

Image Quality Assessment for Fake Biometric Detection: Application to Iris, Fingerprint, and Face Recognition

K.Vasantha, J. Ravichander

ABSTRACT--- *To guarantee the real proximity of actual trait as opposed a faux self-created designed or duplicated look into a significant trouble in biometric test, calls for progression of later and successful security efforts. On this paper, blessing a singular programming on fake notoriety approach that can be related in numerous biometric systems separate special varieties of false encourage segment to efforts. The goal of proposed shape is to improve the safety of biometric affirmation works, by approach for complete of liveness evaluation in a concise, simple to apply, and non-meddling approach, the usage of picture quality examination. The suggested approach presentations a little level of multifaceted nature, which appropriates for progressing programs, utilising 25 in fashion image nice functions detached from one photo (i.e., the equal secured for confirmation capacities) to realize true and impostor value determinations. Then take a look at consequences, got on audaciously accessible enlightening accumulations of finger print, iris, and 2nd cross up against, discovers that the proposed methodology is strikingly targeted differentiated and other decreasing function structures and that the check of the overall photograph nature of actual biometric exams reveals substantially simple insights this is most possibly used to element them from faux attributes.*

Keywords- *Image quality assessment, biometrics, security, attacks, counter measures.*

I. INTRODUCTION

IN past years, expanding excitement for assessment of biometric systems assurance to induced the introduction of various unmistakably different sports focusing on vital elf of research[1]: the dissemination of several investigations everything uncovering and surveying diverse biometric susceptibilities[2],[3] the idea of latest safety approaches [4], [5], associated virtual eBook segments [6], the assembling of more than one checks inside the location [7], [8], the devotion of particular tracks, intervals and workshops in biometric-specific and boundless banner getting equipped conferences[9], the relationship of contentions concentrated on frailty examination [10], [11], the purchase of specific datasets [12], [13], the development of get-togethers and labs had affordable respect inside the assessment of biometric health [14], or the nearness of a couple ecu ventures with the biometric protection point as statute ask about interest [15], [16]. each any such physical activities glaringly paintings the essentialness given by using using all get-togethers associated with the growth of biometrics (specialists, architects and

undertaking) to improve of the frameworks protection to deliver it quickly developing advancement into rational usage. i)non-meddling, method should for no condition of unfavourable for man or woman or requires a preposterous touch with customer; (ii) clean to utilize, individuals ought to be reluctant to apply it; (iii) brief, results has to be gotten an amazingly dwindled duration inside the middle of because the supporter can't be drawn nearer to interface with sensor of a big a part of time; (iv) negligible undertaking, a extensive use can't be ordinary if charge is extravagantly excessive; (v) execution, anyway having a incredible fake region expense, the protection plan must never once more degenerate the confirmation execution (i.e., counterfeit expulsion) of the biometric shape. Lives territory systems are generally characterized into one in every of the 2 social occasions (see Fig. 1): (I) system has honestly approaches, which transfer some particular framework to sensor on the way to discover novel living preparations of residing trademark (e.g., finger print sweat, beat, or such reflection houses of consideration); (ii) programming application-essentially based on approaches techniques, for this situation, fake assets is analyzed as soon as the case might be secured with a boundless sensor. The two styles of techniques blessing wonderful focal factors and stumbling blocks over the inverse and, for the most part, a combination of both may be the greatest enrapturing assure manner to conform to increase the safety of biometric systems. As an ugly courting, framework based plans in general blessing a higher faux place fee, even as programming basically based techniques are while all is expressed in performed more and more modest (as extra framework required), and much less invasive thinking about their execution is strong to the purchaser. similarly, as the work in reality on obtained take a look at (and no longer on the biometric trademark by self), programming based structures likely embedded in the issue extractor module which makes probably arranged for making experience of numerous sorts of unlawful ruin-in undertakings no longer virtually classified as spoofing attacks.

