Personality Prediction Based on Iris Position Classification Using Support Vector Machines

Sofea Ramli, Sharifalillah Nordin
Faculty of Computer & Mathematical Sciences, Universiti Teknologi MARA, 40000 Shah Alam, Selangor, Malaysia

Article Info

Article history:

Received Sep 24, 2017
Revised Dec 27, 2017
Accepted Jan 16, 2018

Keywords:

Accessing cues
Auditory
Iris
Kinaesthetic
Neuro-linguistic programming
Support vector machines
Visual

ABSTRACT

Predicting personality generally involves personal interpretations of a person which makes the current methods for personality prediction process less adequate, timely and tedious. Thus, a simple yet efficient alternative method is proposed in this project for detecting iris positions which are used in Neuro-Linguistic Programming as clues for the human internal representational system and mental activity. This study set out to determine several positions of the iris of a person based on the Eye Accessing Cues. The design and the development of a complete system will be undertaken as for the users to use as a medium to predict their personality based on their iris position. Several pre-processing techniques were executed to each of the data before run into the testing and training activities for accuracy gaining. The algorithm used for classification of the positions is Support Vector Machine which by taking rectangle crop of an eye with 9000 pixels as inputs. Radial Basis Function is used for the kernel parameter of the proposed method. The classification will then map into the type of a person with the lists of his personality based on Visual, Auditory and Kinaesthetic theory. The result of the classification of the iris positions is currently 84.9% accurate which in the future might be increased by tuning several other parameters that consisted in Support Vector Machine.

Corresponding Author:

Sofea Ramli,
Faculty of Computer & Mathematical Sciences,
Universiti Teknologi MARA,
40000 Shah Alam, Selangor, Malaysia.
Email: sofearamli@yahoo.com

1. INTRODUCTION

Personality is the dynamic organization within the individual of those psychophysical systems that determine his characteristic behaviour and thought" (Allport, 1961). The Merriam-Webster dictionary defines personality as the set of emotional qualities and also the ways of behaving that make a person different from other people. There are many theories used in the counselling session in order to predict or read a person's personality. This project adopted a neuro-linguistic programming (NLP) model that uses the visual, auditory and kinaesthetic (VAK) classifications to predict one's personality which in particular focuses on a person's learning styles.

Neuro-linguistic programming was first introduced by John Grinder and Richard Bandler whose background was in linguistics and mathematics and gestalt therapy respectively. The purpose of having NLP is to make explicit models of human excellence. Neuro-linguistic programming consists of the three most influential components involved in producing human experience which are neurology, language and programming. The neurology system controls the functions of our bodies whereas the language acts as the medium to communicate with other people and the programming part determines the models of the world we create. Basically, neuro-linguistic programming defines the fundamental dynamics between mind and language as well as showing the effects of their interaction to our body and behaviour (Dilts, 1999).

Among all the personality theories that are being applied today, visual, auditory and kinaesthetic (VAK) learning styles are the ones that were found most suitable for the research undertaking. According to a study conducted by Swinburne University of Technology, this correlation is probably because VAK conveys the personality that leads to the way a person learns best. There is no right or wrong in terms of the styles of learning of a person but in taking this opportunity to actually help those potential readers to understand the type of learning that would work best for them and thus rightfully adopt that style as their own preferred learning style. In this neuro-linguistic programming, the concept of visual accessing cues is introduced for an application for eye feature analysis (Brandler & Grinder, 1999). The positions of the iris can be used as indicators for the internal representational system for which part of the brain is active during the mental process (Vrânceanu, Florea, Florea, & Vertan, 2015). Furthermore, biometric-based method of identification has the lowest error rate that leads to a good reliability for iris recognition (Shi et al., 2009).

2. RESEARCH METHOD

Development of a system creates and alters the system using several processes, techniques, models, practices and methodologies. For this project, Support Vector Machine (SVM) as one of the machine learning method is used to develop the system to classify particularly the positions of the iris to assist the predictions of personality. Figure 1 demonstrates roughly on how the system will be operated. It starts with data collection from the users. The data will be in term of eye images. Thus its supposed to be called as features. Then, the features will be uploaded into the system using the developed graphical user interface (GUI) to start the pre-processing procedures.

