Support Vector Machine Based Feature Extraction For Gender Recognition From Objects Using Lasso Classifier

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Abstract

The blind people has their difficulty to identify the object moving around them, therefore with a high accuracy score object detection and human face recognition system will helps them in identifying the things around them with ease. Facial record images are immobile an difficult assignment for biometric authentication systems due to various types of characteristics are dimensions, pose, expressions, illustrations and age etc. In facial and other united images includes different objects classifications. In this research article, a minimum distance trainer for feature selection by accessing SVM feature optimization process. For feature selection process SVM (support vector machine) was considered for improving its feature interpretability and computational efficiency., then LASSO classifier applied to perform object recognition and gender classification. Original face image database used for the gender classification. This approach was implemented with dual classification model (1) Recognizing or classifying human faces from various objects and (2) Classifying gender through face recognition] is made possible with the help of combining modified SIFT feature in combination with ridge regression (RR), elastic net (EN), lasso regression(LR) and lasso regression with Gaussian Support Vector Machines (LRGS) based classification.

Key words Support Vector Machine, Ridge Regression, Eleastinet, Logistic Regression, LRGS and gender classification.

1 Introduction

Sex or gender is a feature that helps to identify a person initially. Gender based separation among humans is classified into two: male and female. Distinctive gender groups might also show off diverse propensities. For instance, younger guys and young girls may like toys; human beings may have an inclination towards a variety of clothes varying in colours anf styles.In enterprise understanding, to know the gender (and age) of the customers may also assist business chiefs to publicize their objects as indicated by using numerous purchaser groups and accumulate sizeable statistic facts about the clients, for instance, the number of women enteriup during a retail region or a shopping centre inside a given period.In picture healing, gender (or age) can be a treasured semantic concept for photo association and search, as coming across men or women in specific scenes. In social collaborations or exercises, guys and ladies can also perform contrastingly and have numerous jobs. In this manner perceiving the gender of a person has extensive variations. People can see the gender of each other. It has been a dynamic research in brain science to reflect on consideration on the effect of gender on people [1–3]. In brain technology about, the development is usually the face photographs for gender popularity. In the visible computational investigation for gender characterization or acknowledgement, a large portion of the current works applied face pictures. For example, see [4–8]. As of past due, some methodologies, for example, [9, 10], established that human bodies must used be for gender grouping. Victories display on unmarried dataset images wherein a bodily drawn box containing someone walking utilized all round for frame records extraction. The upsides of using body over face pictures for gender acknowledgement include the accompanying list.

(1) Image Resolution. When the face locale has a low dream or is motion obscured, the face highlights in all likelihood won't be usable for gender order. Be that as it can, the self-belief may also at gift help isolate guys from ladies.

(2) Viewpoint Change. At the factor when the head present is altogether one of a kind from frontal perspectives, the face-primarily based on gender acknowledgement may additionally have low execution or even can not be appropriate. Notwithstanding, self-perception can at gift use. Indeed, even the returned angle on the frame can be used for gender acknowledgement [9, 10].

(3) Acquisition Distance. At the factor when the camera is some distance away from the person, the face photograph won't supply good enough records to gender segregation. Be that as it could, self-belief may additionally even now be usable.

(4) Occlusion. At the point, when the facial part is blocked, the face image probable might not be applied to do away with gender statistics. Be that as it can, the self-notion is as but useful, in any event, while a person features are impeded. Be that as it could, in the ones spearheading ways to deal with sex acknowledgement from the body, as an instance, [9, 10], merely the upstanding self-perceptions with the complete frame look explored. The information normally applied are individual strolling images, as an instance, the MIT passer by database [11],can be named which is an interactive database for walker identity. One pressing necessity is that the whole body in upstanding shows up in each picture, as regarded in Figure 1, and in this way, there is no compelling motive to pressure over to adjust the self-perceptions in coordination. Highlights can be extricated from the entire self-perceptions and used to put together a classifier.

The organisation of this paper is as follows, in section various machine learning schemes applied for object detection and face based gender recogntion were identified. In sectioin 3, SVM based feature extraction in combinatioin with MSIFT (Multi Scale Invariant Feature Transform) demonstrated along with LASSO based regession classification analysis, in section 4 various dataset based results were plotted alongwith simulation setup.Section 5, concludes the paper with breife note on how our research paper finds a solution with performance metrics.