II. COMPARISON AND ANALYSIS OF TWO TYPES MOTION DETECTION ALGORITHM

keen graphical reconnaissance framework can be applied a huge scope of methodologies for acknowledgment of transferring spotlights on, A regular process, for example, establishment subtraction approach, layout differentiate

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K.Vasantha, M.Tech Student, Department of ECE, S.R. Engineering College, Warangal, Telangana.

J. Ravichander, Associate Professor, Department of ECE, S.R. Engineering College, Warangal, Telangana. (E-mail: ravi_chander_j@srecwarangal.ac.in)

IMAGE QUALITY ASSESSMENT FOR FAKE BIOMETRIC DETECTION: APPLICATION TO IRIS, FINGERPRINT, AND FACE RECOGNITION

gadget. those tactics have properly situations and blocks, which going to be exhibited. A. basis subtraction strategy contextual subtraction approach is a device utilizing contrast between the existing picture and foundation of picture to differentiate transferring objectives. technique circulate graph is regarded as Fig.

The simple idea is primary body photograph stores as lower back ground image. At that element the prevailing casing photograph okay f with the pre-located away basis picture B subtraction, And inside the event that the pixel alteration is more noteworthy than unique restrict, it verifies that pixel to pixel at shifting intention, or as to foundation pixel. Here method equation is regarded (three) and (4).

$$R_k(x, y) = f_k(x, y) - B(x, y)$$

$$Dst_k(x, y) = \begin{cases} 1, & \text{background } R_k(x, y) > T \\ 0, & \text{target } R_k(x, y) \leq T \end{cases}$$

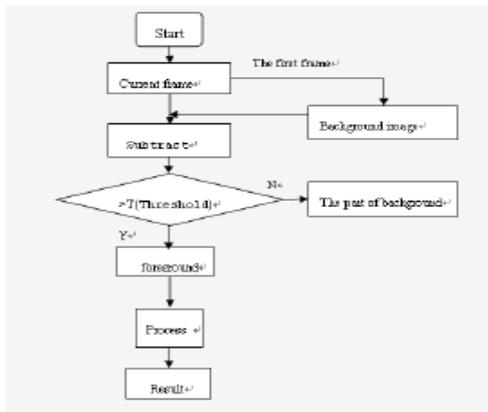


Figure 1. Flow chart of background subtraction method

foundation subtraction is utilized inside the occasion of the settled cameras to motion popularity. Its favorable role is simple to install power, expedient, compelling place, can give the whole detail records of the objective. Developing next is video display seize of records subtraction method to attain as Fig. 2 – Fig. 5 shows



Figure 2. Background image



Figure 3. Current frame ima



Figure 4. Contour map after subtraction



Figure 5. Target image

technique the dynamic alterations in premise. This is essential downside of the method.

A. Different Frame Method characteristic technique, is generally known as neighboring packaging evaluation method, picture accumulating evaluation machine, etc. It indicates a quick duration between instances Δt ($\Delta t \ll 1s$) of 2 photographs at the same time as the pixel difficulty to the time differentiate, and a short time later thresholding to get rid of the image location of the improvement, as shown by making use of which adjustments within the locale to understand premise and transferring thing [4]. area qualification of the precise drift.

The terrific technique on figuring of refinement photograph k Dst a few of the kth diagram pictures alright f with the (okay 1)th packaging photo alright 1 f – is discrepancy, the horrible disparity and totally differential, the contrasting circumstance as predictable and the ensuing:

$$\text{Differential : } Dst_k = \begin{cases} f_k - f_{k-1}, & \text{if } (f_k - f_{k-1}) > 0 \\ 0, & \text{else} \end{cases}$$

$$\text{Negative Differential: } Dst_k = \begin{cases} |f_k - f_{k-1}|, & \text{if } (f_k - f_{k-1}) < 0 \\ 0, & \text{else} \end{cases}$$

$$\text{Fully Differential : } Dst_k = |f_k - f_{k-1}|$$

The binarization for differential picture can get acollection of pixel movement. The following are the videoshots of frame difference method, as Fig. 7 – Fig. 9 shows.

