

# Status Report: Face To BMI

Trung Pham • 29.05.2020

# Overview

## **Expected delivery**

May 28, 2020

## **Recent progress**

- Train setting
- Train model for BMI
- Train model for Height
- Train model for Weight
- Cross validation train for BMI
- Cross validation train for Height
- Cross validation train for Weight
- Fixing crop face function
- Analyze test result for western data
- Analyze test result for asian data
- Train pretrained model to train on asian data

# Train Setting

1. Training, Validation, Testing ratio: 0.72, 0.08, 0.2
  - a. Training size 752 images/1026 images
  - b. Validation size 96 images/1026 images
  - c. Testing size 208 images/1026 images
2. Face detection algorithm
  - a. Using dlib library -> fhog\_object\_detector

# Train model for BMI, Weight, Height

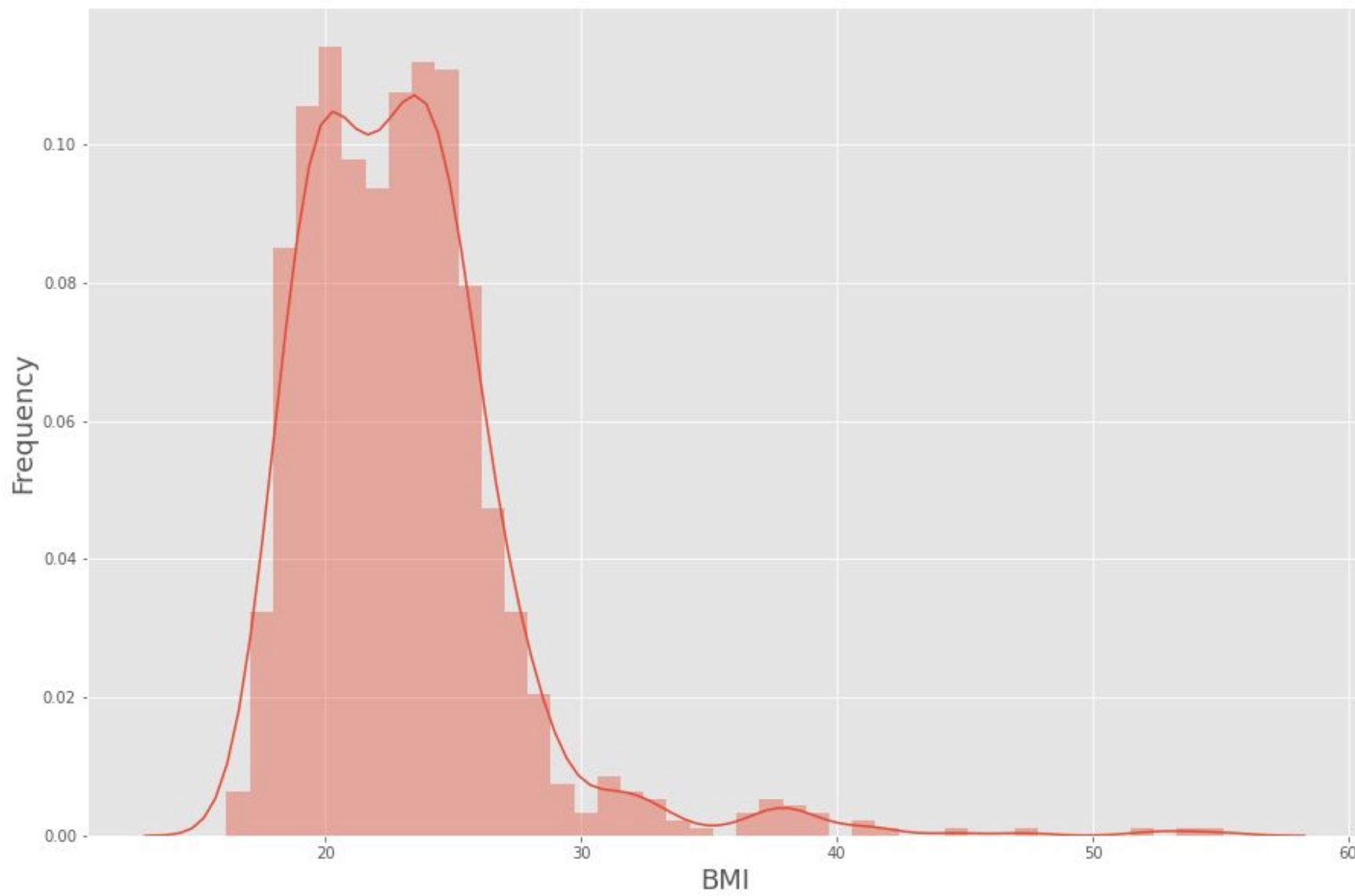
Sample training: epochs = 500

Cross Validation train: 20 times, each with 500 epochs

Final train: epochs = 5000

# Cross validation train for BMI

Distribution of BMI

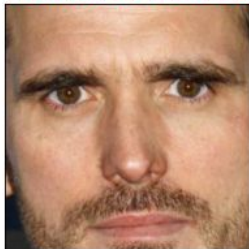


# Prediction for BMI - Sample

Predicted:18.11/ Actual: 19.72



Predicted:22.30/ Actual: 24.49



Predicted:20.66/ Actual: 20.57



Predicted:22.55/ Actual: 18.83



Predicted:22.32/ Actual: 21.73



Predicted:25.27/ Actual: 20.05



Predicted:20.67/ Actual: 38.14



Predicted:21.12/ Actual: 25.20



Predicted:21.62/ Actual: 19.49