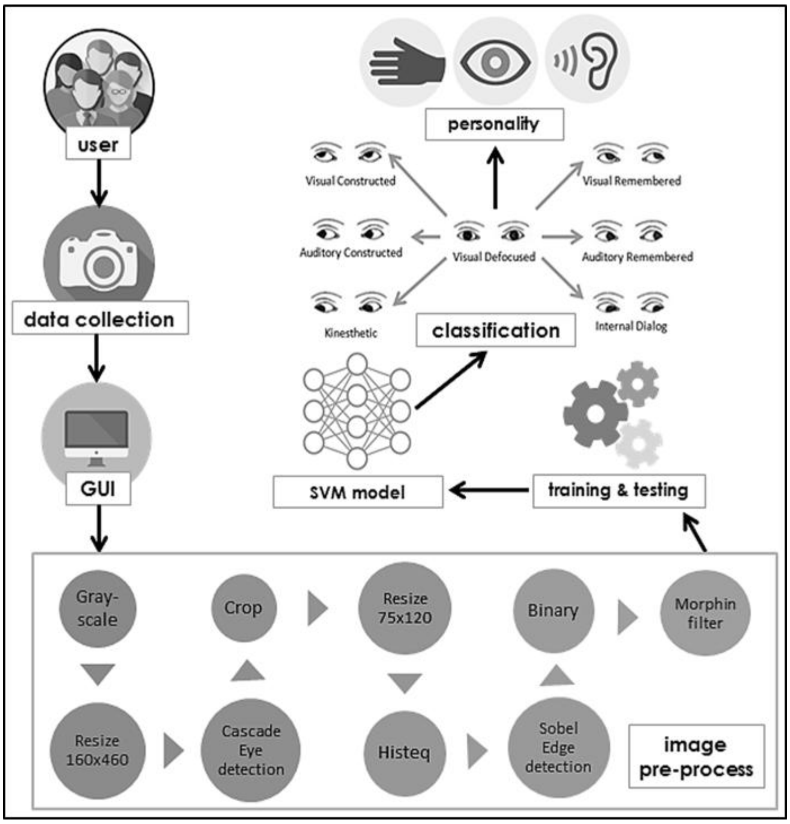


Figure 1. System Architecture of Iris Position Classification Using SVM

Data pre-processing includes firstly, the system will convert the image into gray-scale image that will then proceed to the eye detection procedure using Cascade Object detector under Viola-Jones algorithms. At first, these features were resized into 160 by 460 which gave 73600 pixels in total for each data. Unfortunately, when these huge data were about to run into the classifier, it took hours for the system to actually finish its classification process. This also leads to low system performance because it was too time consuming. Therefore, in order to overcome this problem, the images were resized into smaller size of 75 by 120 with 9000 pixels in total per data samples, which then increases the performance of the system in terms of the classification process using SVM. Furthermore, for feature extraction, the system will be using histogram equalisation for image enhancement and smoothing. The detection of the eyes edges was using Sobel Edge Detection and afterwards is the image Binarization and lastly the morphological filtering process. This filtering enquires an image using a small shape or template namely structuring element that is used to define the interest region or the neighbourhood around the pixel.

After the features have been saved into text files, they will then be training and testing using SVM classifier. It starts with training the data collected which are the iris images. The features that have been pre-processed are stored in terms of binary values with 9000 pixels in total of number of all 215 data samples. These features were then converted into tables for the purpose of training using SVM. The conversion of the features was made using the classification learner application that were already been built in the MATLAB. Out of the kernels that consist in SVM, Radial Basis Function or also known as Standard Gaussian Kernel is used for the actual implementation of this system. There were five classes in total for the features samples to be classified. By using one to many for the multiclass method as well as fixing the total box constraint of value five, the performance of the trained data that have been accurately classified was optimum.

In the feature extraction phases, the images are given the associated labels to each of them. Therefore, after done training, if the image similar in label, it classifies as a group or a class. If the image has different in label, in will be included into other class. Then, the classification method applies testing activity. Testing gives the result of accuracy and eventually shows the system performance. Proceeding to the last stage is the classification of the images themselves based on the iris positions using the trained SVM method. After the position has been classified, the type of person and the lists of the personality will be retrieved to the users.

