method.

In this study, randomized 5 males and 5 females' experiments were performed by the MSSIM method (Table 4.2). The SSIM values for each color channel (R, G, B) of the color images were obtained for the MSSIM method. Judging from the obtained

values, the SSIM method was found to be much more successful than the MSSIM method.

PSNR and SNR methods were also used in this study. These methods are compared with the images in question and the images in the database using error values (Table 4.3). The PSNR and SNR criteria are inversely proportional. When one increases, the other decreases.

The effect of the SSIM parameters on the inquiries in the study was also examined. The experiments on the exponential parameters $a, \beta$ and $y$ of the SSIM methods are exmined. Two trials were compared between male and female images, the parameters measures the order of the SSIM similarity and measures the effects of the luminance, contrast and structure components. In the experiment, the SSIM similarity value between two images (Query and Refrence Images) of the same person is examined to different values of exponential parameters. It is seen that the value of SSIM effects of luminance component of the SSIM similarity value is higher than that of the contrast and structure components (Table 4.5 and Table 4.6).

The study also investigated the effect of the SSIM radius parameter. This radius is expressed as the standard deviation of the isotropic Gaussion function that is used as a positive coefficient. This value is used to weight the pixel to estimate local statistics in an image. The size of sub images in an image is indicated by radius. Specifies the window size to obtain the similarity value from the local regions of the image (Table 4.7). As this value increase the value of SSIM decreases. The Table also includes weighted images obtained in the case of an increase in radius. Images can also be seen to be different from each other's. As a result, this study has shown that the used image similarity method SSIM was a very successful method for person identification.

In this research I analyzed the effects of SSIM, PSNR and SNR on face recognition. The purpose of the research was to study the face recognition with SSIM, PSRN, SNR to check the proficiency through MATLAB Software and analyze its relationship between given variables. We take sample of 200 students between 19 to 70 years old. The style of the research was quantitative. Data was collected from the Artificial Intelligence Laboratory of FEI. This dataset contains totally 2800 images, which were 640x640 pixels sized. Similarity value was calculated using SSIM, PSNR and SNR methods. When a randomly selected image was scanned from a web-based

database, the most similar images were listed with SSIM method. When images were converted to grey level images then we calculate the averages of SSIM indices obtained in all tapes that were taken. We analyze the PSNR value is high when the similarity between the query image and the reference image increases. As the similarity decreases, the PSNR value decreases. As the similarity increases, the SNR value decreases in our results. In the present research MSE measures mean squared difference between real and ideal pixel values. MSE is a commonly used metric to compare two images. The exponential parameters measure the order of the SSIM and effect of luminance, contrast and struct components. We obtain the result through the value of SSIM decreases in case of increase of parameter values. The effect of the luminance component of the SSIM similarity value is higher than that of the contrast and struct components. Variations in the luminance value have much more effect on the low frequency components. In comparison of different radius values with SSIM in case of increase the radius value the value of SSIM was decreases. SSIM have the positive relations with values if we increase the parameter or increase the variables the SSIM values increase and if we decrease the parameters or variables SSIM value decreases. SSIM was not good method for face recognition because when we increase our sample size or increase our parameters the values of SSIM decreases, its mean similarity of images decrease

**REFERENCES**


Aldahdooh, A., Masala, E., Van Wallendael, G., and Barkowsky, M., 2017. Framework for reproducible objective video quality research with case study on PSNR implementations, *Digital Signal Processing*.

Anitha, S., and Nagabhushana, B.D., 2012. Quality assessment of resultant images after processing, *The International Institute for Science, Technology and Education (IISTE)*, *3*(7), 105-112.

Bach, J.R., Paul, S., and Jain, R., 1993. A visual information management system for the interactive retrieval of faces, *IEEE transactions on Knowledge and data engineering*, *5*(4), 619-628.

Bach, J.R.A., 1993. Visual information management system for the interactive retrieval of faces, *IEEE Transactions on Knowledge and Data Engineering* 5(4) , 619-628

Chaofeng, Li, Alan C.,and Bovik., 2010. Content-partitioned structural similarity index for image quality assessment, Signal Processing:*Image Communication 25,* 517–526.