2 Literature Survey

One of the simple issues with any photo making prepared or PC vision undertaking is the clear up of a becoming language for addressing the realities. Face association, carries the extraction of a collection of parameters or estimations that permit portraying of the variations between human beings, instead of the sorts amongst snapshots of individuals.

This method is authentic notably after the photographs have been coded with the component of the dismissal of non-facial variations as the internal man or woman, regardless need to be banned. A regularly carried out method for characterization is Support Vector Machine (SVM) [16,18]; those tune in to the ideal hyper-flying system for keeping apart several getting ready by way of the method for confining the peril of mis-association. Recognization method is regularization or subject based strategy. SVMs have in recent times been used for face grouping [10, 14], displaying dependably better.These compositions grew to become out to be maximum of the way maintained through Ministry of Education, Culture, Sports, Science and Technology Grant-in-Aid for Scientific Research(B) 15300076. The makers are thankful to the Softopia Japan Foundation for the HOIP dataset. Prevalence execution than famous nearest neighbour strategies. Facial sex plan has, also, been taken into consideration [3, 6, 9, 11]. Likewise, a non-instantly SVM based honestly classifier has appeared to make through and via higher outcomes than particular frameworks [12].

The sizeable separation between sexual orientations changed into approval to be strikingly twisted, and this comes to be the pinnacle gone to utilize the help of vector attitude. Regardless, none of those structures chooses to become, robust estimations at which point to organize the countenances. In this paper, a machine for showing up highlight the determination-making use of SVMs delineated wherein the improvement occurs in the parameter location.

Using the board model throughout the eccentrics work, a pitiful dating of features made with a considerable scope of the classifier's parameter is assessed to be 0. The capabilities are greater vigorous than SVM estimations and are efficaciously among the considered. This tool has been named Lasso regression[15], or dynamic [1] or purpose intrigue [4] characterization.

When acting characteristic devotion, it's miles simple to realize the trustworthiness of the element choice method. This approach can do with the aid of discovering the most elements with bunches of complicated insufficient classifiers. In this paper, a different approach for finding the entire relationship of small SVMs is portrayed, which produces internationally perfect classifiers for the development of lin-ear programming sub-problems. It is then suggested to ap-contract Automatic Relevance Detection (ARD) [13] and choose a lone rendition it is enhancing the probability of the practice statistics explained over the various stages of scantiness, while it is the far some distance normal that numerous portrayals and an ever-growing number of versatile amounts supply the advanced arrangement exactness.

The simple thought system in this paper is to depict how the individual which wants, and between congruity of confirmation to bring about talented highlights works of art and smash down their duties in a prime dimension between contain a choice problem.

Most of the approaches mentioned in this section were focused on gender recognition with the help of various classifiers and most of the approaches were applied on nominal databases. Therefore in this scenario, in this research article a new dataset was implemented using the college student

database (SRK college, Vijayawada) to proceed for the real time extinction of the research work.
The major contributions of the all other researchers were stopped with just detecting the gender with 2 class identification approach but here in this research article a combination of 13 classes which supports in identifying the objects and human faces will separated in them and the gender will be identified. This made other researchers to think on blind vision people problem solution tracing.