Predicted:19.71/ Actual: 21.21



Predicted:20.05/ Actual: 18.04



Predicted:28.35/ Actual: 26.00



Predicted:23.01/ Actual: 22.27



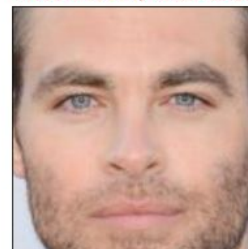
Predicted:24.69/ Actual: 23.37



Predicted:22.47/ Actual: 24.30



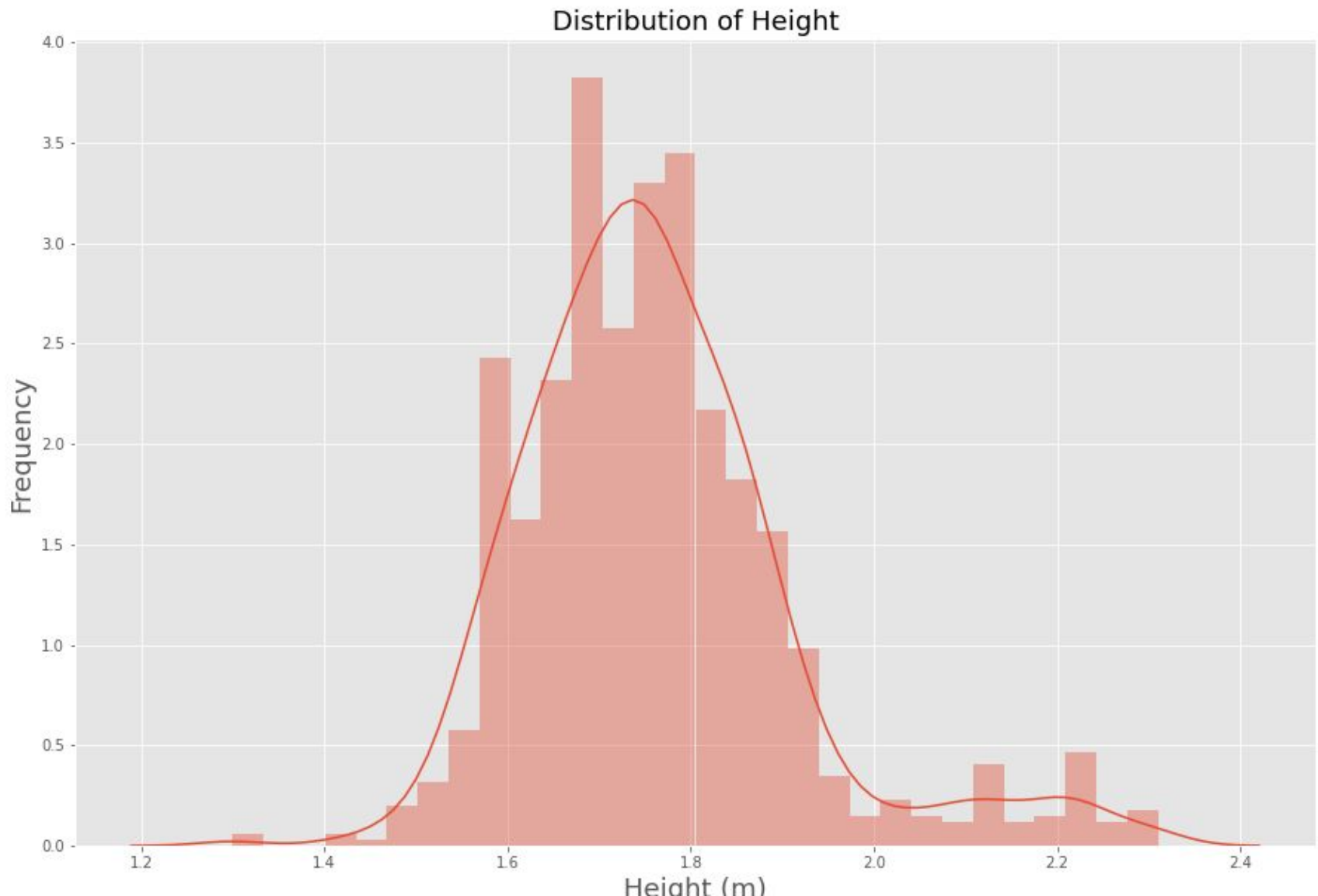
Predicted:21.65/ Actual: 23.29



# Testing result distribution for cross validation on BMI

Still training

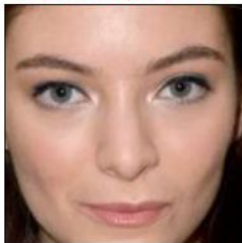
# Cross validation train for Height



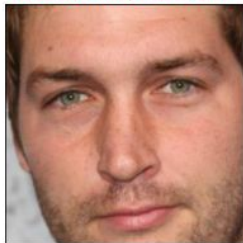


# Prediction for Height - Sample

Predicted:1.72/ Actual: 1.65



Predicted:1.68/ Actual: 1.77



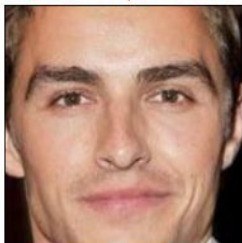
Predicted:1.69/ Actual: 1.89



Predicted:1.90/ Actual: 1.80



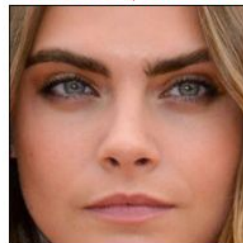
Predicted:1.70/ Actual: 1.70



Predicted:1.63/ Actual: 1.59



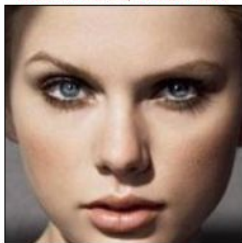
Predicted:1.70/ Actual: 1.73



Predicted:1.92/ Actual: 1.78



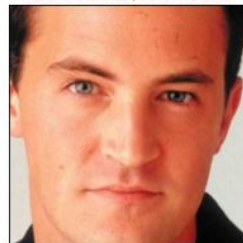
Predicted:1.52/ Actual: 1.79



Predicted:1.77/ Actual: 1.85



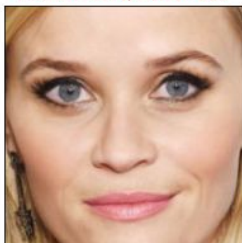
Predicted:1.93/ Actual: 1.83



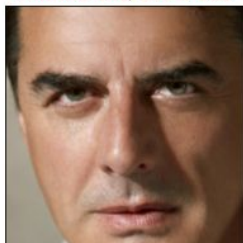
Predicted:1.63/ Actual: 1.70



Predicted:1.76/ Actual: 1.55



Predicted:1.65/ Actual: 1.85



Predicted:1.68/ Actual: 1.83



Predicted:1.95/ Actual: 1.88

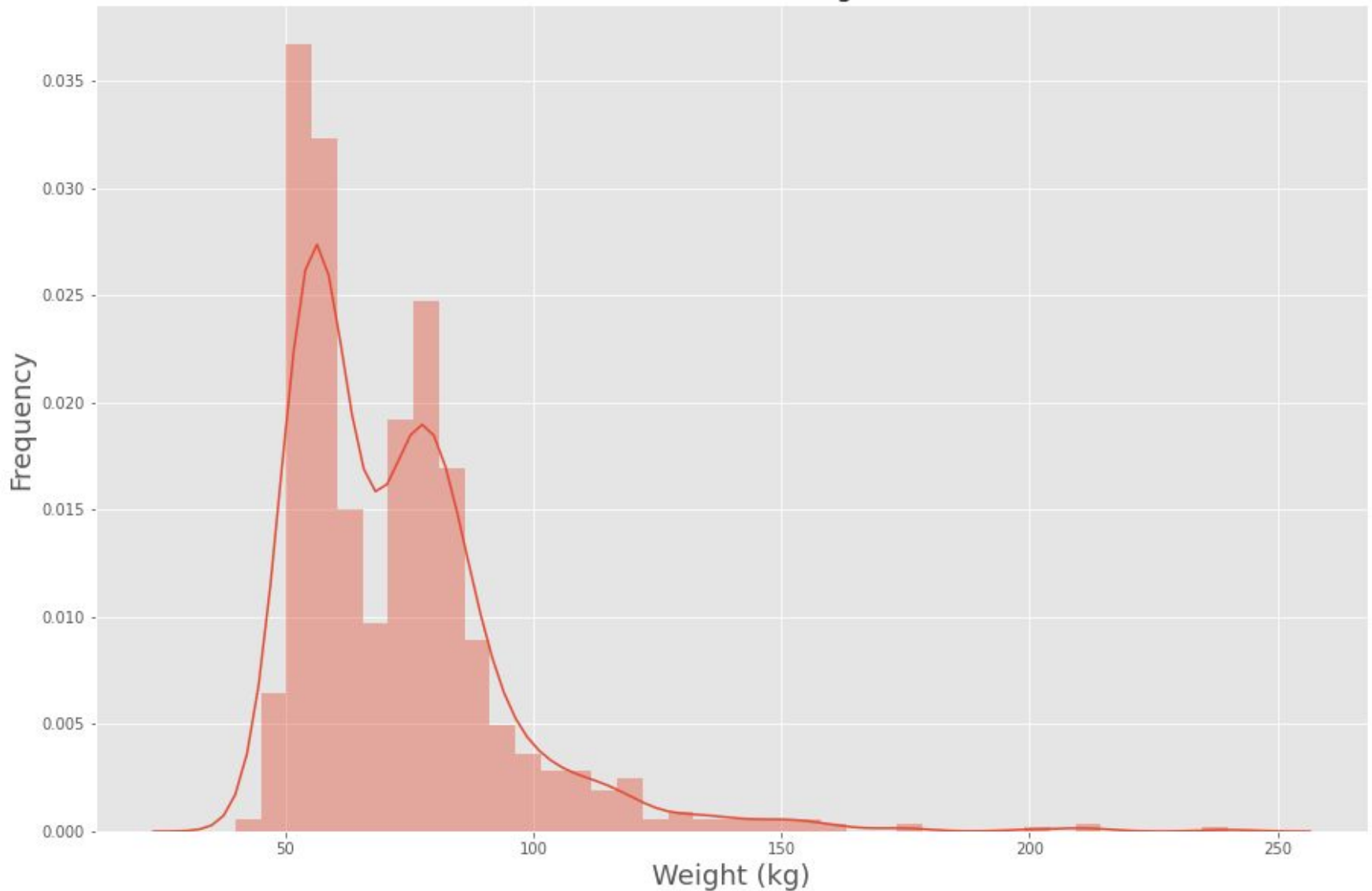