Chen, Y.K., Cheng, F.C., and Tsai, P., 2011. A gray-level clustering reduction algorithm with the least PSNR, *Expert Systems with Applications*, *38*(8), 10183-10187.

Chen, Y.K., Cheng, F.C., and Tsai, P., 2011. A gray-level clustering reduction algorithm with the least PSNR, *Expert Systems with Applications*, *38*(8), 10183-10187.

*computer methods and programs in biomedicine,(*99). 289–297.

Cox, I.J., Miller, M.L., Minka, T.P., Papathomas, T.V., and Yianilos, P.N., 2000. The Bayesian image retrieval system, PicHunter: theory, implementation, and psychophysical experiments, *IEEE transactions on image processing*, *9*(1), 20-37.

Dai, H.J., Wu, C.Y., Tsai, R.T.H., and Hsu, W.L., 2014. Chapter 12: Text Mining in Biomedicine and Healthcare, In *Biological Data Mining and its Applications in Healthcare* (pp. 325-372).

De Oliveira, J.E., Machado, A.M., Chavez, G.C., Lopes, A.P.B., Deserno, T.M., and Araújo, A.D.A., 2010. MammoSys: A content-based image retrieval system using breast density patterns, *Computer methods and programs in biomedicine*, *99*(3), 289-297.

Dumić, E., Grgić, S., Šakić, K., Rocha, P.M.R., and da Silva Cruz, L.A., 2017. 3D video subjective quality: a new database and grade comparison study, *Multimedia tools and applications*, *76*(2), 2087-2109.

Eakins, J.P, Boardman, J.M., and Graham, M.E., 1998. Similarity retrieval of trade mark images" *IEEE Multimedia, 5*(2), 53-63

*Expert Systems with Applications* (29),589-597.

Fan, G., Wang, Z., and Wanga, J., 2010. CW-SSIM Kernel based Random Forest for Image Classification", Visual Communications and Image Processing.

Fan, G., Wang, Z., and Wang, J., 2010. Cw-ssim kernel based random forest for image classification, In *Visual Communications and Image Processing 2010* (Vol. 7744, p. 774425). International Society for Optics and Photonics.

Gudivada, V.N., and Raghavan, V.V., 1995. Design and evaluation of algorithms for image retrieval by spatial similarity, *ACM Transactions on Information Systems 13*(2), 115-144

Huang, C.S., Huang, Y.C., and Lai, P.J., 2012. Modified genetic algorithms for solving fuzzy flow shop scheduling problems and their implementation with CUDA, *Expert Systems with Applications*, *39*(5), 4999-5005.
*Information Processing and Management* (47).176–185

Iqbal, M.S., Hussain, S., and Ghafoor, A., 2017. Peak to average power ratio based spatial spectrum sensing for cognitive radio systems, *Computers and Electrical Engineering*, *63*, 30-40.

Javier S.B., 2011. Structural similarity image quality reliability Determining parameters and window size, *Signal Processing 91*.1012–1020.

Li, C., Huang, Y., and Zhu, L., 2017. Color texture image retrieval based on Gaussian copula models of Gabor wavelets, *Pattern Recognition*, *64*, 118-129.

Liu, Y., 1998. Content-based 3-D neuroradiologic image retrieval: preliminary results in IEEE International Worksho, *on Content-based Access of Image and Video* Databases, (CAIVD'98), Bombay, India, , 91-100

Liu, Y., Zhang, D., Lu, G., and Ma, W.Y., 2007. A survey of content-based image retrieval with high-level semantics, *Pattern Recognition 40* 262 –282

Ma W.Y., and Manjunath., 1998. BSA texture thesaurus for browsing large aerial photographs, *Journal of the American Society for Information Science 49*(7), 633-648

Marcela, X., Ribeiroa, H., Bugatti, P., Caetano, T.J., Marques, M.A.P., Natalia, A.R., and Agma, J.M., 2009. Traina Supporting content-based image retrieval and computer-aided diagnosis systems with association rule-based techniques, *Data and Knowledge Engineering 68*.1370–1382

Muralidharan, V., Sugumaran, V., and Sakthivel, N.R., 2011. Wavelet decomposition and support vector machine for fault diagnosis of monoblock centrifugal pump, *International Journal of Data Analysis Techniques and Strategies*, *3*(2), 159-177.