Fig. 1 Private database image database

3 Proposed Methods

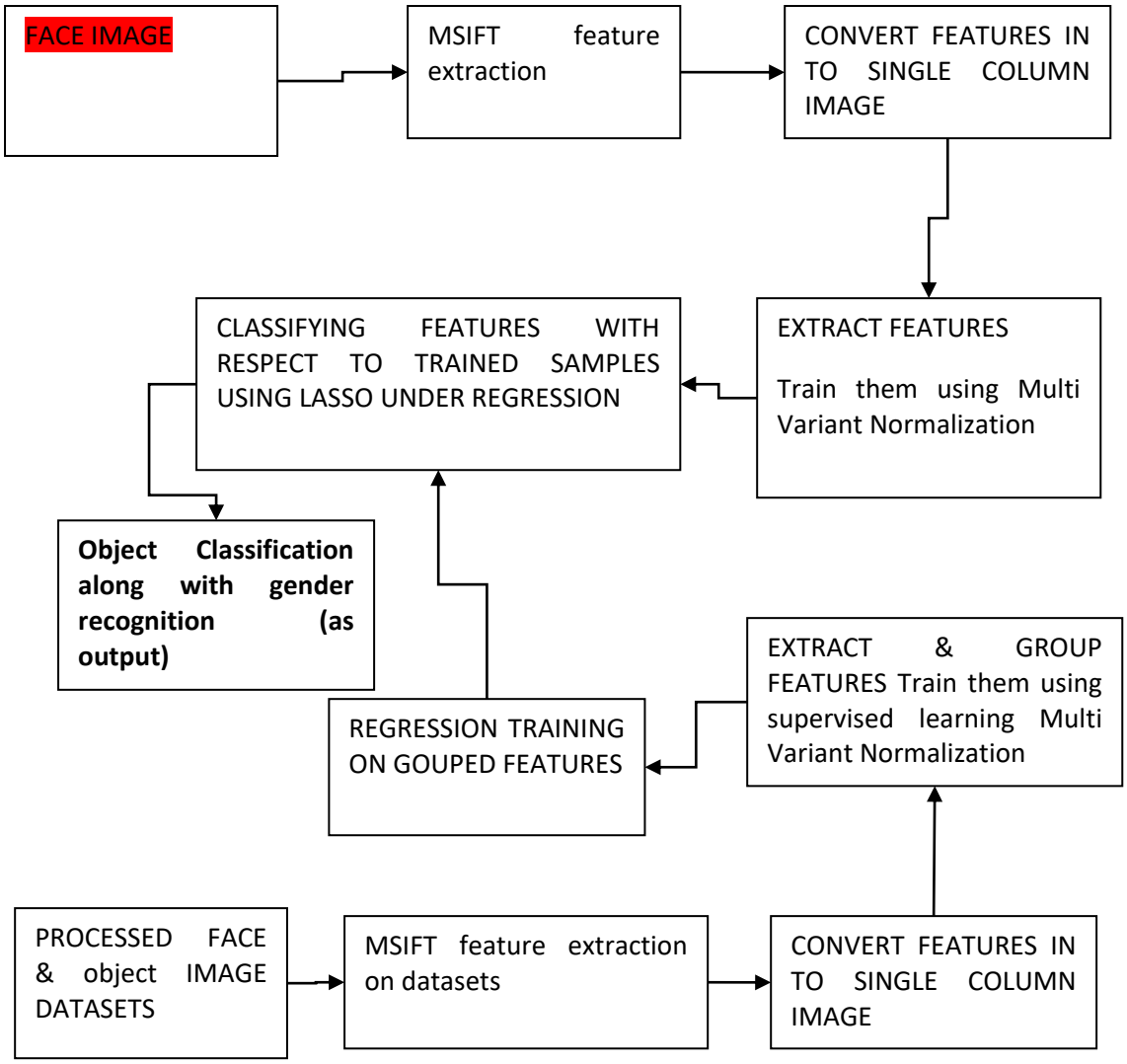

Fig. 2 Block Diagram of proposing scheme

In this paper, propsoing scheme comprised with Multi scale invariant feature extraction and then these features converted into image frame then these gets normalized by using mulit variant normalization. This the feature extraction process followed by training process. Then these 2 gets

classified by using MSVM, GSVM, LASSO, Logistic Regression based LASSO, ELASTIC NET, RIDGE and compared these results in results section of the paper.

