

Facial Keypoints Detection using Neural Networks

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13-March-2015

Introduction

Problem

- ▶ Predict keypoint positions on facial images
- ▶ Evaluate result using RMSE

Applications

- ▶ Analysing facial expressions
- ▶ Biometrics/face recognition

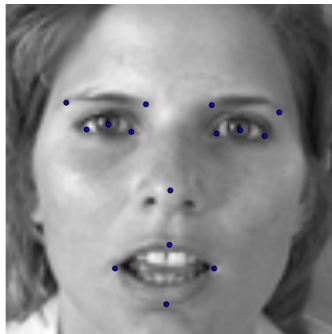


Figure 1: Facial Keypoints

Data

Training Data

- ▶ 7,049 images
- ▶ 70% images with missing target values
- ▶ Each image has 96x96 pixels
- ▶ 15 Keypoints as (x,y) coordinates

Test Data

- ▶ Pixels of 1,700 images

Exploratory Data Analysis

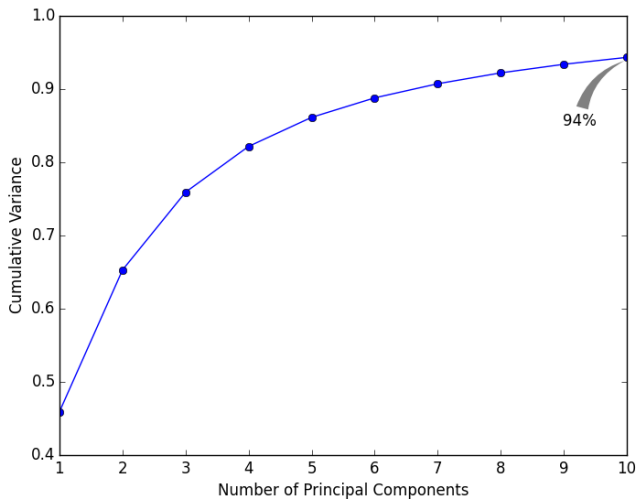


Figure 2: Cumulative Sum of Variance on Average

Baseline Solution

Why Artificial Neural Network

- ▶ Input can be high-dimensional real-valued data
- ▶ Output can be a vector of values
- ▶ Problem demands an intricate model to learn

Features

- ▶ First ten principal components

Testing Result

- ▶ RMSE: 3.355

Advanced Solution

Convolutional Neural Network (CNN)

- ▶ Layers of filters and sigmoid-like functions to extract features
- ▶ Not all neurons on the adjacent layers are connected
- ▶ Weights are allowed to repeat in the network

Running Time Problem

- ▶ Solved by using an AWS Ubuntu GPU instance

Testing Result

- ▶ RMSE: 3.274

Evaluation

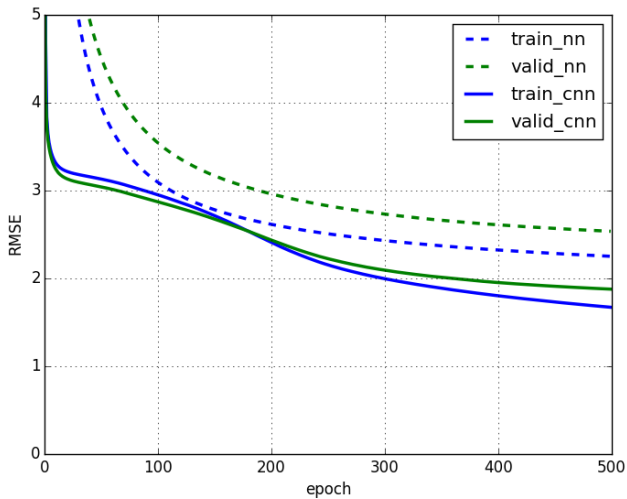


Figure 3: Comparison between CNN and Single Hidden Layer

Images with Facial Keypoints Marked



Future Work

Current Standing

- ▶ Ranked 16 out of 55 teams on the Leaderboard

Next Steps

- ▶ Keep tuning the Convolutional Neural Network
- ▶ Increase our Computer Vision knowledge