Introduction

- Personal training is a $15 billion industry. Over the past 5 years, revenue for the Personal Training industry has increased at an annualized rate of ~1.9%, to $13 billion.

- Growth of the industry is largely fueled by an underlying worsening obesity trend. However, due to the high prices of personal training, populations such as students, and older or low-income workers are seldom able to afford personal training, which partly explains the correlation between poverty and obesity.

- In our project, we built a deep learning model to analyze people’s squat forms so that personal training can be made more accessible to less financially well-off individuals.

Dataset

- Recorded 13 people doing 219 squats.
- Manually labeled the data.
- 149 posed from video (110 bad form, 39 good form).
- Generated 10,000 individual images from the videos.
- 1744 training data (95%), 449 val data (5%), 449 test data (5%).

Pose Analysis

- Tested pose on both original image and black image.

Data Augmentation

- Original
- Zoomed Out
- Flipped
- Flipped & Zoomed Out

Results & Analysis

- Accuracy:
  - Train: 96.36%
  - Test: 88.10%

- Loss:
  - Train: 0.05
  - Test: 1.01

Discussion

- Our CNN with 4 Conv-Crop-MaxPool-Dropout layers is complex enough to understand the features we use and also generalizes well on the test set.
- Percen Trajectory: data quality and quantity can be improved.
- Quality: some negative data was toward the extremes of bad form, really more nuanced.
- Quantity: more data. Different genders, physiques, weight used for the squats.
- Idea can be expanded to more exercises to build a more complex AI Personal Trainer

Experiments

<table>
<thead>
<tr>
<th>Experiment</th>
<th>Squat</th>
<th>Deadlift</th>
<th>Bench Press</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
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<td>4</td>
<td>1.5</td>
<td>1.8</td>
<td>2.4</td>
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</tbody>
</table>

References

- Baker, D. “Comparison of upper-body strength and power between professional and college-aged rugby league players” J Strength Cond Res. 2018;32(10):2888-93
- Femandez, Carolina. “Building muscle: Demand will continue to grow as public health concerns mount.” BBC World, Dec. 2018