# Testing result distribution for cross validation on Height

Still training

# Cross validation train Weight

Distribution of Weight



# Prediction for Weight - Sample

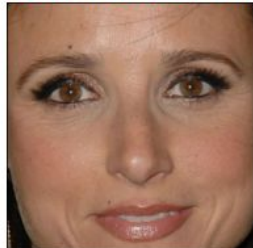
Predicted:62.27/ Actual: 53.00



Predicted:65.30/ Actual: 52.00



Predicted:67.26/ Actual: 54.00



Predicted:65.32/ Actual: 150.00



Predicted:61.58/ Actual: 66.00



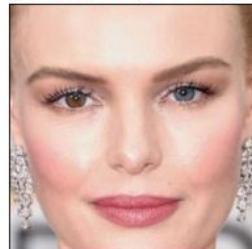
Predicted:60.53/ Actual: 61.00



Predicted:57.95/ Actual: 77.00



Predicted:60.01/ Actual: 52.00



Predicted:68.08/ Actual: 102.00



Predicted:60.02/ Actual: 60.00



Predicted:67.69/ Actual: 155.00



Predicted:80.64/ Actual: 61.00



Predicted:61.44/ Actual: 56.00



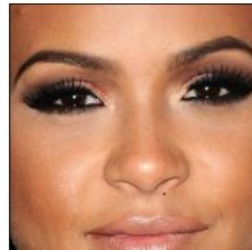
Predicted:85.34/ Actual: 81.00



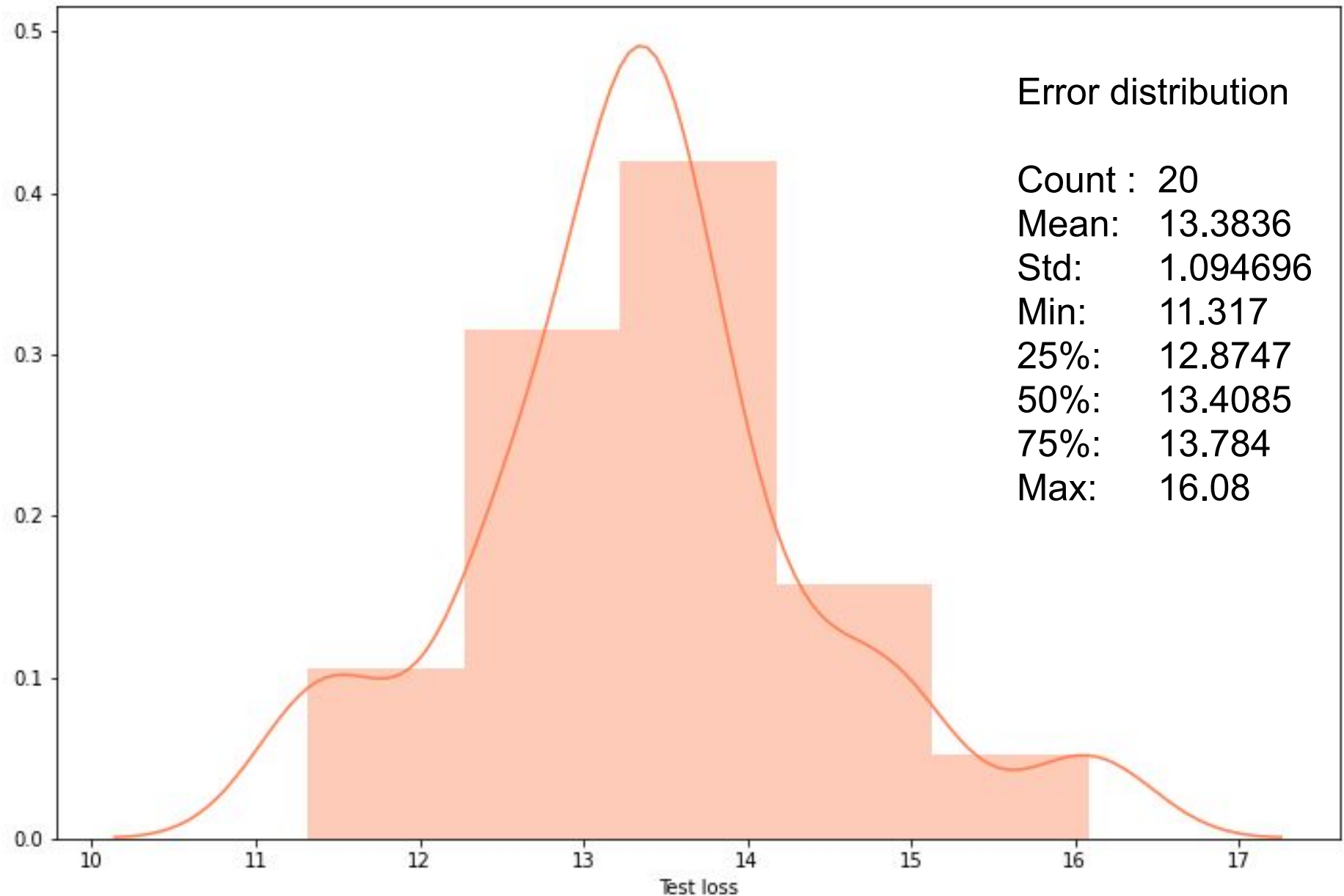
Predicted:64.56/ Actual: 55.00



Predicted:62.78/ Actual: 54.00



# Testing error distribution for cross validation on Weight



# Fixing crop face function

New crop no margin/ Average Error: 3.170



Old crop with 10% margin/ Average Error: 3.273



Analyze test result of original model

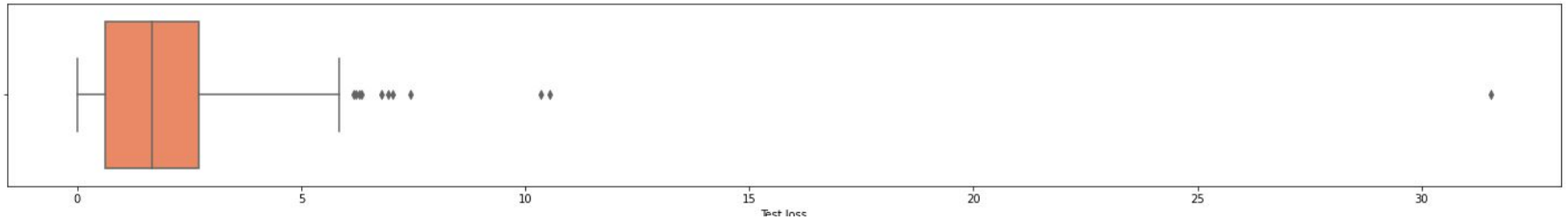
**BMI**

**Analyze test result for western data**

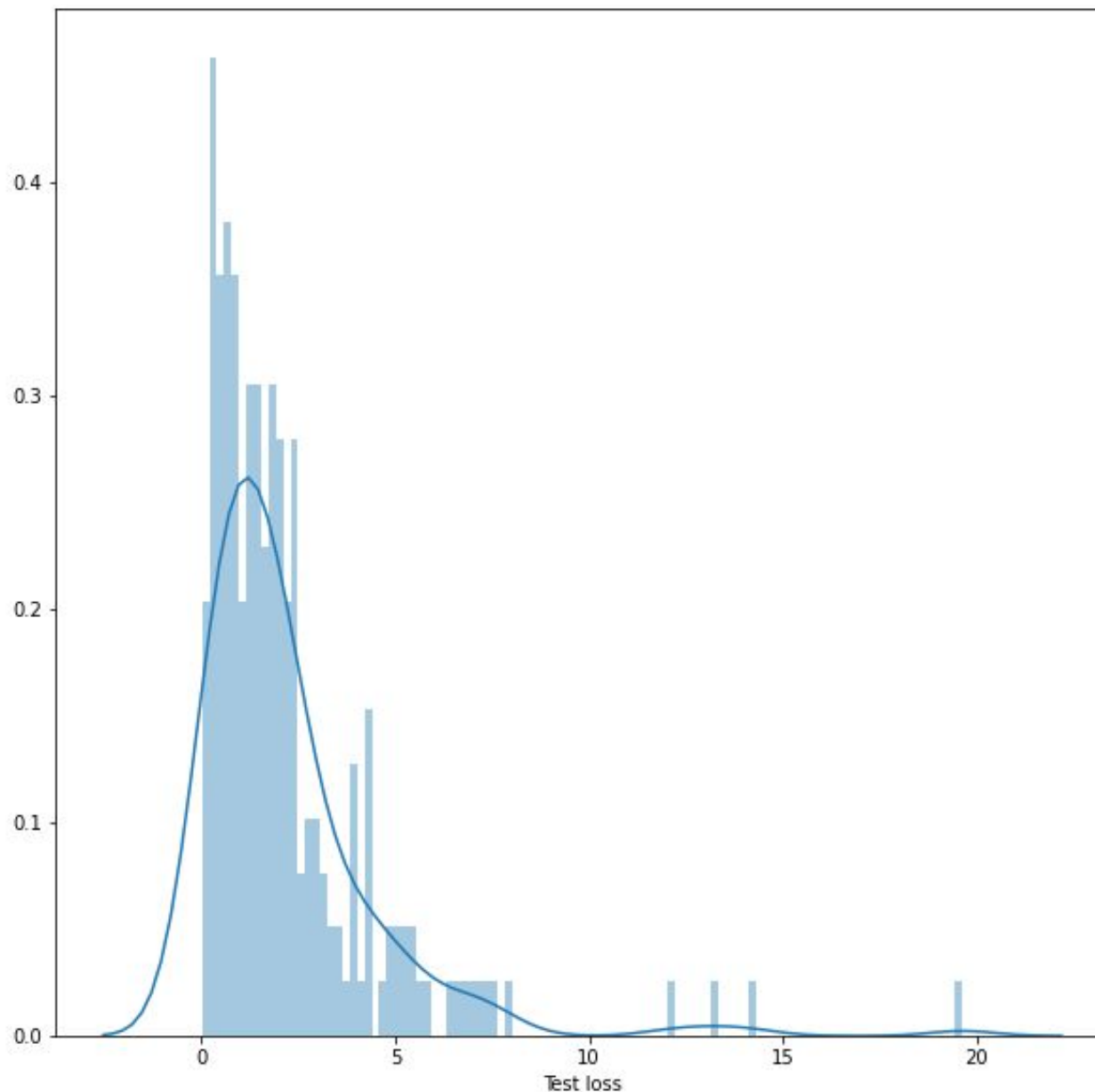


# Analyze BMI test result for western data

Count : 206  
Mean: 2.148342  
Std: 2.702871  
Min: 0.010359  
25%: 0.622971  
50%: 1.658  
75%: 2.722138  
Max: 31.54



