# 1 Review: A Humanlike Predictor of Facial Attractiveness

## 1.1 Introduction

The paper focuses on the human face which has been a source of great interest to psychologists and other scientists in recent years because of the extraordinarily well-developed ability of humans to process, recognize and extract information from other's faces. Physical appearance is important to humans and certain features appear to be found attractive across individuals and cultures. The main objective of the paper is to excel in making a machine which obtains human level information in predicting facial attractiveness. Also, we need to keep in mind to conduct a series of simulated psychophysical experiments and study the resemblance between human and machine judgments.

## 1.2 Summary

The dataset consists of 91 facial images of American Females, all frontal color photographs of young Caucasian females with a neutral expression. They were of similar age, skin color and gender, had no distracting items or accessories like jewellery. All the 91 images were rated by 15 males and 13 females on a 7-Likert scale which is a scale used to represent people's attitudes to a topic. Every rater was asked to view the entire dataset and there was no time limit for judging the attractiveness of each sample and they could even go back and adjust the ratings of already rated samples. An automatic engine was developed to extract facial features which is capable of identifying eyes, nose, lips, eyebrows and head contour leading to 84 coordinates describing the locations of those facial features. Since strong correlations are expected among the features in such representation, principal component analysis (PCA) was applied to these geometric features. However, it is very difficult to develop a big enough face database and to collect ratings for all the faces. Moreover, it is not possible to find real faces with all the possible combinations of facial features.

## 1.3 Results

From the results of the paper, We see that they experimented using algorithms like : simple Linear Regression, Least Squares Support Vector Machine (LS-SVM) (both linear as well as non-linear) and Gaussian Processes (GP) but Simple Linear Regression showed advantage over the rest algorithms and was used. After comparing the predictions with the true targets, the scores are found to be in a high Pearson correlation of 0.82 with the mean ratings of humans (P-value ¡ 10-23), which corresponds to a normalized Mean Squared Error of 0.39. We also tried using the original feature selection strategy narrowing to 300 best features but it failed to produce good predictors due to strong correlations. Each rater has a 91 dimensional rating vector that can be presented in a 91 dimensional ratings space. The euclidean distance is computed and to verify machine ratings are not outliers they surround each of the rating vectors in the ratings space with multidimensional spheres of several radius sizes. Distribution of mean Euclidean distance from each human rater to all other raters in the ratings space. The machine's average distance from all other raters (left bar) is smaller than the average distance of each of the human raters to all others.

## 1.4 Discussion

In the discussion section, they have mentioned how they produced a high quality training set using supervised learning methodologies that achieves accurate, humanlike performance for this task. Their analysis has revealed that symmetry is very much related to the attractiveness of averaged faces, but is definitely not the only factor in the equation. This suggests that a general movement of features toward attractiveness, rather than a simple increase in symmetry, is responsible for the attractiveness of averaged faces. Training a model like this would require taking a large sample of the population and measuring all the psychological and physical traits known to contribute to attractiveness. Then, by adding in objective measures of overall attractiveness – and a dash of machine learning – creating models capable of learning what traits matter the most.

## 1.5 Evaluation

### 1.5.1 PROS:

They have taken inspiration from almost every reference related to facial attractiveness leading to proper use of each feature of the face through the coordinate system. Genetic algorithm hypothesis was mentioned which is useful in image enhancement and segmentation. Discussion in this paper is mostly about the different types of features and hypotheses which is important so that we know every perspective to train the model properly and accurately. PCA was used to visualize the machine ratings among the human ratings which is easy to analyse. This paper used Pearson correlation which is the best method of measuring the association between variables of interest because it is based on the method of covariance.

### 1.5.2 CONS:

For the dataset(image samples) they have taken photographs of only American females i.e. the dataset is not generalised and the built model would only work for the particular type of women. Since every person has a different perspective on facial attractiveness for example, some people like big eyes or small lips, so selecting 28 raters for the task isn't satisfactory, it limits the machine's capability. Though the paper is very well documented, there's still a challenge to figure the role of averageness and symmetry and the role they play with each other, their importance for facial structure. We can focus more on facial features like eye color, skin color, dimples etc.

## 1.6 Conclusion

The paper is very well written and presented with each detail including every major researcher's hypotheses to calculations of the Pearson coefficient. This paper reconsidered some previous papers and produced better results. It is quite surprising and pleasing to see that a machine trained explicitly to capture an operational performance criteria such as rating, implicitly captured basic human psycho-physical biases related to facial attractiveness. Using a combination of extensive automatic facial feature extraction, dimension reduction and feature selection, and supervised learning methodologies; they created the facial attractiveness predictor. Our results add the task of facial attractiveness prediction to the collection of abstract tasks that have been successfully accomplished with current machine learning techniques.