PSY 1406: Project #1 Written Analysis

Question 1: Can FaceNet identify individual chimps?

- Step 4: Document your observations and conclusions
    - Observations: We see that based on the euclidean distances that Facenet is able to tell the difference between different pictures of the same Chimp, Fredy, and pictures of Chimps that aren't Fredy.
    - Interpretation: Facenet is able to tell the difference between pictures of chimps itself vs pictures that are of other chimps
    - Discussion: This is interesting since there are pictures from different angles/positions of Fredy and comparatively the algorithm is still able to detect the difference between whether the chimp is Fredy or not.

Question 2: Can FaceNet discriminate between gender within species?

<u>Chimps</u>

- Step 4: Document your observations and conclusions
    - Observations: We see that based on the euclidean distances comparison that Facenet is unable to discriminate between gender for chimps
    - Interpretation: This means that there may be specific attributes in chimps faces that make it hard for Facenet to detect
    - Discussion: This is interesting because we see that with Rhesus Macaque that Facenet can distinguish between gender but with Chimps there is a difficulty. This suggests that we should compare and contrast different facial features and attributes that may lead to these differing results. Maybe certain features are less pronounced and different between male/females for chimps but there are clear differences between male/females for Macaques.
- Step 5: We first did the chimp dataset to compare between genders. Therefore, since no significant difference was detected this asks the question of is this for all non human animals? We discuss the findings for Macaque below and see if this is a finding just for chimps. We play around with finding an appropriate dataset to test this hypothesis.
- Step 6: Since we know that Facenet is able to distinguish the difference between a named chimp and other chimps it makes sense that there is a possibility that it is able to detect the difference between genders. However, there may be too many variations within one specific gender that it causes the lack of significance in our analysis. In terms of defining "good" for Facenet I would say for our hypothesis and driving question here, Facenet does not qualify as good because it was not able to distinguish between the 2 genders.

Rhesus Macaque

- Step 4: Document your observations and conclusions
    - Observations: Similar to the conclusions from the chimpanzee examples, FaceNet could not differentiate between male and female rhesus macaques based on the euclidean distances.
    - Interpretation: The mean euclidean distances across the positive examples do have smaller values compared to those of the negative images, but they are not statistically different due to large variability.
    - Discussion: It is likely that the input images don't have enough information that can capture the phenotypic differences between male and females for FaceNet to differentiate between the genders.
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Question 3: Can FaceNet discriminate age within species?

- Step 4: Document your observations and conclusions
    - Observations: The mean euclidean distances calculated between our anchor image (female, age 5) and positive images (female, age 5, at a different angle) was less than that of the anchor and negative (female, age 20) images.
    - Interpretation: FaceNet was able to discriminate between different ages of Rhesus Macaques in addition to gender.
    - Discussion: This finding allows us to further investigate the discriminative capacities of FaceNet and shows that FaceNet agrees that the positive is more similar to the anchor than the negative, but with this specific rhesus macaque data set. We did not get significant results for our chimp data set.
- Step 5: We first looked at overall mean differences between the positive and negative pairs but then decided to analyze the euclidean distances of each image by age, to which we found no statistical significance. Given the wide distribution of euclidean distances calculated, FaceNet may not quite be ready to distinguish age differences amongst similar species.

Question 4: Can FaceNet discriminate across species?

- Step 4: Document your observations and conclusions
    - Observations: For this investigation, we used a chimpanzee image as an anchor, other chimp images as positive examples, and rhesus macaques and japanese monkeys as negative examples. We found that there was a significant difference between the positive chimpanzee images and the other species both below the p-value of 0.0008. The positive examples had the lowest distances which also fit our hypothesis.
    - Interpretation: We interpret that the positive images likely had enough physical similarities for FaceNet to use toward discriminating against the non-Chimp images (negative examples).
    - Discussion: Chimpanzees are part of the 'Great Apes', which also includes humans, gorillas, and orangutans. Chimpanzees are more closely related to humans than they are to either rhesus macaques or Japanese monkeys. Meanwhile, Rhesus Macaque (Macaca mulatta) and Japanese Monkey (Macaca fuscata) both belong to 'Old World monkeys'. This family distinction places them further from chimpanzees on the evolutionary tree. Since rhesus macaques and Japanese macaques are both part of the same genus, they are more closely related to each other than either is to the chimpanzee. Using a Chimp face as an anchor, FaceNet calculated lowest euclidean distances for positive Chimp example images, and higher for negative Rhesus Macaque and Japanese Monkeys. Rhesus Macaque and Japanese Monkeys had similar level of euclidean distance away from the Chimp anchor - which may indicate FaceNet capturing phenotypic similarities of these two species

Step 6: Final Thoughts

- FaceNet was able to distinguish between:
    - Different individuals in our chimp data set
- FaceNet was unable to distinguish between:
    - Different genders within a species in our chimp data set
- FaceNet was able to somewhat distinguish between:
    - Different species (chimps v. rhesus v. jap. monkey)
    - Different aged individuals in our rhesus macaque data set
- Results support the notion that FaceNet might have the capability to recognize facial features of animal species that are more closely related to humans on the evolutionary or phylogenetic tree

- Evidence: better recognition of chimpanzee data set than rhesus macaque or japanese monkey
- Further inquiry is needed