3.1 Feature Extraction

Table 1 Different feature extraction algorithms on FERET data sets

S. No	Feature Extractor	Formula	Remark	Result Analysis
1	Gabor PCA[21]	$GP = argmax(Real(I * \psi)^2 + Img(I * \psi)^2) * \lambda$	Extracted real and imaginary features of gabor(G) were optimized by PCA(P)	Extracts edges from the edges by different frequency sacling components with respect to PCA provides a recognition rate of 89.4%
2	Gabor MEAN PCA[21]	$GP = argmax(\sum (Real(I * \psi)^2 + Img(I * \psi)^2)) * \lambda$	Here mean of gabor filter were subjected to PCA optimization	All the extracted edges applied by mean and provides a recognition rate of 92.7%
3	HOG[8]	$H = \frac{v}{\sqrt{\lVert v \rVert_2^2 + e^2}}$	Local feature extraction and normalization will be performed by this theory.	All the block wise extracted histogram features will result under recognitio rate of 83.9%
4	SIFT[18]	Scale $D(x,y,\sigma) = L(x,y,K_i\sigma) - L(x,y,K_j\sigma)$ Position: $D(x) = D + \frac{\partial D^T}{\partial x}x + \frac{1}{2}x^T\frac{\partial^2 D}{\partial x^2}x$ Orientation: $m(x,y) = \sqrt{(L(x+1) - L(x-1))^2 + (L(y+1) - L(y-1))^2}$ $\theta(x,y) = atan2(L(y+1) - L(y-1), L(x+1) - L(x-1))$	One descriptor base 4 features will be extracted from SIFT algorithm and point descriptor of best form will help exact identificaiton of objection. Even scale of the object varied yet will recognize it.	As per remarks it compares the object with point key descriptors and results with an accuracy of 92.7% for recognition
5	MSIFT-Proposing	Scale $D(x,y,\sigma) = (L(x,y,K_i\sigma) - L(x,y,K_j\sigma)) * \Psi$ Position: $D(x) = \left(D + \frac{\partial D^T}{\partial x}x + \frac{1}{2}x^T\frac{\partial^2 D}{\partial x^2}x\right) * \Psi$ Orientation: $m(x,y) = \sqrt{(L(x+1) - L(x-1))^2 + (L(y+1) - L(y-1))^2}$ $\theta(x,y) = atan2(L(y+1) - L(y-1), L(x+1) - L(x-1))$	The image is splitted into multiple frequencies components and extracted sift features from them will result in effective detection even in images of different sizes	The modified SIFT results in most format and results in best recognition rate of 98.3% in this proposing approach

3.2 Classification

Table 1 represents different feature extraction process that were implemented along with our proposing approach to verify which feature extraction will results the high accuracy rate for classification. In table 1 the results column helps in selecting the best approach for feature selection process applied by support vector machine.

Logistic regression a modelling method for estimating the $\theta(X) = P(Y = 1|X)$, and hence $P(Y = 0|X) = 1 - P(Y = 1|X) = 1 - \theta(X)$ As well. Thus it can be used as a classification method for binary classification problems, i.e. the nominal

response has two levels, generically "Yes/Success ($Y = 1$)" and "No/Failure ($Y = 0$)".

Our general classification rule based on these estimated probabilities is given by, If $\hat{\theta}(X) = P(Y = 1|X) \geq p$ then classifies Y as being from class 1, i.e. "Yes" or "Success". If $\hat{\theta}(X) = P(Y = 1|X) < p$ then classify Y as being from class 0, i.e. "No" or "Failure".

$p = 0.50$ makes the most sense from a logical standpoint, but we could certainly use other values. Also, we can rank observations based on these estimated probabilities to find most likely observations/cases where $Y = 1$ (see the discussion of Lift in Section 12.)

The probabilities are estimated using a generalised linear model (GLM) for the natural log of the odds for "success", which is called the logit (L). The logistic regression model is given by,

$$L = ln\left(\frac{\theta(X)}{1-\theta(X)}\right) = \beta_o + \beta_1 U_1 + \beta_2 U_2 + \cdots + \beta_{k-1} U_{k-1} \quad (1)$$

As was the case with the general OLS model, the terms $(U_j's)$ are all functions of the predictors $(X_1, X_2, \ldots, X_p)$. Once we have obtained estimates of the model parameters $(\hat{\beta}_j's)$, and hence the estimated logit $\hat{L}$, we can estimate the probability of "Yes/Success" as,

$$\hat{\theta}(X) = \frac{e^{\hat{L}}}{1+e^{\hat{L}}} = \frac{1}{1+e^{-\hat{L}}} \quad (2)$$

Model selection (e.g. stepwise methods) and cross-validation (if the goal is accurate prediction) are essential elements of the model building process in logistic regression. Term creation, for example, power transformations and interactions, is less straight forward for these models but can be crucial in developing a "good" model for a given situation. On the next page, some guidelines for term creation in logistic regression given.