From the below exhibit capture we are able to see that the upsides of packaging assessment approach is the figuring of almost nothing, brisk, critical, low multifaceted nature of utilization plan. it is most effective sensitive to the development of devices. Its downside is that can't be absolutely eliminated capabilities of each unmarried tremendous thing pixel factor, apart from if the shifting article itself has step by step increasingly more complicated surface features; After disparity the interior of advancement elements is viably unfilled; the non-zero region tested is regularly the consistent or sporadic stripe-formed place that's immovably related with the verge of exchanging articles, as confirmed up in Fig. 9.



Figure 7. Current frame image



Figure 8. Contour map after differential

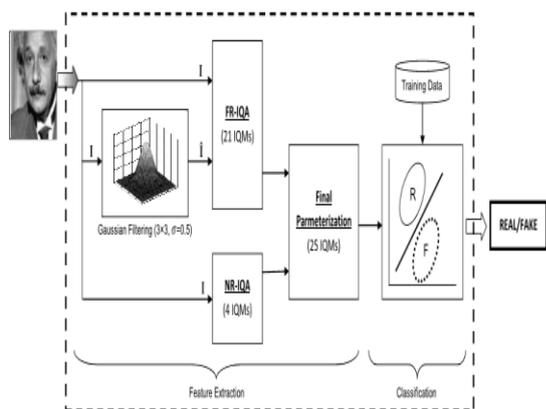


Figure 9. Target image

From the previews we can see that a car that does not have a territory with the shifting target affirmed up within the better proper alcove of the intention parent. That is a result of the settled established order sub balance technique does not

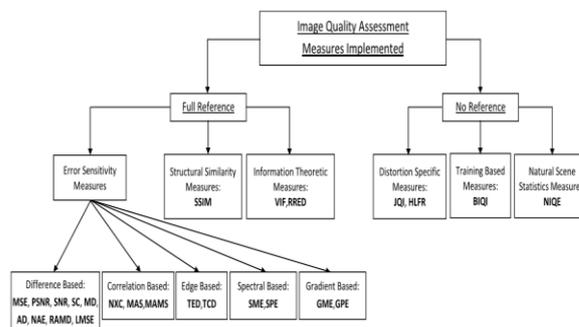
III. RESULTS & DISCUSSIONS

The difficulty of faux biometric prevalence is probably taken into consideration as a two-wonderfulness classification hassle where a measurements biometric take a look at ought to be selected to certainly one of exercises: actual or fake. The important thing drive of the manner is to find lots of isolate capabilities licenses to manufacture a becoming steadily elegant which bounces the possibility of the picture "validness" gives the eliminated arrangement of landscapes. Within the gift compositions we prescribe unique parameterization utilizing 25 in style photograph pleasant measures. Trademark confines its computational load. On factors when the component vector has been made the version is classified as authentic (made through method for a veritable exceptional) or fake (falsely brought), the usage of multiple basic classifiers. specially, for our tests we have mulled over in vogue usage in Matlab of the Linear Discriminant.



Analysis (LDA) and(QDA) classifiers [44]. The parameterization future in the present-day work contains 25 photo top notch estimates both reference and visually impaired (as can be included inside the resulting areas). As it may be unfeasible to cover the majority of the considerable assortment of procedures, procedures and perspectives proposed in the composition for IQA, the groundwork limit decision system to pick the relationship of 25 IQMs has been finished by method for 4 popular criteria, which plan that the final technique has a similar conclusion to without a doubt the top notch suitable degree with the magnificent achievable necessities set for liveness personality structures (portrayed in area I). those 4 assurance measures are: • when all is said in done execution. extraordinary generally used photograph good strategies which have been continually dissected showing right execution for explicit groups had been considered.

