

# “Finding limits of deep learning with bodybuilder image comparison”

Executive Summary

Luke Corwin, David Osterman, Andrei Prokhorov

## Background and Motivation

This project is an extension of a similar project from the Spring cohort. Our goal was to train a convolutional neural network (CNN) that would ingest images of two bodybuilders and output which was more likely to win in competition.

## Data

Our data set consists of photos from the National Physique Committee website.<sup>1</sup> To reduce training time and needed model complexity, we focused on contests from 2024 and in the Men’s Physique division. Each contestant has a variable number of photos from the competition. We manually selected two photos, one front and one back, from each. Each competition also contained the final rankings of the competitors from 1 up to 16. If more than 16 competitors were present, all are tied at 16th place. We used these rankings to determine the winner in a given pairing, with the lower rank winning. We divided the data into training, validation, and test sets. To avoid overfitting, we kept competitions intact and ensured no competitor appeared in more than one of the tree sets.

## Models

We tried a hand-written model called TwoInput Net, which consists of three Conv2d() layers with ReLu() and MaxPool2d() functions between them, and the ResNet50 model. For every competition in the training set, we gave the model all pairs of pictures that had different rankings and a one-hot-coded variable indicating which picture was the winner. This gave us a training set of 11,776 pairs. We optimized using the BCELoss() function.

## Results

After our model was trained, we measured the loss function and accuracy for the validation set. Despite varying multiple hyperparameters, including learning rate and number of epochs, we were unsuccessful in validating either of the models. In every case, we found that either the model did not learn (training and validation loss functions remained flat) or overfit (training loss function decreased while validation loss function increased).

## Potential Improvements

Potential improvements include investigating the behavior of our models carefully, collecting more data from the NPC website, and adding more photos per competitor. We think it might be useful to train a separate network to facilitate the photo selection process.

---

<sup>1</sup> <https://contests.npcnewsonline.com/contests/2024>