Table 2 Univariate Considerations

$f(x \mid y)$ - **conditional distribution x gave as y which is 0 or 1.**	**Suggested model terms**
Normal, common variance i.e. $Var(x_j \mid y=0) = Var(x_j \mid y=1)$	X_j, i.e. the predictor itself These values imply that if X_j is NOT normally distributed we might consider transforming X_j to approx. normality.
Normal, unequal variances i.e. $Var(x_j \mid y=0) \neq Var(x_j \mid y=1)$	X_j and X_j^2
Skewed right	X_j and $\log_2(X_j)$ Log base 2 is more comfortable to interpret
$x \in [0,1]$	$\log_2(X_j)$ and $\log_2(1 - X_j)$
X_j~ Poisson, i.e. X_j is a count	X_j, i.e. the predictor itself

3.3 Multivariate Considerations

When considering multiple continuous predictors simultaneously, we look at multivariate normality.

$$f(\underset{\sim}{x} \mid y) \sim MVN(\mu_{y=k}, \Sigma) \quad (3)$$

then use the x's themselves

$$f(\underset{\sim}{x} \mid y) \sim MVN(\mu_{y=k}, \Sigma_{y=k}) \quad (4)$$

then include X_j^2's and $X_i X_j$ terms

For example in the two predictor case ($p = 2$) $x_1 x_2$ is needed if $E(x_1 \mid x_2) = \beta_o + \beta_{1,y=k} x_2$

Moreover, if the variances are different for the x_i across levels of y then, we add x_i^2 terms as well. A scatterplot matrix with the colour of the points coded by the levels of the response Y is a good tool for visualizing which situation is appropriate for our classification problem.

In cases where this instability in the predicted probabilities happens (as in the previous example), ridge, LASSO, and Elastic Net logistic regression are good options. These are also good options when one has a "wide data" problem where $n < p$ or when p is large and also when you have some highly correlated predictors. For logistic regression, the regularised logistic models using the ridge and Lasso given below.

Ridge Logistic:

$$ln\left(\frac{\theta(x)}{1-\theta(x)}\right) = \beta_o + \sum_{j=1}^{k} \beta_j u_j + \lambda \sum_{j=1}^{k} \beta_j^2 \qquad (5)$$

Lasso Logistic:

$$ln\left(\frac{\theta(x)}{1-\theta(x)}\right) = \eta_o + \sum_{j=1}^{k} \beta_j u_j + \lambda \sum_{j=1}^{k} |\beta_j| \qquad (6)$$

Elastic Net Logistic:

$$ln\left(\frac{\theta(x)}{1-\theta(x)}\right) = \eta_o + \sum_{j=1}^{k} \beta_j u_j + \lambda_1 \sum_{j=1}^{k} |\beta_j| + \lambda_2 \sum \beta_j^2 \qquad (7)$$

4 Results and Discussion

4.1 Datasets Performance metrics with Description:

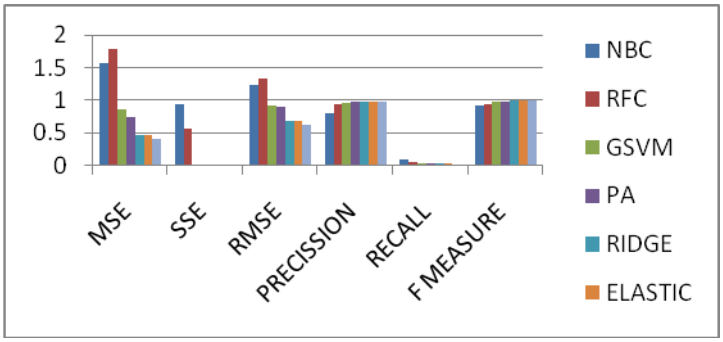

Fig. 3 Performance metrics for different classifiers under FG-NET database

FG-NET Database: The face and gesture recognition network (FG-NET) database discharged in 2004. The FG-NET database is a freely accessible picture database containing face pictures of several subjects at various ages not just for age estimation for gender based extraction at various ages. The database contains 1002 pictures from 82 distinct subjects with ages extending between infants to 69 years of ages. Be that as it may, ages between zero to 40 years are the most populated in the database.

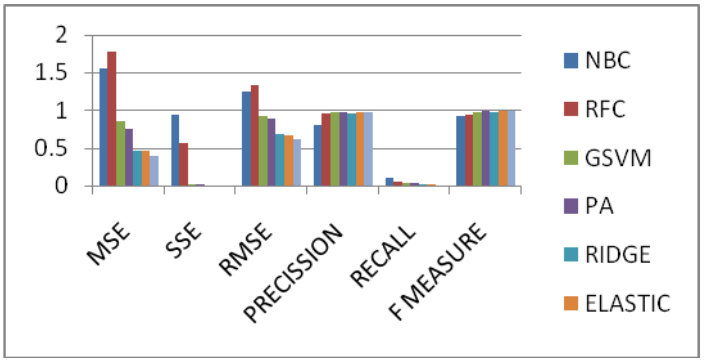

Fig. 4 Performance metrics for different classifiers under ORL database.