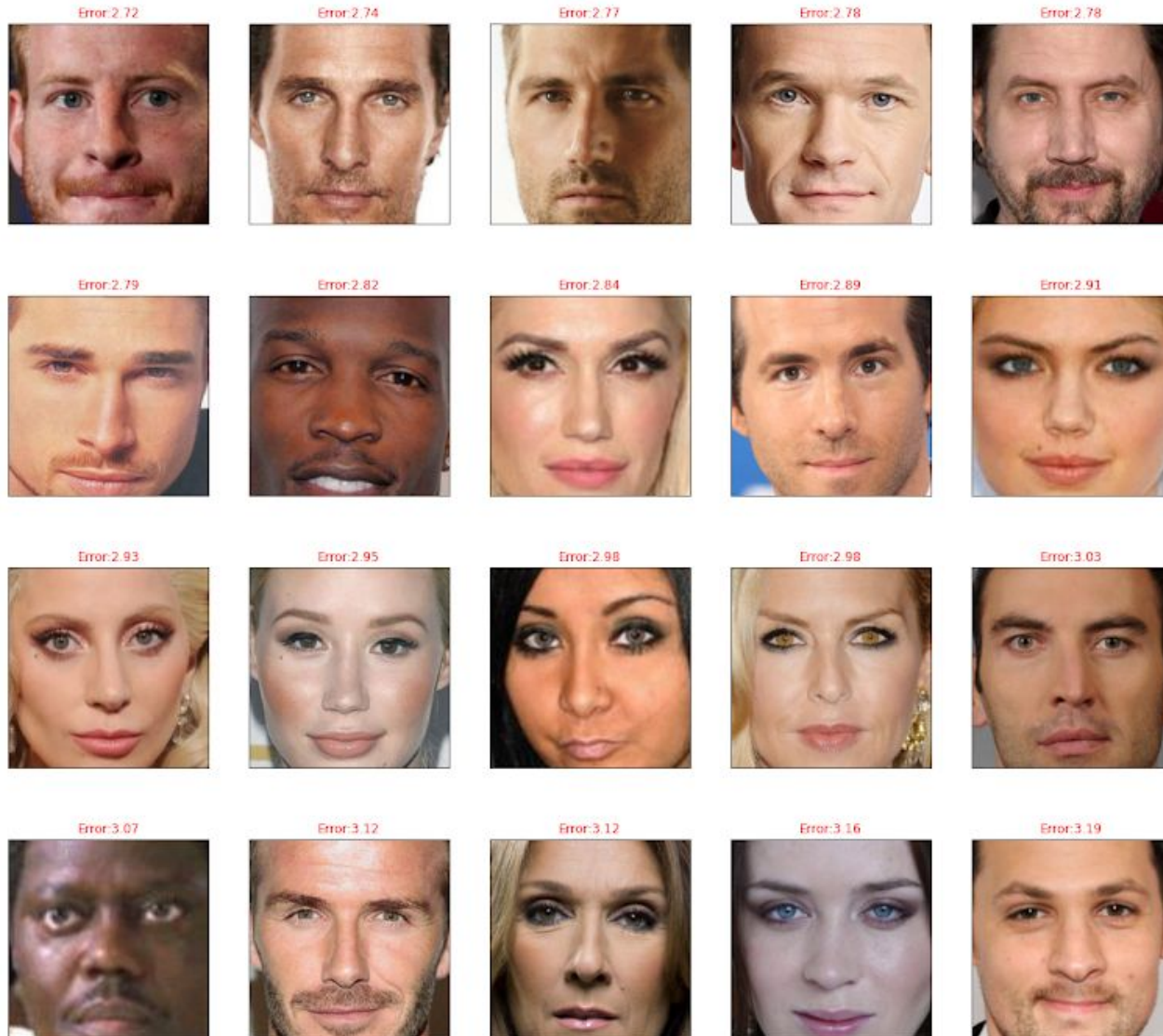
# Analyze test result for western data



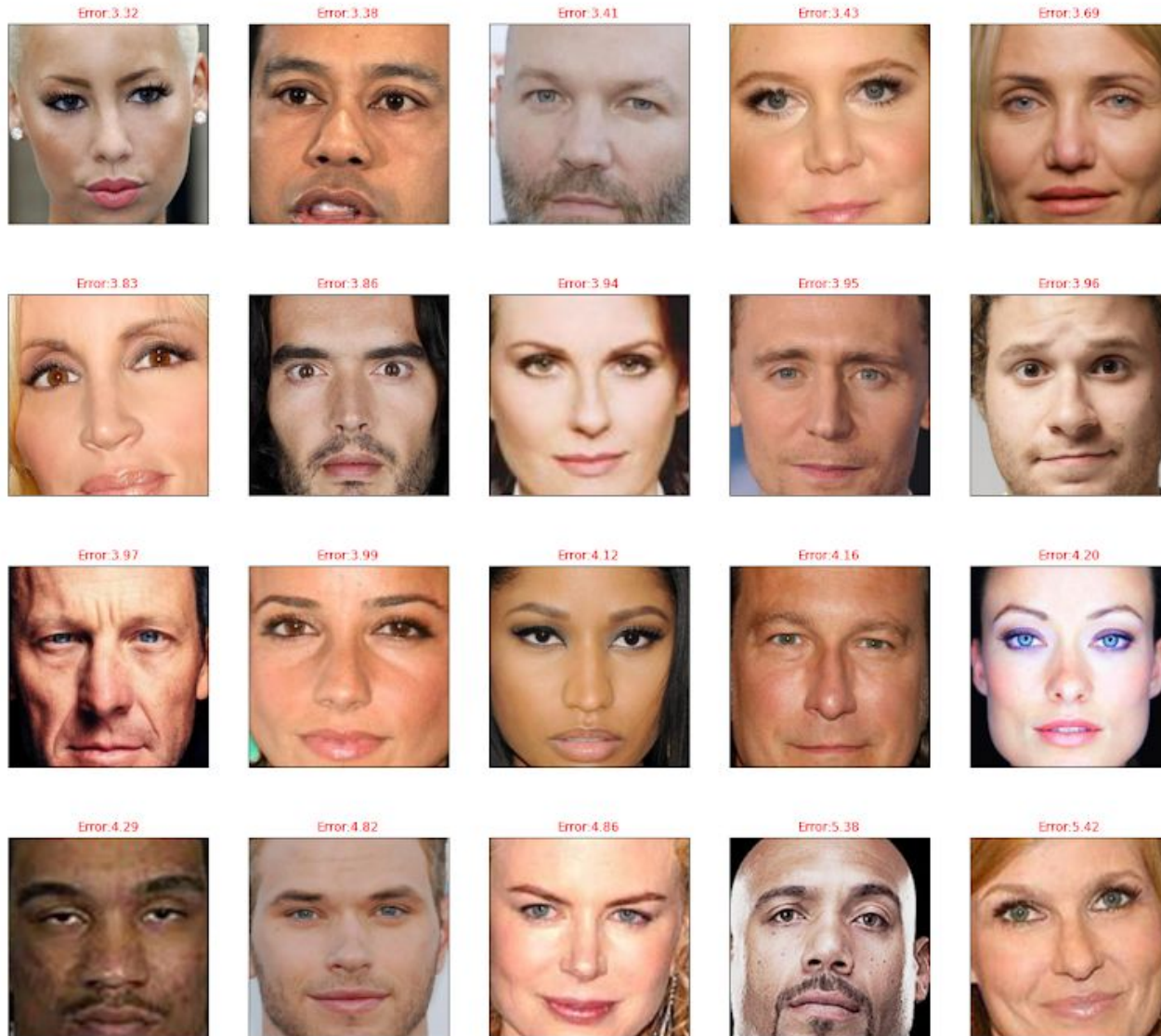
Error distribution

Count : 206  
Mean: 2.148342  
Std: 2.702871  
Min: 0.010359  
25%: 0.622971  
50%: 1.658  
75%: 2.722138  
Max: 31.54

