Homework 2 Part 2
Face Classification & Verification using Convolutional Neural Networks

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1 Model Architecture

This project uses Residual Network (ResNet) with 7 identity blocks, each has a residual connection as either an identity or a convolutional connection. The model takes a $32 \times 32 \times 3$ image as an input and output a 2300-dimensional label vector, a 2048-dimensional feature vector and a 4096-dimensional loss vector. The architecture is shown below:

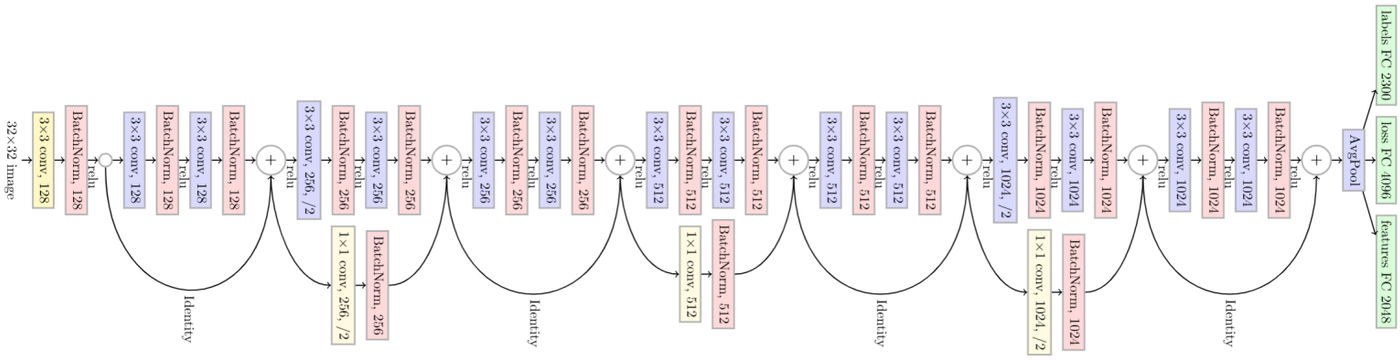

Figure 1: ResNet Architecture

Loss function: Cross-Entropy loss for labels, Center-Loss for features.
Hyper parameters: Model architecture: feature dimensions.
Loss criterion: weight for feature loss.
Optimizer: learning rate.
Scheduler: patience, threshold, factor to decrease learning rate by.
Training: batch size for Mini-batch Gradient Descent, number of epochs.

2 Other Analysis

The ResNet uses identity connections that allow the network to go deeper. Since deeper neural network faces greater gradient vanishing problems, adding identity connections will accumulate gradient when flowing back. Therefore, deep network with identity connections is easier to learn from loss and update weights.

Due to the identity connections, ResNet can be very deep that can extract more abstract features layer by layer. Using small filters at each level, it can pick up detailed features in images. As the layer goes deeper, filters in deeper layers summarize features from previous layers and extract more thorough features, and the feature vectors generated from the last layer will be more comprehensive. Therefore, image classification and verification will be very accurate.