ORL Database: ORL(Olivetti Research Laboratory) database[19] contains many face images taken between April 1992 and April 1994 at the lab. The database utilised with regards to a face based gender extraction task did in a joint effort with the Speech, Vision and Robotics Group of the Cambridge University Engineering Department. There are ten unique images of every one of 40 particular subjects. For certain subjects, the images were taken on various occasions, differing the lighting, outward appearances and facial subtleties. Every one of the images taken against a dim homogeneous foundation with the subjects in an upright, frontal position. Ten various images of every one of 40 particular subjects. For certain subjects, the images were taken on various occasions, fluctuating the lighting, outward appearances.

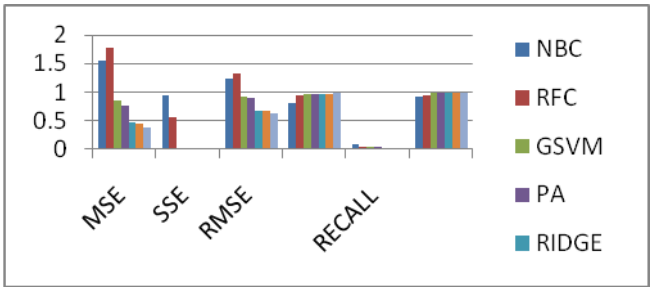

Fig. 5 Performance metrics for different classifiers under FERET database.

FERET Database: The FERET database gathered in 15 sessions between August 1993 and July 1996. The database contains 1564 arrangements of pictures for a sum of 14,126 pictures that incorporates 1199 people and 365 copy sets of pictures. A copy set is a moment set of pictures of an individual as of now in the database and typically taken on an alternate day. The Facial Recognition Technology (FERET) database is a dataset utilised for facial based gender extraction framework assessment as a significant aspect of the Face Recognition Technology (FERET) program. The FERET database fills in as a standard database of facial pictures for specialists to use to create different calculations and report results.

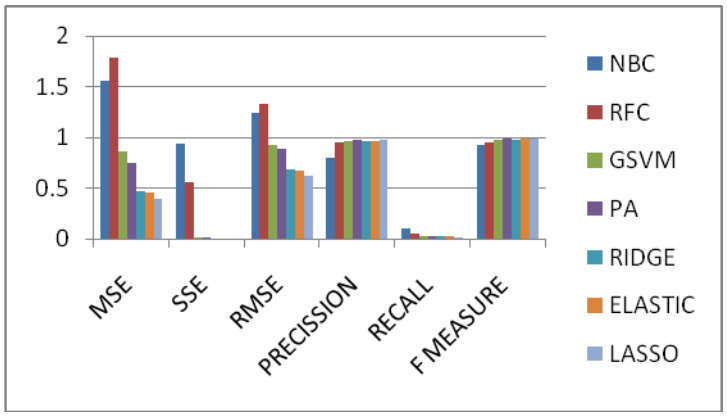

Fig. 6 Performance metrics for different classifiers under LFW database.

LFW database: (LFW) Labeled Faces in the Wild, a database of face photos intended for examining the issue of the unconstrained face-based gender extraction. The informational collection contains more than 13,000 pictures of appearances gathered from the web. Each face has marked with the name of the individual imagined. One thousand six hundred eighty of the general population imagined having at least two unmistakable photographs in the informational collection.