Nasr, M.A.S., AlRahmawy, M.F., and Tolba, A.S., 2016. Multi-scale structural similarity index for motion detection, *Journal of King Saud University-Computer and Information Sciences*

Nasr, M.A.S., AlRahmawy, M.F., and Tolba, A.S., 2017. Multi-scale structural similarity index for motion detection, *Journal of King Saud University-Computer and Information Sciences*, *29*(3), 399-409.

Okagbue, H.I., Opanuga, A.A., Adamu, M.O., Ugwoke, P.O., Obasi, E.C., and Eze, G.A., 2017. Personal name in Igbo Culture: A dataset on randomly selected personal names and their statistical analysis, *Data in brief*, *15*, 72-80.

Okon, C., 1998. Mainstreaming face recognition apps" *Advanced Imaging 13*(4), 16-18

Pandey, S., Khanna, P., and Yokota, H., 2016. A semantics and image retrieval system for hierarchical image databases, *Information Processing and Management*, *52*(4), 571-591.

Park, S.S., Seo, K.K., and Jang., D.S, 2005. Expert system based on artificial neural networks for content-based image retrieval.

Pedronette, D.C.G., Almeida, J., and Torres, R.D.S., 2016. A graph-based ranked-list model for unsupervised distance learning on shape retrieval, *Pattern Recognition Letters*, *83*, 357-367.

Qian, F., Guo, J., Sun, T., and Wang, T., 2014. Multi-scale SSIM metric based on weighted wavelet decomposition, *Optik-International Journal for Light and Electron Optics*, *125*(20), 6205-6209.

Qian, F., Guo, J., Sun, T., and Wang, T., 2015. Quantitative assessment of laser-dazzling effects through wavelet-weighted multi-scale SSIM measurements, *Optics and Laser Technology*, *67*, 183-191.

Ribeiro, M.X., Bugatti, P.H., Traina, J.C., Marques, P.M., Rosa, N.A., and Traina, A.J., 2009. Supporting content-based image retrieval and computer-aided diagnosis systems with association rule-based techniques, *Data and Knowledge Engineering*, *68*(12), 1370-1382.

Rouse, D.M., and Hemami, S.S., 2008. Analyzing the role of visual structure in the recognition of natural image content with multi-scale SSIM, In *Human Vision and Electronic Imaging XIII* (Vol. 6806, p. 680615). International Society for Optics and Photonics.

Rouse, D.M., and S. Hemami, S.S., 2007. "Analyzing the Role of Visual Structure in the Recognition of Natural Image Content with Multi-Scale SSIM Similarity Criterion, *IEEE Western New York Image Processing Workshop* (WNYIP),

Seo, Y., Corona, D., and Hall, N.A., 2017. On the theoretical maximum achievable signal-to-noise ratio (SNR) of piezoelectric microphones. *Sensors and Actuators A: Physical*, *264*, 341-346.

Seshadrinathan, K., Soundararajan, R., Bovik, A.C., and Cormack, L.K., 2010, February. A subjective study to evaluate video quality assessment algorithms, In *Human Vision and Electronic Imaging XV* (Vol. 7527, p. 75270H). International Society for Optics and Photonics.

Silvestre-Blanes, J., 2011. Structural similarity image quality reliability: Determining parameters and window size, *Signal Processing*, *91*(4), 1012-1020.

Smeulders, A.W., Worring, M., Santini, S., Gupta, A., and Jain, R., 2000. Content-based image retrieval at the end of the early years, *IEEE Transactions on pattern analysis and machine intelligence*, *22*(12), 1349-1380.

Swanson, D.C., 2015. Precision spectral peak frequency measurement using a window leakage ratio function, *Mechanical Systems and Signal Processing*, *54*, 1-15.

Tanchenko, A., 2014. Visual-PSNR measure of image quality, *Journal of Visual Communication and Image Representation*, *25*(5), 874-878.