# Test result for western data - Biggest error ( $\geq 2.72$ )



# Test result for western data - Biggest error ( $\geq 2.72$ )

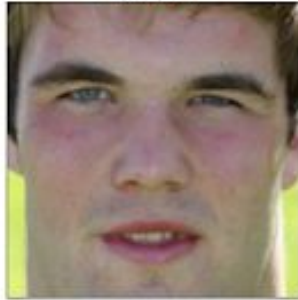


# Test result for western data - Biggest error ( $\geq 2.72$ )

Error:5.84



Error:6.17



Error:6.22



Error:6.30



Error:6.33



Error:6.80



Error:6.93



Error:7.04



Error:7.44



Error:10.35



Error:10.55



Error:31.54



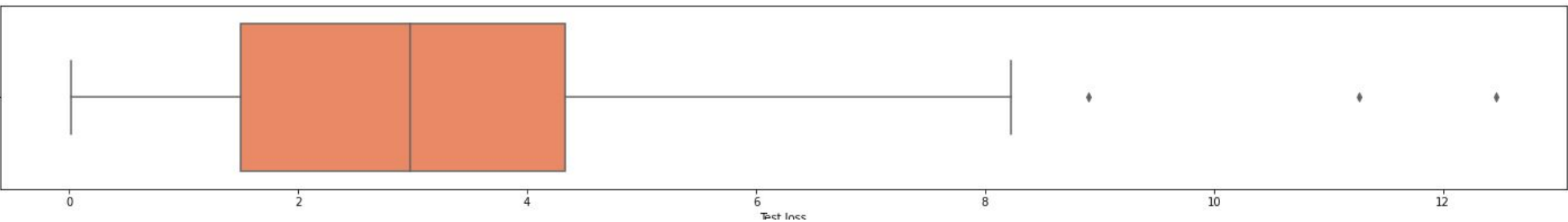
**BMI**

**Analyze test result for Asian data**

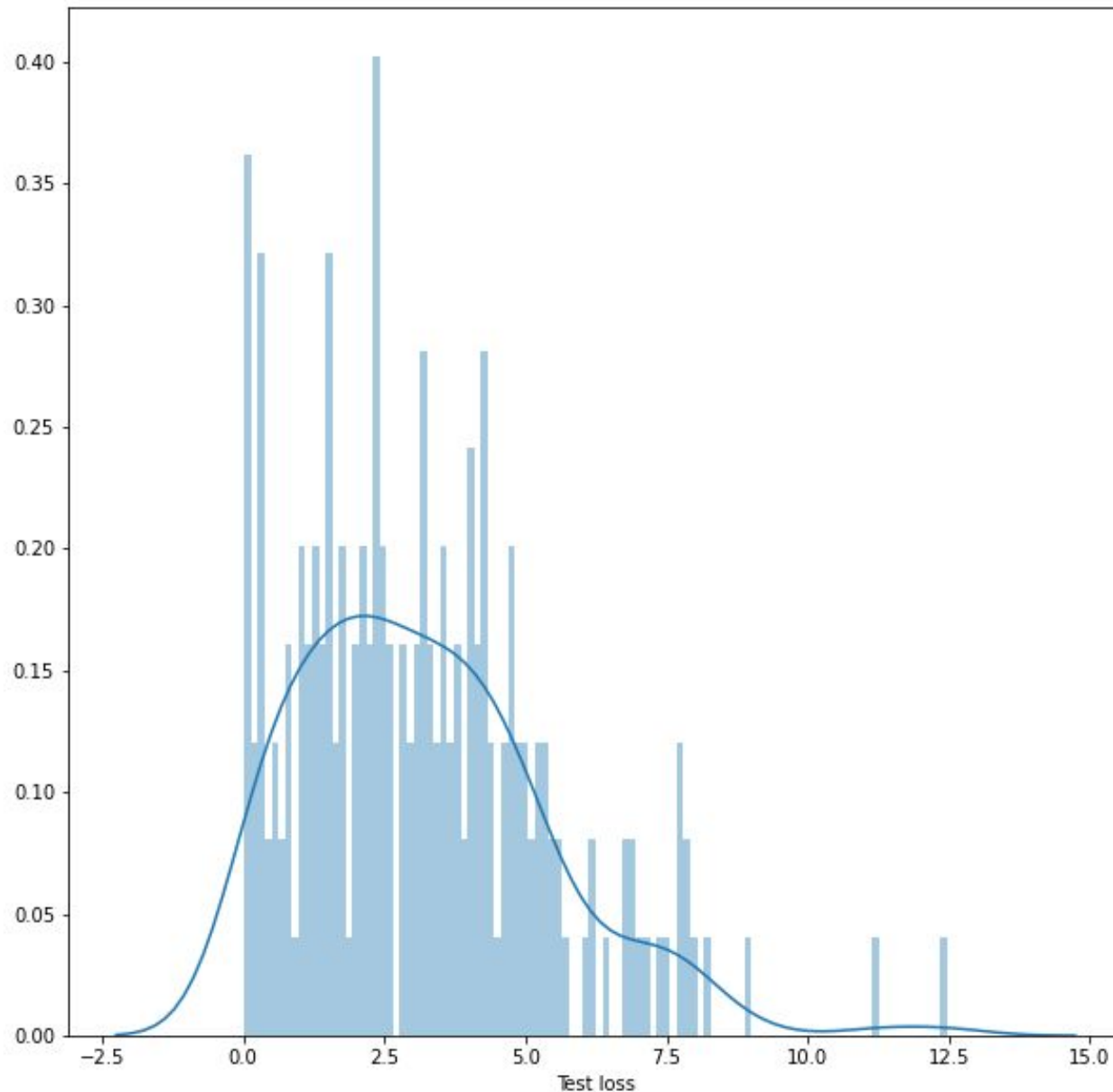


# Analyze test result for asian data

Count : 208  
Mean: 3.170377  
Std: 2.212229  
Min: 0.019562  
25%: 1.492668  
50%: 2.976602  
75%: 4.336589  
Max: 12.460855