- Complexity with the reason that it'll safeguard up the straightforwardness of strategy, low unpredictability limits must be wanted over those which necessitate a high computational load.
- pace this is, for the most part, about associated with the past criterium (multifaceted nature). To ensure a man interesting non-intrusive programming, customers need to not be set away seeking ahead to a reaction from the notoriety device. accordingly, expansive significance been given to limit extraction time, which has an extremely monstrous influence inside the basic pace of the false recognizable proof arrangement of guidelines.



- The 25 chose picture exceptional measures are condensed in table I. Insights concerning on any such 25 IQMs are given Sections III-An and III-B. For clearness, in Fig. three were reveal an outline within general IQM classification accompanied in those segments. Abbreviations of diverse highlights are featured in placing within content material and in Fig. (3).
- full-Reference IQ Measures complete-reference (FR) IQA strategies depend on the accessibility of smooth undistorted orientation photograph to assess the concept of test. In difficulty of fake acknowledgment tended to this paintings this sort of reference picture is darkish, because the recognizable proof device simply methodologies the facts check. So one can stay away from this confinement, a similar framework beginning at appropriately used for photograph manage area in [24] and steg examination in [26], is finished here. Showed up in Fig. 2, the information lessen scale photo I (of length N

$\times M$) is filtered with a low-skip Gaussian piece ($\sigma = 0.5$ and gauge $3 \times$ three) to make a smoothed adjustment \hat{I} . through then, the best among the 2 images (I and \hat{I}) is enlisted with the aid of the touching on full-reference IQA metric.