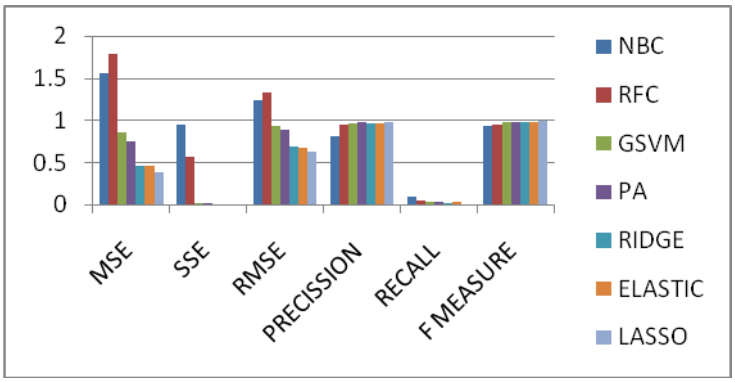

Fig. 7 Performance metrics for different classifiers under PRIVATE database

Private Database: private database contains various gender orientations and also had various ages of coloured facial images with proper resolution. Human images are accumulated through the camera with quality facial images with 275*314 dimensional measurements and also 254 dpi resolutions. These images are in JPEG format with reasonable contrast and white balance. The database provided 259 images gathered for face recognition (shown in figure 7). **Simulation Setup**In this section, the paper describes the experimental setup for different objects based on feature extractions concerning facial and other related images. For simulation MATLAB latest version with minimum 4GB RAM and 250 HD for processing multi-label images. Implementation of design for uploading data sets shown in figure 7.

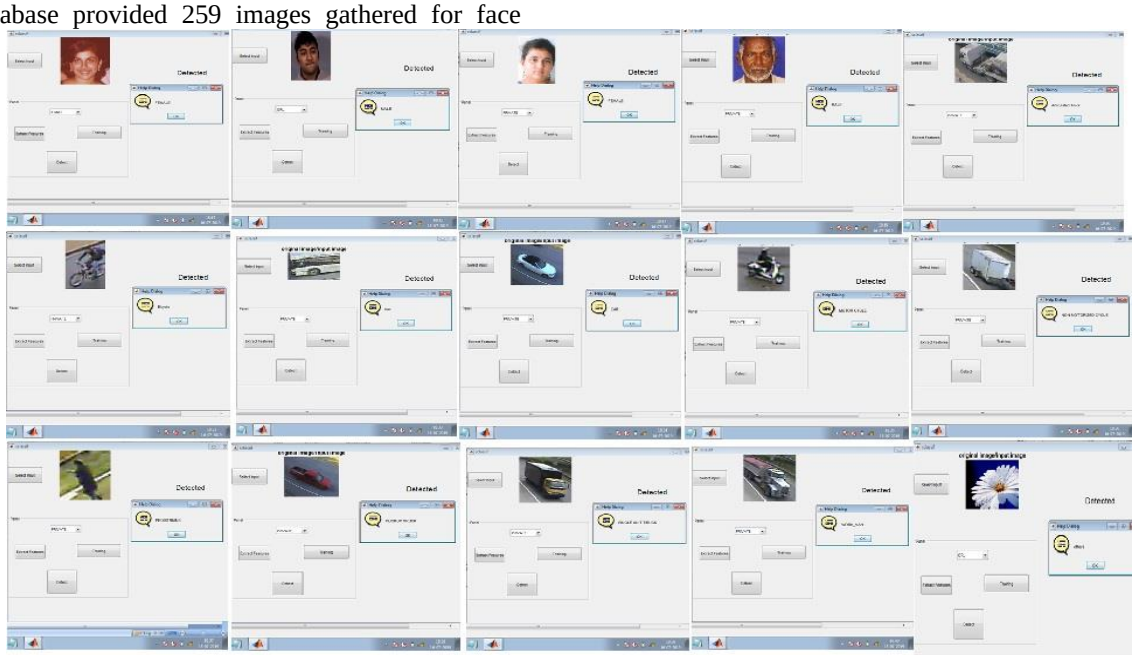

Fig. 8 User interface design for uploading the image to classify objects.

Matched and mis-matched class detection is carried out by various algorithms and compared with performance metrics like MSE, RMSE, SSE, PRECISION, RECALL, FMEASURE, ACCURACY and TIME for various datasets. In figrue 4, to show case the performance of different classification algorithms naive bayes (NBC), Random Forest (RFC), Gaussian SVM (GSVM), Fuzzy C Means Gaussian SVM (FGSVM) [20], Multivariant ridge logistic regression (RIDGE), Multivariant elastic net logistic regression (ELASTIC), Multivariant Lasso logistic regression(LASSO)Here data set size varied based results are tabulated for accuracy and Time for various datasets mentioned in the intial stages of results section.

Performance Metrics:

The Metrics used to compare the performace of various algorithms for feature extraction, selection and classification are Mean Square Error, Accuracy, Precision, Recall, Sum of Squared Error, Root Mean Square Error, F measure.