Thomas, M., Mark, L.O., Gu, I., Deselaers, T., Keysers, D., Schubert, H., Spitzer, K., Ney, H., and Berthold W.B., 2005. Automatic categorization of medical images for content-based retrieval and data mining, *Computerized Medical Imaging and Graphics* (29),143–155.

Triantafyllou, C., Polimeni, J.R., and Wald, L.L., 2011. Physiological noise and signal-to-noise ratio in fMRI with multi-channel array coils, *Neuroimage*, *55*(2), 597-606.

Wang Z., Bovik, A.C., Sheikh, H.R., and Simoncelli, E.P., 2004. Image quality assessment: from error visibility to structural similarity, *IEEE transactions on image processing*, *13*(4), 600-612.

Wang, Z., Li, Q., and Shang, X., 2007. Perceptual Image Coding Based on A Maximum of Minimal Structural, *International Conference on Image Processing*, ICIP, pp. II-121 – II-124

Wang, Z., Simoncelli, E.P., and Bovik, A.C., 2003. Multi-Scale Structural Similarity for Image Quality Assessment *IEEE the thrity seventh asilomar conference on signals systems and computers*.CA, USA, 1398- 1402

Wang, Z., Bovik A.C., Sheikh, H.R., and Simoncelli, E.P., 2004. "Image Quality Assessment: From Error Visibility to Structural Similarity", *IEEE Transactions On Image Processing, 13*(4), 600-612

Wang, Z., Bovik, A.C., 2002. A universal image quality index, *IEEE Signal Processing Letters 9*, 81–84.

Wang, Z., Lu, L., 2004. Video quality assessment based on structural distortion measurement, Signal Processing, *Image Communication 19* (1) 1–9.

Wang, Z., Bovik, A.C., Sheikh, H.R., and Simoncelli, E.P., 2004. Image qualityassessment: from error visibility to structural similarity, *IEEE Transactions on Image Processing 13* (4)600–612

Welvaert, M., and Rosseel, Y., 2013. On the definition of signal-to-noise ratio and contrast-to-noise ratio for fMRI data, *PloS one*, *8*(11), e77089.

Winkler S., and Mohandas, P., 2008. The evolution of video quality measurement: From PSNR to hybrid metrics, *IEEE Transactions on Broadcasting*, *54*(3), 660-668.

Yang, C., Zhang, J.Q., et al., 2008. A novel similarity based quality metric for image fusion, *Information Fusion 9* (2) 156–160

Ying, K., Yu, Z., Baxley, R.J., and Zhou, G.T., 2015. Optimization of signal-to-noise-plus-distortion ratio for dynamic-range-limited nonlinearities, *Digital Signal Processing*, *36*, 104-114.

Yuan, K., Zhen T. Z.J., Bai Y., and You Q., 2011. Brain CT image database building for computer-aided diagnosis using content-based image retrieval,

Zengzhen, M., 2014. Image quality assessment in multiband DCT domain based on SSIM, *Optik-International Journal for Light and Electron Optics*, *125*(21), 6470-6473.

Zhao, T., Zeng, K., Rehman, A., and Wang, Z., 2013, November. On the use of SSIM in HEVC, In *Signals, Systems and Computers, 2013 Asilomar Conference on* (pp. 1107-1111). IEEE.

Zheng, Y., Gu, M., Shi, D., Li, M., Ye, L., and Wang, X., 2014. Tomography-guided palisade sacroiliac joint radiofrequency neurotomy versus celecoxib for ankylosing spondylitis: a open-label, randomized, and controlled trial, *Rheumatology international*, *34*(9), 1195-1202.

Zhu, R., Zhou, F., and Xue, J.H., 2018. MvSSIM: A quality assessment index for hyperspectral images, *Neurocomputing*, *27*

Zhu, R., Zhou, F., and Xue, J.H., 2018. MvSSIM: A quality assessment index for hyperspectral images, *Neurocomputing*, 272, 250-257.

Zwan., V.D., 1999. The Informedia digital video library system at the Open University" to be presented at CIR-99, *the Challenge of Image Retrieval, Newcastle upon Tyne, 25-26,*

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