# Analyze test result for asian data

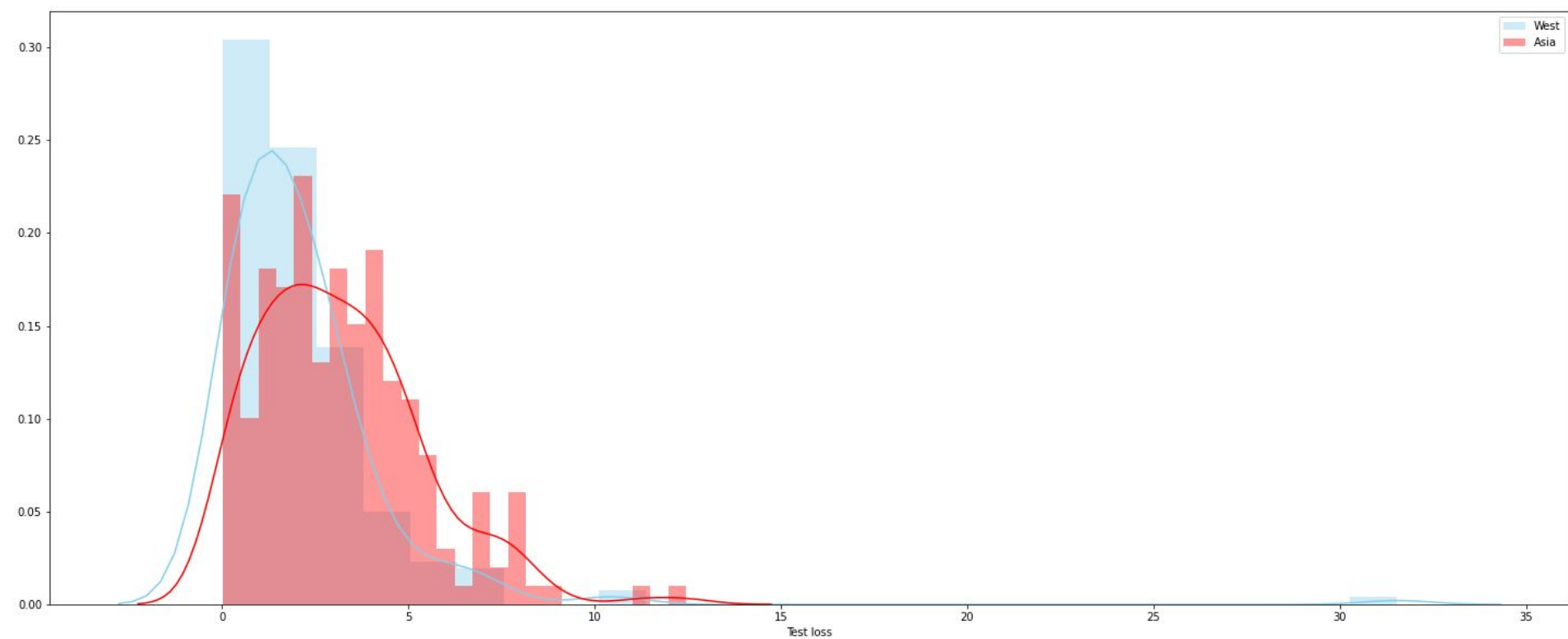


Error distribution

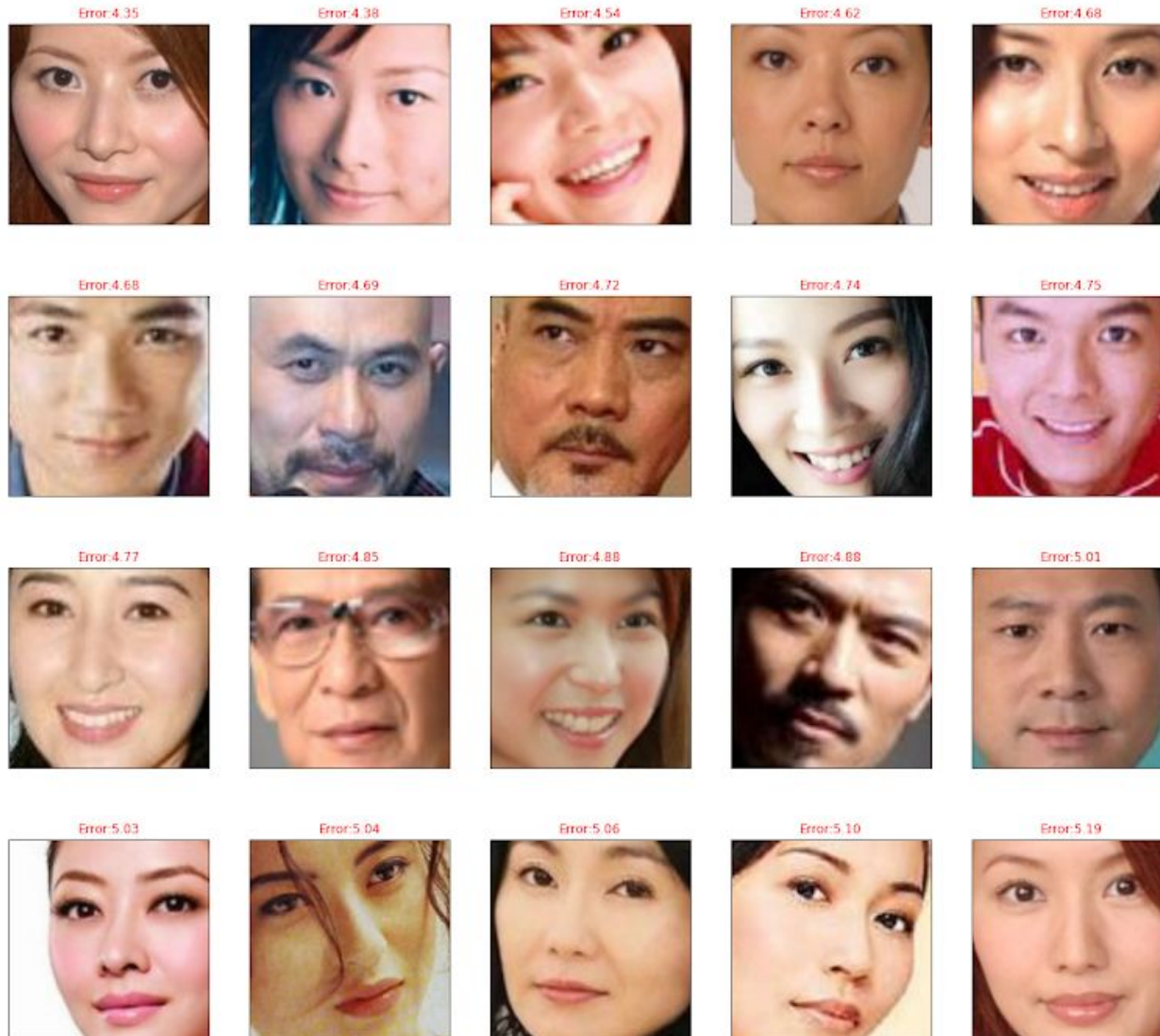
Count : 208  
Mean: 3.170  
Std: 2.212  
Min: 0.019  
25%: 1.492  
50%: 2.976  
75%: 4.336  
Max: 12.46



