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Facial Beauty Prediction Using the Golden Ratio: A Deep Neural Network Approach

Rate your face on a scale of 1 to 5. Each person's face should be respected as a personality, but handsome and ugly certainly exist. The most ideal ratio for the human eye is called the golden ratio. I thought that there would be a golden ratio on the face, too, and I hypothesized that it would have a correlation with handsomeness. In my project, I use this hypothesis to find each ratio of a face using data from which a photo of a face and a person's face score were evaluated, to learn a deep natural network by inputting each ratio value, and to predict the score by analyzing the face projected on the camera with the learned model.

Let me explain the data first. I used the data set “SCUT-FBP5500” from Liang et al. There are four races and genders: Asian Male, Asian Female, Caucasian Male, and Caucasian Female: 2,000 for Asians and 750 for Caucasians: a total of 5,500 data. Each person has a face image, and a total of 60 evaluators give a score of 1 to 5 for each person's face. The data is an Excel file below, which contains the scores of each of 60 people (330,000 rows x 3 columns).

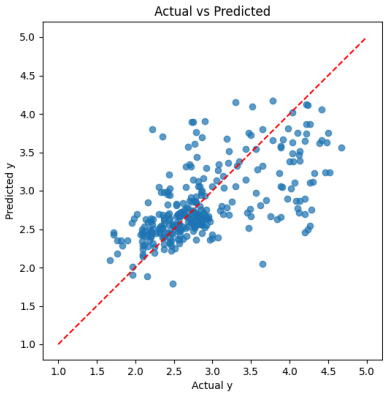
Rater	Filename	Rating
1	CF1.jpg	3
1	CF10.jpg	3
1	CF100.jpg	1
1	CF101.jpg	2
1	CF102.jpg	3
1	CF103.jpg	2
1	CF104.jpg	3
1	CF105.jpg	2
1	CF106.jpg	3
1	CF107.jpg	3
1	CF108.jpg	2
1	CF109.jpg	2
1	CF11.jpg	4
1	CF110.jpg	1
1	CF111.jpg	2
1	CF112.jpg	2
1	CF113.jpg	1
1	CF114.jpg	2
1	CF115.jpg	2

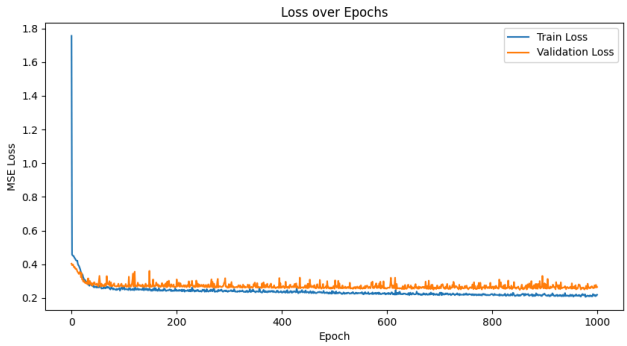
Pandas worked to average the 60 scores each person received and exported them to .csv files. After that, the coordinate values of each major part of the face were obtained by using Mediapipe and OpenCV. Using the faces function of the Mediapipe module, 468 major positions of the face are informed as coordinate values, and the ratio of each major part was calculated. The data frame is given below:

	Filename	Rating	Landmarks
0	AF1.jpg	2.333333	[(180, 224), (180, 201), (180, 207), (174, 177...
1	AF2.jpg	3.950000	[(122, 229), (114, 204), (121, 210), (110, 174...
2	AF3.jpg	3.183333	[(171, 260), (175, 243), (173, 246), (169, 201...
3	AF4.jpg	2.683333	[(179, 239), (179, 216), (179, 223), (173, 191...
4	AF5.jpg	2.000000	[(171, 233), (169, 211), (170, 218), (163, 185...
...	...	...	...
5495	CM746.jpg	4.316667	[(111, 249), (99, 220), (108, 226), (94, 183),...
5496	CM747.jpg	3.850000	[(179, 277), (178, 253), (178, 258), (170, 223...
5497	CM748.jpg	3.716667	[(184, 251), (182, 228), (182, 234), (174, 198...
5498	CM749.jpg	4.283333	[(147, 208), (144, 169), (147, 181), (139, 137...
5499	CM750.jpg	3.216667	[(178, 256), (179, 221), (178, 230), (172, 187...

The ratio calculated in this way first generates a total of 13 ratio values, including the vertical ratio, the horizontal ratio, the nose and lip size ratio, and the upper and lower face size ratio. It is stored as a parameter and used to learn the DNN model. The model was trained using the TensorFlow Keras module. The average evaluation value of each face obtained above was trained by designating the Y value and each ratio of the face as the X value, and each data was divided into 70% training data, 15% validation data, and 15% test data. We used double layers, each neuron has 64 and 32, and we used reLU for activation. 1,000 epochs were trained in 16 batch sizes, and through this, the difference between test Y and test hat Y, quantification of loss,

etc. were saved as a diagram and the model was saved through keras file format. You can see the diagrams of each race/gender below.





Finally, using OpenCV's VideoCapture function, the face was captured in real-time with the first webcam installed on the computer. This captured and predicted the landscape of the media pipe through the model's pre-processing process as before.

From the charts, we found that each ratio of faces is also closely correlated with the handsome face, and through this, we can make a significant evaluation of the scores. However, while the average face made predictions with high accuracy, the more handsome and pretty faces they became, the higher the variance was. In light of this, we could further hypothesize that the standard of handsomeness can be somewhat subjective. Many celebrities who say they are the most handsome in the world may actually not have the golden ratio. In other words, although the ratio of faces is true to be an important criterion for evaluating beauty, it has come to a new conclusion that the value of beauty in the palace can vary from person to person.

When calculating the ratio of Landscape, we extracted points that we thought were arbitrarily important so we could make more accurate and diverse attempts. DNN has many parameters that can be adjusted, and by changing the number of neurons in the layer, the

activation function, the epochs, and the batch size, a model with higher accuracy can be developed.

Works Cited

Liang, et al. “SCUT-FBP5500: A Diverse Benchmark Dataset for Multi-Paradigm Facial Beauty Prediction.” *ICPR*, 2018. https://github.com/HCIILAB/SCUT-FBP5500-Database-Release. Accessed 19 Dec 2024.