Assignment1 Report

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Task1

I trained a model of a 99.03% final accuracy. I implemented the model evaluation function and runs it in each training loop. I also implemented the infer function, it can give an infer result given an input image. Now the infer function only works well on MNIST digits.

```
Epoch: [5/10]; Time: 12.48; Loss: 0.02801
Accuracy: 98.82%
Epoch: [6/10]; Time: 12.59; Loss: 0.02220
Accuracy: 98.77%
Epoch: [7/10]; Time: 12.67; Loss: 0.01845
Accuracy: 98.87%
Epoch: [8/10]; Time: 12.34; Loss: 0.01568
Accuracy: 98.9%
Epoch: [9/10]; Time: 12.37; Loss: 0.01346
Accuracy: 98.94%
Epoch: [10/10]; Time: 12.44; Loss: 0.01046
Accuracy: 99.03%
Training completed, saving model to ./save/
Accuracy: 99.03%
Infer result: 6
```

Task2

1. How many types of ResNet have been proposed in the paper?
   5 types: ResNet-18, ResNet-34, ResNet-50, ResNet-101, ResNet-152
2. What is the fundamental difference between ResNet and VGG?
   VGG has fully-connected layers, where the output of one layer is the input of the next layer. But for ResNet, the output of one layer will add its input to form a new output and pass it to the next layer, in order to make sure a deeper model should produce no higher training error than its shallower counterpart.
3. What is the input size of the images for ResNet-50?
   224x224, as mentioned in 3.4. Implementation.

Task3

1. Face verification.
 I chose 6 images, 2 of Joe Biden, 2 of Donald Trump, 2 of Bruno Mars. The verify function well distinguishes Mars from the other two, but cannot distinguish Biden and Trump. It seems this algorithm works better when two people have significant age or race difference.

```
Biden1 and Biden2: {'verified': True, 'distance': 0.14794269216085076,
Trump1 and Trump2: {'verified': True, 'distance': 0.3084343162460603,
Biden1 and Trump1: {'verified': True, 'distance': 0.28664208946703096,
Biden2 and Trump2: {'verified': True, 'distance': 0.27467227252702686,
Mars1 and Mars1: {'verified': True, 'distance': 0.1659861319484902, 't
Mars1 and Biden1: {'verified': False, 'distance': 0.6068526473456528,
Mars1 and Trump1: {'verified': False, 'distance': 0.6603437292431589,
```

2. Facial attribute analysis

This algorithm works very well on analyze gender, race and emotion, but is not good at determine age. Though it can basically tell the age gap between two people, it cannot give a precise age number. All estimated age is smaller than actual value.

```
Biden: age: 36, gender: Man, race: white, emotion: happy
Trump: age: 40, gender: Man, race: white, emotion: neutral
Mars: age: 31, gender: Man, race: latino hispanic, emotion: happy
```

3. Face detection

This function seems more reliable than the other two, it can quickly detect the facial area with a high confidence level.

```
Biden1: facial area: {'x': 269, 'y': 100, 'w': 253, 'h': 253}, confidence: 5.59589905309258
Trump1: facial area: {'x': 117, 'y': 130, 'w': 305, 'h': 305}, confidence: 6.284133875917178
Mars1: facial area: {'x': 177, 'y': 97, 'w': 178, 'h': 178}, confidence: 8.689792055811267
```