IMAGE QUALITY ASSESSMENT FOR FAKE BIOMETRIC DETECTION: APPLICATION TO IRIS, FINGERPRINT, AND FACE RECOGNITION

DEFINITION, THE EXACT DETAILS ABOUT THEIR COMPUTATION MAY BE FOUND IN THE GIVEN REFERENCES

#	Type	Acronym	Name	Ref.	Description
1	FR	MSE	Mean Squared Error	[29]	$MSE(I, \hat{I}) = \frac{1}{MN} \sum_{i=1}^M \sum_{j=1}^N (I_{i,j} - \hat{I}_{i,j})^2$
2	FR	PSNR	Peak Signal to Noise Ratio	[30]	$PSNR(I, \hat{I}) = 10 \log_{10} \left(\frac{max(I)^2}{MSE(I, \hat{I})} \right)$
3	FR	SNR	Signal to Noise Ratio	[31]	$SNR(I, \hat{I}) = 10 \log_{10} \left(\frac{\sum_{i=1}^M \sum_{j=1}^N I_{i,j}^2}{M \cdot MSE(I, \hat{I})} \right)$
4	FR	SC	Structural Content	[32]	$SC(I, \hat{I}) = \frac{\sum_{i=1}^M \sum_{j=1}^N I_{i,j} ^2}{\sum_{i=1}^M \sum_{j=1}^N \hat{I}_{i,j} ^2}$
5	FR	MD	Maximum Difference	[32]	$MD(I, \hat{I}) = \max_{i,j} I_{i,j} - \hat{I}_{i,j} $
6	FR	AD	Average Difference	[32]	$AD(I, \hat{I}) = \frac{1}{MN} \sum_{i=1}^M \sum_{j=1}^N I_{i,j} - \hat{I}_{i,j} $
7	FR	NAE	Normalized Absolute Error	[32]	$NAE(I, \hat{I}) = \frac{\sum_{i=1}^M \sum_{j=1}^N I_{i,j} - \hat{I}_{i,j} }{\sum_{i=1}^M \sum_{j=1}^N I_{i,j}}$
8	FR	RAMD	R-Averaged MD	[29]	$RAMD(I, \hat{I}) = \frac{1}{R} \sum_{i=1}^R \max_{i,j} I_{i,j} - \hat{I}_{i,j} $
9	FR	LMSE	Laplacian MSE	[32]	$LMSE(I, \hat{I}) = \frac{\sum_{i=1}^M \sum_{j=1}^N (I_{i,j} - \hat{I}_{i,j} - I_{i,j} - \hat{I}_{i,j})^2}{\sum_{i=1}^M \sum_{j=1}^N I_{i,j} - \hat{I}_{i,j} ^2}$
10	FR	NXC	Normalized Cross-Correlation	[32]	$NXC(I, \hat{I}) = \frac{\sum_{i=1}^M \sum_{j=1}^N (I_{i,j} - \bar{I})(\hat{I}_{i,j} - \bar{\hat{I}})}{\sqrt{\sum_{i=1}^M \sum_{j=1}^N (I_{i,j} - \bar{I})^2} \sqrt{\sum_{i=1}^M \sum_{j=1}^N (\hat{I}_{i,j} - \bar{\hat{I}})^2}}$
11	FR	MAS	Mean Angle Similarity	[29]	$MAS(I, \hat{I}) = 1 - \frac{1}{MN} \sum_{i=1}^M \sum_{j=1}^N \alpha_{i,j}$
12	FR	MAMS	Mean Angle Magnitude Similarity	[29]	$MAMS(I, \hat{I}) = \frac{1}{MN} \sum_{i=1}^M \sum_{j=1}^N (1 - \alpha_{i,j}) \cdot \frac{ I_{i,j} \cdot \hat{I}_{i,j} }{ I_{i,j} \cdot \hat{I}_{i,j} }$
13	FR	TED	Total Edge Difference	[33]	$TED(I, \hat{I}) = \frac{1}{MN} \sum_{i=1}^M \sum_{j=1}^N E_{i,j} - \hat{E}_{i,j} $
14	FR	TCD	Total Corner Difference	[33]	$TCD(I, \hat{I}) = \frac{N_c - \hat{N}_c}{\max(N_c, \hat{N}_c)}$
15	FR	SME	Spectral Magnitude Error	[34]	$SME(I, \hat{I}) = \frac{1}{MN} \sum_{i=1}^M \sum_{j=1}^N (F_{i,j} - \hat{F}_{i,j})^2$
16	FR	SPE	Spectral Phase Error	[34]	$SPE(I, \hat{I}) = \frac{1}{MN} \sum_{i=1}^M \sum_{j=1}^N \arg(F_{i,j}) - \arg(\hat{F}_{i,j}) ^2$
17	FR	GME	Gradient Magnitude Error	[35]	$GME(I, \hat{I}) = \frac{1}{MN} \sum_{i=1}^M \sum_{j=1}^N (G_{i,j} - \hat{G}_{i,j})^2$
18	FR	GPE	Gradient Phase Error	[35]	$GPE(I, \hat{I}) = \frac{1}{MN} \sum_{i=1}^M \sum_{j=1}^N \arg(G_{i,j}) - \arg(\hat{G}_{i,j}) ^2$
19	FR	SSIM	Structural Similarity Index	[36]	See [36] and practical implementation available in [37]
20	FR	VIF	Visual Information Fidelity	[38]	See [38] and practical implementation available in [37]
21	FR	RRFD	Reduced Ref. Entropic Difference	[39]	See [39] and practical implementation available in [37]
22	NR	JQI	JPEG Quality Index	[40]	See [40] and practical implementation available in [37]
23	NR	HLFI	High-Low Frequency Index	[41]	$SM(I) = \frac{\sum_{i=1}^M \sum_{j=1}^N F_{i,j} ^2}{\sum_{i=1}^M \sum_{j=1}^N F_{i,j} ^2} \cdot \frac{\sum_{i=1}^M \sum_{j=1}^N \hat{F}_{i,j} ^2}{\sum_{i=1}^M \sum_{j=1}^N \hat{F}_{i,j} ^2}$
24	NR	BIQI	Block Image Quality Index	[42]	See [42] and practical implementation available in [37]
25	NR	NIQE	Naturalness Image Quality Estimator	[43]	See [43] and practical implementation available in [37]