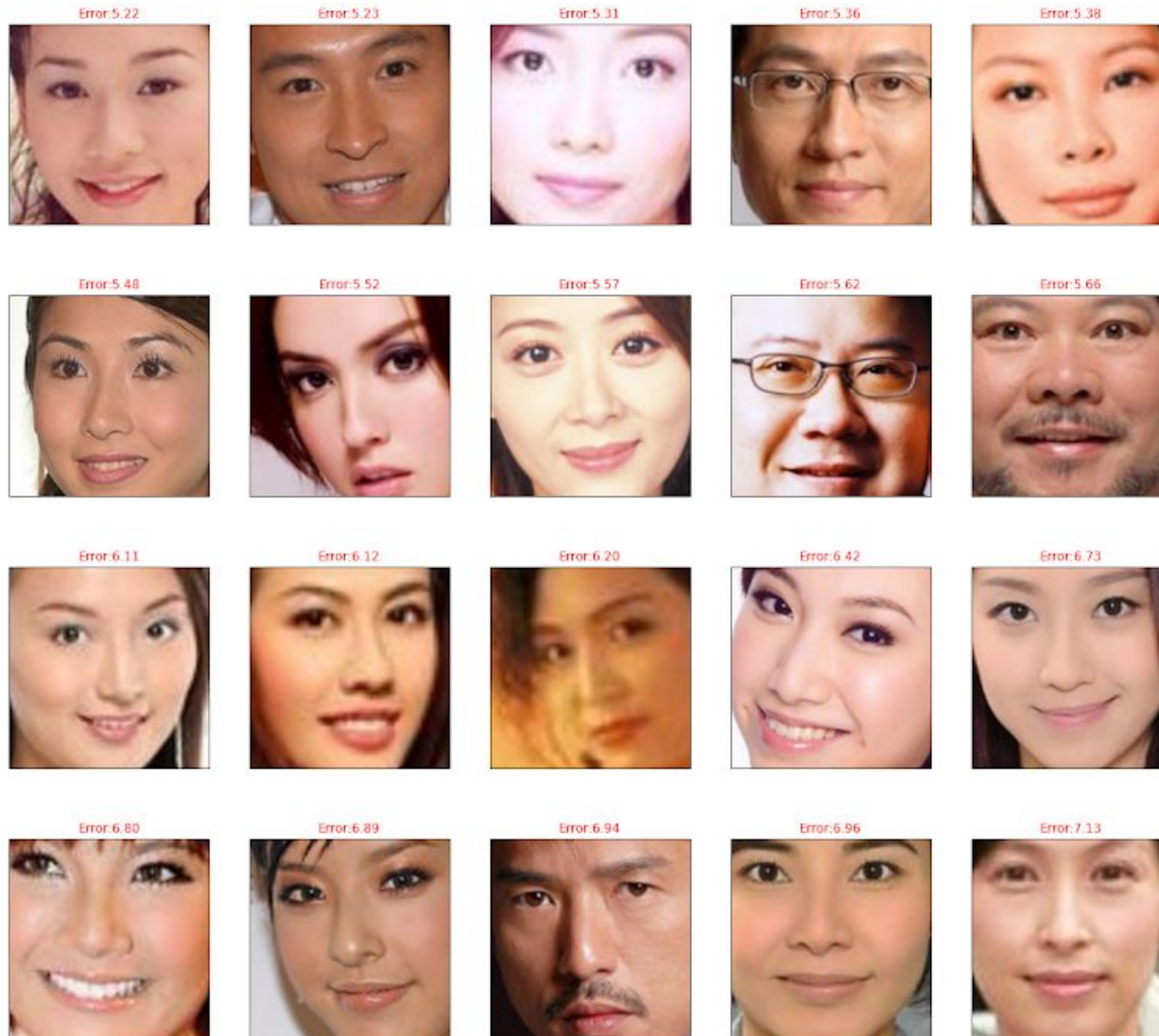
# BMI error distribution West vs Asia



# Test result for asian data - Biggest error ( $\geq 4.33$ )



# Test result for asian data - Biggest error ( $\geq 4.33$ )



# Test result for asian data - Biggest error ( $\geq 4.33$ )

Error: 7.40



Error: 7.50



Error: 7.70



Error: 7.73



Error: 7.74



Error: 7.82



Error: 7.88



Error: 7.94



Error: 8.23



Error: 8.90



Error: 11.26



Error: 12.46

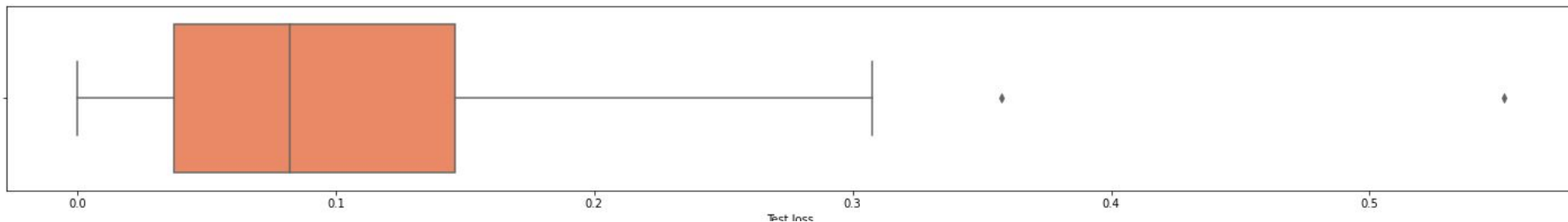


Height

Analyze test result for western data

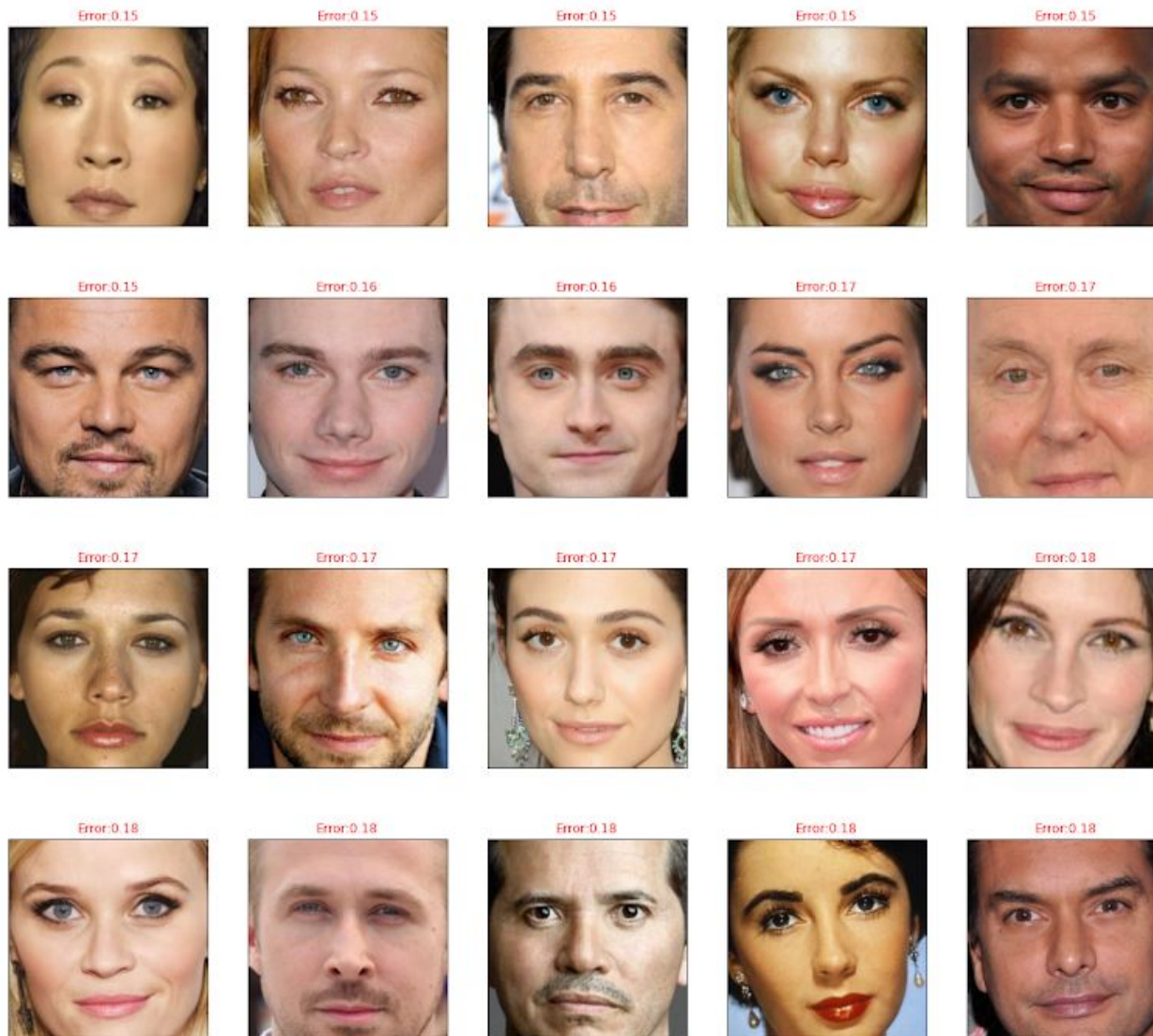
# Analyze Height test result for western data

Count : 206  
Mean: 0.101752  
Std: 0.084011  
Min: 0.000150  
25%: 0.037468  
50%: 0.082075  
75%: 0.145986  
Max: 0.551839