3. RESULTS AND ANALYSIS

There are several factors that influence the accuracy of the training and testing sections of the data samples in the project. The factors might also lead to changes in the overall results of the system. The factors include differences in pre-processing techniques which by using Histogram Equalisation, images show more solid image of an eye rather than using Adapted Histogram Equalisation for image enhancement. This method balances the colour distributions of its RGB channels so as to produce more eye-catching colours rather than to compare than the other auto-level methods (Brindha et al., 2017). Next for feature extraction, images run through Sobel Edge Detection emphasize the significant lines which made easier for the lines of the iris to be detected if to compare with Canny Edge Detection. Lastly, images resized into smaller size of 755 by 120 that result 9000 pixels in total per data samples increase the performance of the SVM classification.

Table 1 presents the differences of the accuracy influenced by different ratio of the training and testing split percentage. These training and testing activities were conducted using Radial Basis Function (RBF) kernel for SVM data training. The split percentages are of 20:80%, 25:75%, 30:70% and 35:65% ratios. However, among all the split ratios, 25:75% gained the highest percentage of its classification with 84.9%. While, Table 2 below shows the number of data for each classification obtained in the data collection for the split ratio with the highest accuracy, 25:75%.

Table 1. Split ratio for data testing and training

Split Ratio (%)		Accuracy (%)	Error (%)
Testing	Training		
20	80	79.1	20.1
25	75	84.9	15.1
30	70	82.8	17.2
35	65	80.0	20.0

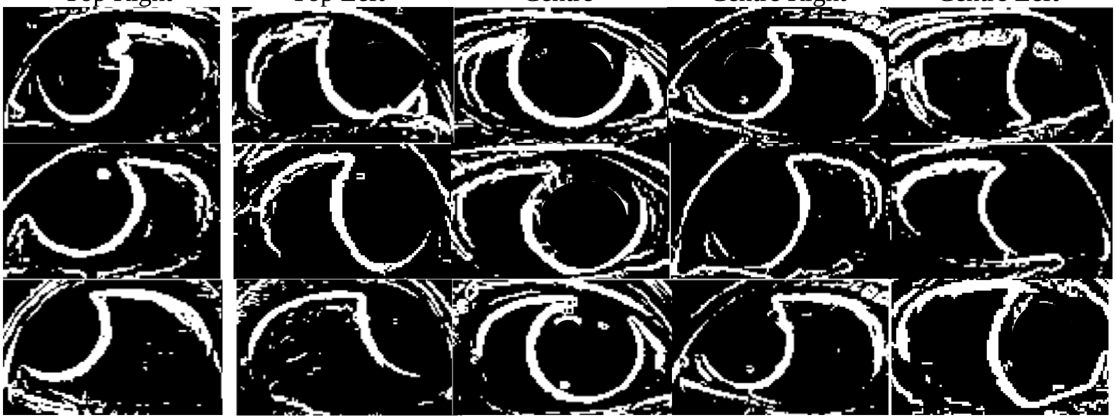
Table 2. Sample data for training and testing with ratio 25:75%

Position	Top Right	Top Left	Centre	Centre Right	Centre Left	Total
Training	34	37	34	30	27	162
Testing	11	13	11	10	8	53
Total	45	50	45	40	35	215

Table 3 displays the sample data that have been pre-processed. The features were presented based on their position of the iris which are top right, top left, centre, centre right and centre left. These features will then be trained and tested which eventually classified using SVM to obtain their position and retrieve the result of personality.

Table 3. Sample of training data

Top Right	Top Left	Centre	Centre Right	Centre Left



For parameters involved in Support Vector Machine classifier such as the main key is the kernel used, box constraints, scales that also known as gamma and others. Based on table 4 which shows several types of kernel were used in the training process for the purpose of comparing the highest classification accuracy using MATLAB classification learner application. This apparently revealed that by using RBF, the classification process would give better results than the others.