Their formulation is dependent on true positive, true negative, false positive and false negative conditions. These were selected during the classification of the images and were mathematically represented using the below equations.

$$Accuracy = \frac{TP + FN}{TS} \quad (8)$$

$$F - Measure = 2 * \left(\frac{1}{\frac{1}{Precision} + \frac{1}{Recall}} \right) \quad (9)$$

$$Precision = \frac{TP}{TP + FP} \quad (10)$$

$$Recall = \frac{TP}{TP + FN} \quad (11)$$

$$MSE = \frac{1}{N} \sum_{j=1}^{1} (y_i - \tilde{y}_i)^2 \quad (12)$$

$$SSE = \sum_{j=1}^{1} (y_i - \tilde{y}_i)^2 \quad (13)$$

$$RMSE = \sqrt{\frac{1}{N} \sum_{j=1}^{1} (y_i - \tilde{y}_i)^2} \quad (14)$$

Table 3 Accuracy and Time comparison of 3classification algorithms with MSIFT features training based on Multivariant principle for FERET database comparing with Dictioinary feature based approach

Dataset size	Training images	Testing images	RIDGE		LASSO		Proposed	
			Accuracy	Time	Accuracy	Time	Accuracy	Time
170	130	40	92.4	0.59s	94.6	0.6s	**99.75**	**0.48s**
280	130	190	91.7	0.59s	94.6	0.6s	**98.6**	**0.48s**
350	130	220	91.7	0.59s	92.7	0.6s	**98.7**	**0.48s**
500	130	370	90.6	0.59s	91.5	0.6s	**97.6**	**0.48s**
750	130	620	90.3	0.59s	89.4	0.6s	**97.6**	**0.48s**

Table 4 Accuracy for different classifiers worked on FERET database

Technique	Dictionary	SVM-MSIFT	GSVM-MSIFT	LASSO	RIDGE	Proposed
Accuracy	93.86	92.45	94.86	94.23	92.46	**98.3**

Table 5 Accuracy for different classifiers worked on FGNET database

Technique	Dictionary	SVM-MSIFT	GSVM-MSIFT	LASSO	RIDGE	Proposed
Accuracy	-	86.45	91.69	93.4	92.46	**98.3**

Table 6 Accuracy for different classifiers worked on ORL database

Technique	Dictionary	SVM-MSIFT	GSVM-MSIFT	LASSO	RIDGE	Proposed
Accuracy	-	92.45	94.86	94.23	92.46	**98.3**

Table 7 Accuracy for different classifiers worked on PRIVATE database

Technique	Dictionary	SVM-MSIFT	GSVM-MSIFT	LASSO	RIDGE	Proposed
Accuracy	-	92.45	94.86	94.23	92.46	**98.3**

Table 8 Accuracy for different classifiers worked on FERET database

Technique	Dictionary	SVM-MSIFT	GSVM-MSIFT	LASSO	RIDGE	Proposed
Accuracy	-	92.45	94.86	94.23	92.46	**98.4**

From Tabe 4 to Table 8 Accuracies were compared with different databases under different classifiers was presented. Outratedly our proposing approach delivers the best accuracy out of all algorithms with a minimum of 3% best rate

5 Conclusion

In this paper, 5 different databases are tested with different algorithms and some thechniques are compared with with repect to references. In results section of this paper, 3 different approaches are compared with multivariant mode. At most of the references are authors implemented FERET databases, to show case the best outcome cited the comparison this dataset results are compared with other results are compared at dataset level. The proposed approach results in best accuracy with less time of execution. In future the enhanced process can be applied on video processing units for real time operations of detection in objects.

Abbreviations:

SIFT –Scale Invariant Feature Transform,RR-ridge regression ,EN-elastic net ,LR-lasso regression,LRGS-lasso regression with Gaussian Support Vector Machines ,SVM-Support Vector Machine,MSIFT -Multi Scale Invariant Feature Transform,ARD-Automatic Relevance Detection ,GSVM-Gaussian Support Vector Machine,MSVM-Multi

Support Vector Machine,LASSO- Least Absolute Shrinkage and Selection Operator, PCA-Principle Component Analysis,HOG-histogram of oriented gradients,GLM-generalised linear model ,MSE-Mean Square Error,SSE-Sum of Squared Error,RMSE-Root Mean Square Error,ORL-Olivetti Research Laboratory,FERET-Facial Recognition Technology ,LFW- Labeled Faces in the Wild FG-NET-The face and gesture recognition network ,NBC-Naive bayes Classifier,RFC-Random Forest Classifier ,FGSVM- Fuzzy C Means Gaussian SVM

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