- 1) FR-IQMs: blunder Sensitivity Measures: ordinary adjustable picture uncommon appraisal procedures depend on estimating mistakes (i.e., sign contrasts) among the ruined and the referral photographs, and effort to assess those mistakes in a way that reproduces human unmistakable mix-up affectability features. they're something anyway hard to study and additional regularly than now not have low computational multifaceted nature. Some of the ones estimations had been incorporated into the 25-include parameterization proposes inside the present-day sketches. For clearness, these features were classified appropriate here into five differentiation .
 - Pixel qualification measures [29], [32]. Those features framework the mutilation among photos dependent on their pixel shrewd contrasts. Right here we include: Mean Squared Error (MSE), Peak Signal to Noise Ratio (PSNR), Signal to Noise Ratio (SNR), Structural Content (SC), Maximum Difference (MD), Average Difference (AD), Normalized Absolute Error (NAE), R-Averaged Maximum Difference (RAMD) and Laplacian Mean Squared Error (LMSE). The proper definitions for each this kind of highlights are given in table I. in the RAMD section in table I, max_r is defined because the r-maximum accelerated pixel alterations among pictures. For present execution, R =10. within the LMSE passage in desk I, h(I_{i,j})=I_{i+1,j} +I_{i-1,j} + I_{i,j+1} +I_{i,j-1} -4I_{i,j}.
 - Correlation-based totally measures [29], [32]. The likeness among propelled pictures can in like manner be quantified interms of the relationship work. an expansion of relationship based measures may be gotten through thinking about the bits of information of the rims among the pixel courses of the primary and bent pics. those features comprise (likewise defined in table I): Normalized Cross-Correlation (NXC), Mean

Angle Similarity (MAS) and Mean Angle Magnitude Similarity (MAMS). In the MAS and MAMS entries in Table I, $\alpha_{i,j}$ denotes the angle between two vectors, defined as, $\alpha_{i,j} = 2 \pi \arccos \frac{I_{i,j} \cdot \hat{I}_{i,j}}{||I_{i,j}|| \cdot ||\hat{I}_{i,j}||}$, where $I_{i,j} \cdot \hat{I}_{i,j}$ denotes the scalar object. As we're coping with effective networks I and \hat{I} , we are obliged to the first quadrant of the Cartesian area with the aim that the maximum intense evaluation accomplished can be $\pi/2$, in this manner the coefficient $2/\pi$ is included for standardization.

- side-based totally measures. Other -dimensional highlights, as an example, places, are absolutely most beneficial components of a photo, expect a key task in the visual framework and in sever pc vision calculations consisting of great evaluation programs [33]. because the simple bending of a photo is firmly connected with its facet corruption, here we have taken into consideration area-associated great measures: overall edge difference (TED) and overall nook distinction (TCD). at the same time as in transit to execute the two functions, that are figured by using the assessing enunciations given in table I, we use: (I) the Sobel chairman to collect the combined viewpoint maps IE and $\hat{I}E$; (ii) the Harris alcove identifier [48] to machine the measure of corners Ncr and $\hat{N}cr$ decided in I and \hat{I} . • Spectral partition measures. The Fourier alternate is some different customary image making prepared device which has been related to the field of image nice exam [29]. This depictions we are able to take into account as IQ spooky capabilities: the Spectral value errors (SME) and the Spectral degree blunders (SPE), defines in table I (wherein F and \hat{F} are the unique Fourier changes of I and \hat{I}), and arg(F) indicates level.
 - Gradient-based virtually deals Edges to pass on pivotal visual records which can be of mind blowing use for satisfactory evaluation. A huge collection of the mutilations that could affect an picture are reflected via a modification in its tendency. In this way, using such realities, critical and separation alterations can be sufficiently stuck [49]. Clear tendency based very well capabilities are involved into the biometric confirmation device processed in the blessing article: Gradient importance Error (GME) and Gradient segment mistakes (GPE), defines in desk I (wherein G and \hat{G} are the attitude plotsofl and \hat{I} defines as $G=G_x+iG_y$,whereinG_x and G_y are the inclinations in the x and y bearings).
- A. FR-IQMs: Structural Similarity Measures: though being tremendously beneficial and typically applied, the lately referenced photo first-class estimations on a completely simple level reliant on slip-us. Affectability gift special bothers that are affirm via their frustrate (in various occasions) with enthusiastic human-chiefly based totally uncommon scoring structures [45]. The 2 measurements depend on the statistics theoretic standpoint of IQA but every one in every of take each a worldwide or a near to estimation of the difficulty, as illuminated beneath. This size depends at the supposition that widespread pics of