Table 4. Accuracy results based on kernels

Kernel	Accuracy (%)	Error (%)
Linear	83.7	16.3
Quadratic	82.8	17.2
Cubic	81.3	18.7
RBF	84.9	15.1

After several trials that have been done using different kind of parameters, it can be concluded that Standard Gaussian or RBF kernel produces better results in terms of its classification accuracy and lower error rate on the data that has been misclassified if to be compared to Fine Gaussian, Medium Gaussian or Course Gaussian. Therefore, out of the kernels that consist in SVM, RBF will be used for the actual implementation of this project system.

There are variety techniques in Artificial Intelligence that can be used for classification process. The techniques include Backpropagation Neural Network (BPNN), Support Vector Machine (SVM), K-Nearest Neighbour, Perceptron, and some lot others more. In this particular project, the main classifier chosen is Support Vector Machine, and for the comparison purposes, BPNN is selected to compare the result of its accuracy. This is because based from few research reviews, ANN and SVM were two most consistent machine learning methods used for classification process and one of the example was a facial expression classification for input into emotion using Artificial Neural Networks (Salmam et al., 2017).

These Figures of 2, 3, and 4 present the results of the iris position classification using Artificial Neural Network (ANN). Although the training result of ANN technique reached 100% but the validation and testing parts of the data is quite low which are 71.9% and 68.8% respectively. Apart from the result of the classification process using ANN is not stable and consistent, SVM contributes to a higher percentage in terms of its accuracy and this value added to the reasons on using SVM instead of ANN for this project.

Figure 2. Training Matrix

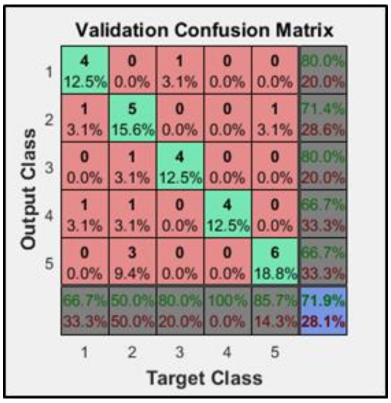


Figure 3. Validation Matrix

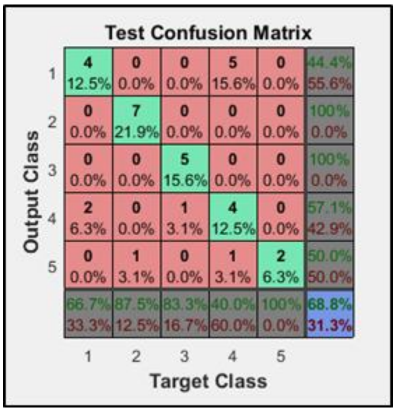


Figure 4. Test Matrix

4. CONCLUSION

Some extensive and extra hard work that has been put together in the effort of the completion of this project has come to an end. The overall discovery in this project, it is proved that the steps on image pre-processing methods for the eyes images is way more complicated and difficult that definitely needed extra effort to be completed. For this particular system, some of these recommendations would be able to help for the sake of the future work. They include providing a lot more of images to be processed so as the iris positions could be better trained and classified particularly in the Support Vector Machine (SVM) method. Apart from that, by modifying the pre-process methods would be much help therefore to improve its efficiency of the system for instance by applying a different method for eye detection such as using Gabor Filter as proposed by K. Sudhakar and P.Nithyanandam (2017). This is for the purpose of making better detections of the iris position of the eye images without granting the control to the users on the manual settings. Lastly, the GUI of the system would be way much better with the betterment of some good graphic usage and user friendly. However, all the challenges have been accepted also with the accuracy factor provided using Support Vector Machine (SVM) is acceptable for the whole project completion. Besides, with the God's willing, this research project has completed all of the processes in the range of time given.

ACKNOWLEDGEMENTS

The authors gratefully acknowledge the help of the Ministry of Science, Technology and Innovation (MOSTI) of Malaysia in providing the Science Fund research grant and Universiti Teknology Mara (UiTM) for making available its Fellowship scheme. The authors are also thankful to the knowledge providers of the trainees of certified counsellors that specifically in Neuro-Linguistic Programming (NLP) from K & J Consultancy in Bangi, Malaysia.

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