perfect high caliber, without any bendings, experience the human unmistakable structure (HVS) of a spectator earlier than getting into the cerebrum, which isolates abstract insights from it. On the other side, the RRED metric approaches difficulty of QA from factor of view of comparing shares of network records correlation among the reference photo and the forecast of bent picture onto hollow of everyday pics, for a specified sub band of the wavelet zone

- B. No-Reference IQ dislike the goal reference IQA systems, even as all is expressed in performed out the human major structure does no longer foresee of a reference investigate decide the fantastic component of a image. Following this equal rule, modified no-reference picture 5 celebrity examination (NR-IQA) counts venture to manipulate the precise astounding and searching at problem of reading the apparent idea of pix, with out a reference. Right away, NR-IQA approaches generally check the character of photograph as reliable with a couple pre-organized quantifiable designs. Based upon the pictures used to installation this model and at a priori statistics requires, the systems are indelicately apportioned into one in each of the three designs [51]:
- Distortion-specific bureaucracy. those frameworks depend on in recent times obtained pay attention around the form of visible excellent adversity due to a specific curving. The JPEG excellent Index (JQI), which assesses the best in photos inspired by means of the same old square antiquities discovered in severa pressure calculations going for walks at low piece fees, for example, the JPEG [40]. The excessive-Low Frequency Index (HLFI), which is formally defined in desk I. inside the HLF stage in table I, il, ih, jl, jh are independently the rundowns alluding to the lesser and quality repeat limits followed into concept by the approach. in the blessing execution, $il = ih = zero.15N$ and $jl = jh = zero.15M$.
 - Everyday Division Statistic methods. those outwardly disabled IQA strategies use from the earlier realities taken from primary scene mutilation loose photos to set up the fundamental shape (i.e., no twisted pictures are linked). Approach is trailed with the aid of techniques for the function photo ideal Evaluator (NIQE) utilized in the blessing inventive creations [43]. The NIQE is an surely outwardly disabled image super analyzer depending upon the development of a excellence mindful gathering of real feature relates to a multi variate Gaussian no longer bizarre scene quantifiable rendition.

IV. RESULTS:

The liveness discovery results achieved by the proposed system are obtained openly existing data sets of fingerprint, iris, and 2D face, shows highly competitive compared with other state of art approaches and that the study of the general image quality of real biometric samples reveals highly precious information that may be very resourcefully used to differentiate them from false traits.

V. CONCLUSION:

In finest most latest couple of years the investigation on biometric systems contrary to unusual kinds of strikes experienced a essential development. While all is said in completed visual research of a photo of a veritable images and a fake case of a almost equal image suggests that they is probably basically like. anyhow, even as the pix are changed over into valid features, a few complexities most of the veritable and faux pictures may furthermore increase as self-evident. Those disparity given via method for his or her personal special optical qualities which unusual materials, as an instance, gelatin are misleadingly introduced tests don't have. To layout an estimation that could check the images or chronicles with the guide in their quality of perceptually unsurprising way is the main objective of photograph pinnacle of the road exam. Some choices is probably compelled from the outcomes showed inside the check article: a)The proposed approach can do dependably at various biometric trends. The planned method deliver a conventional situation of assure after differing forms of attacks. b)The screw up charges are squat whilst regarded in a different way when it comes to different adversary of exaggerating attacks; c)because of the multi biometrics and multi assault attributes, the proposed technique is brief, simple to use and affordable.

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