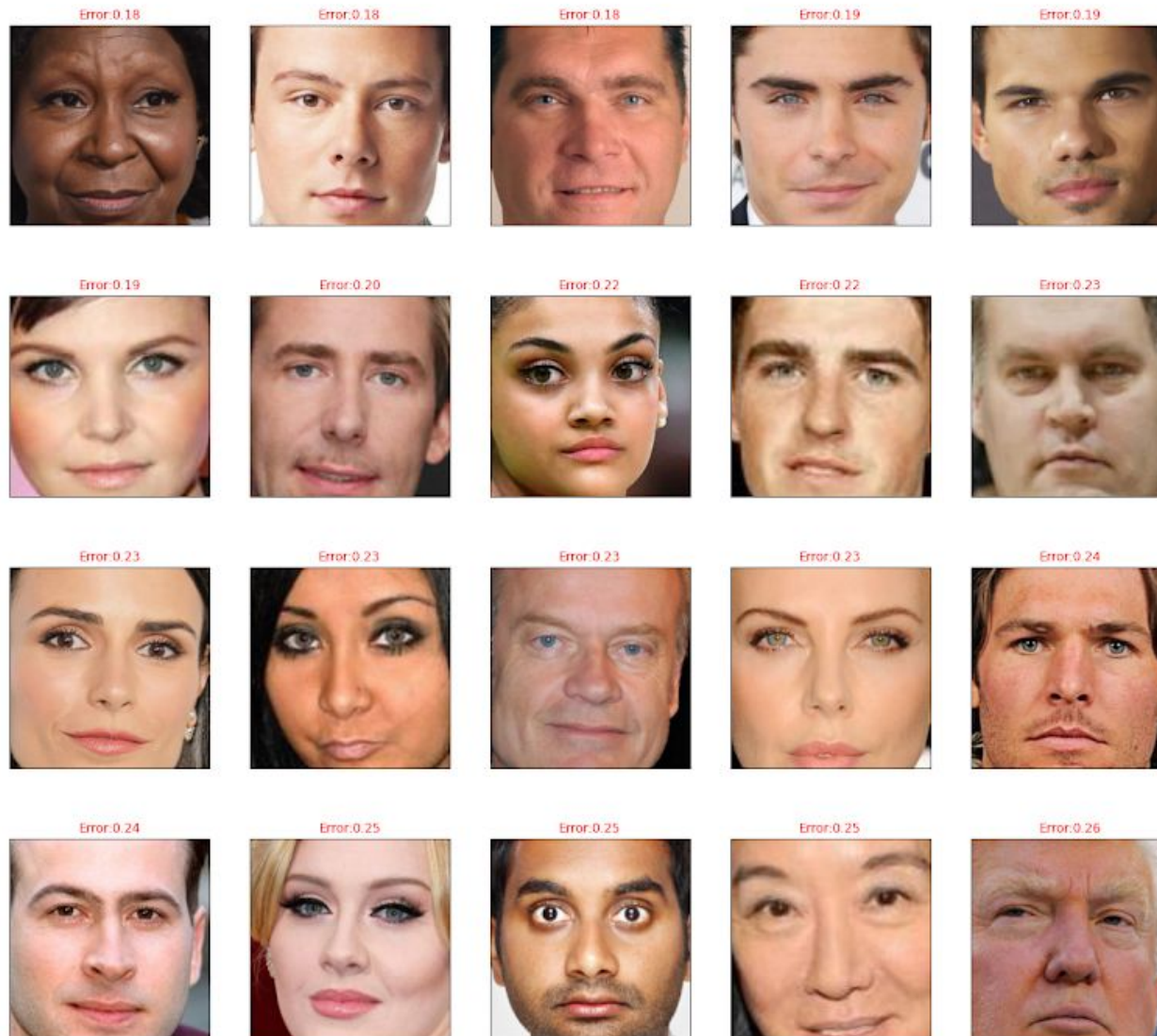




# Test result for western data - Biggest error ( $\geq 0.145$ )



# Test result for western data - Biggest error ( $\geq 0.145$ )





# Test result for western data - Biggest error ( $\geq 0.145$ )

Error:0.26



Error:0.26



Error:0.26



Error:0.26



Error:0.27



Error:0.28



Error:0.28



Error:0.30



Error:0.30



Error:0.31



Error:0.36



Error:0.55

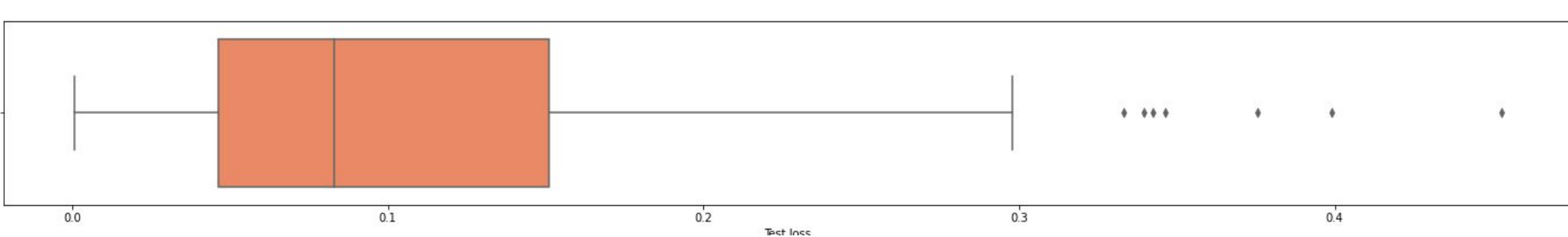


Height

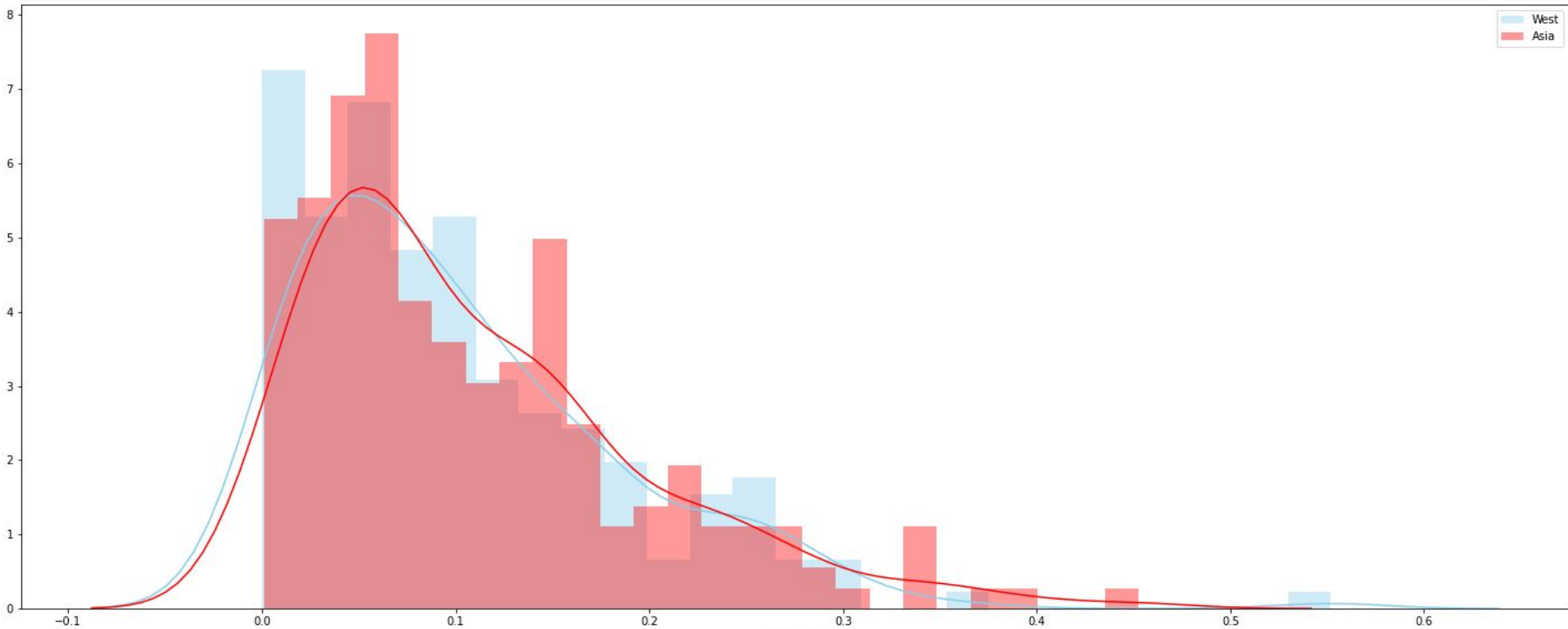
Analyze test result for Asian data

# Analyze test result for asian data

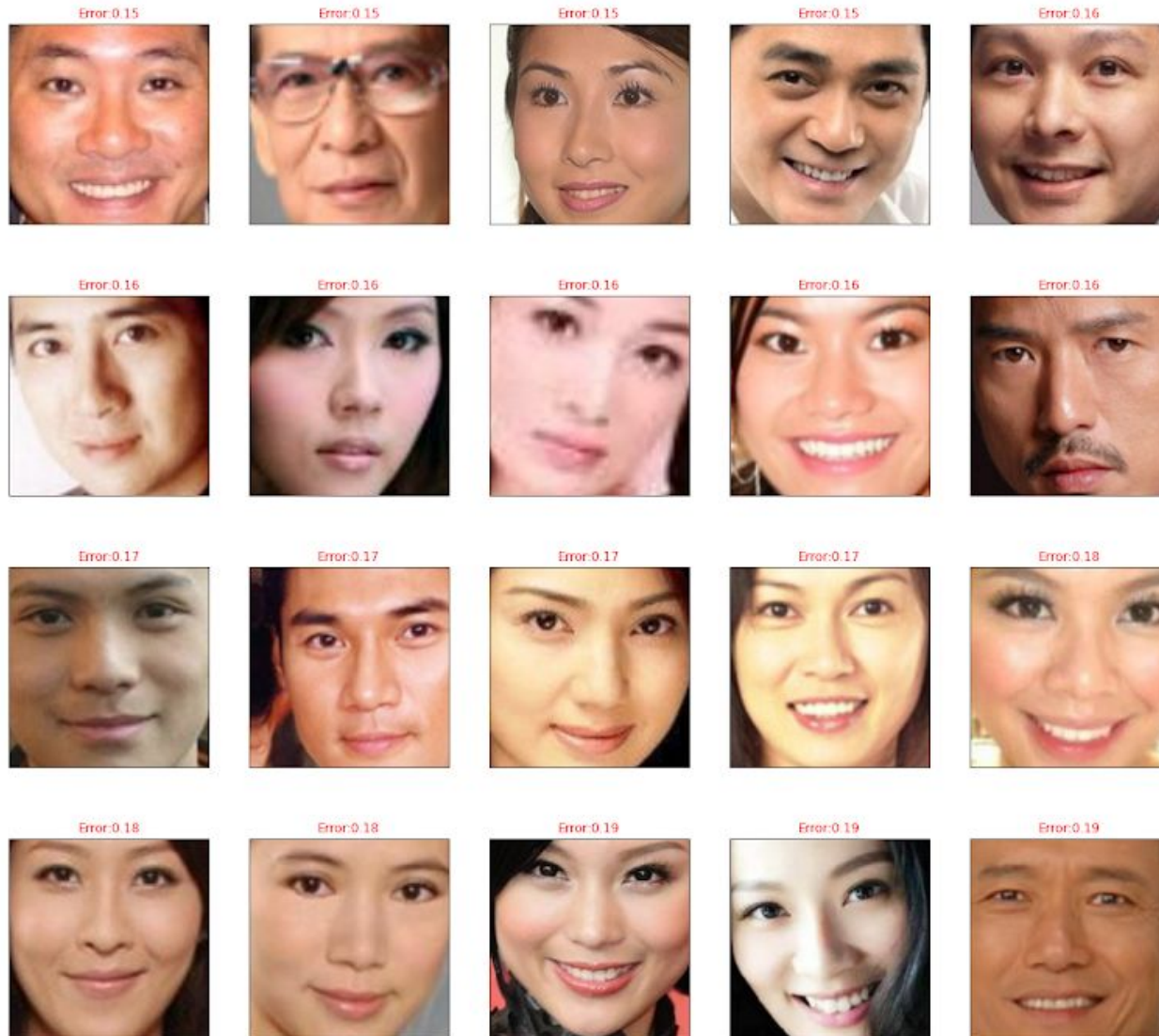
Count : 208  
Mean: 0.109418  
Std: 0.086420  
Min: 0.000916  
25%: 0.046195  
50%: 0.083020  
75%: 0.150958  
Max: 0.452671



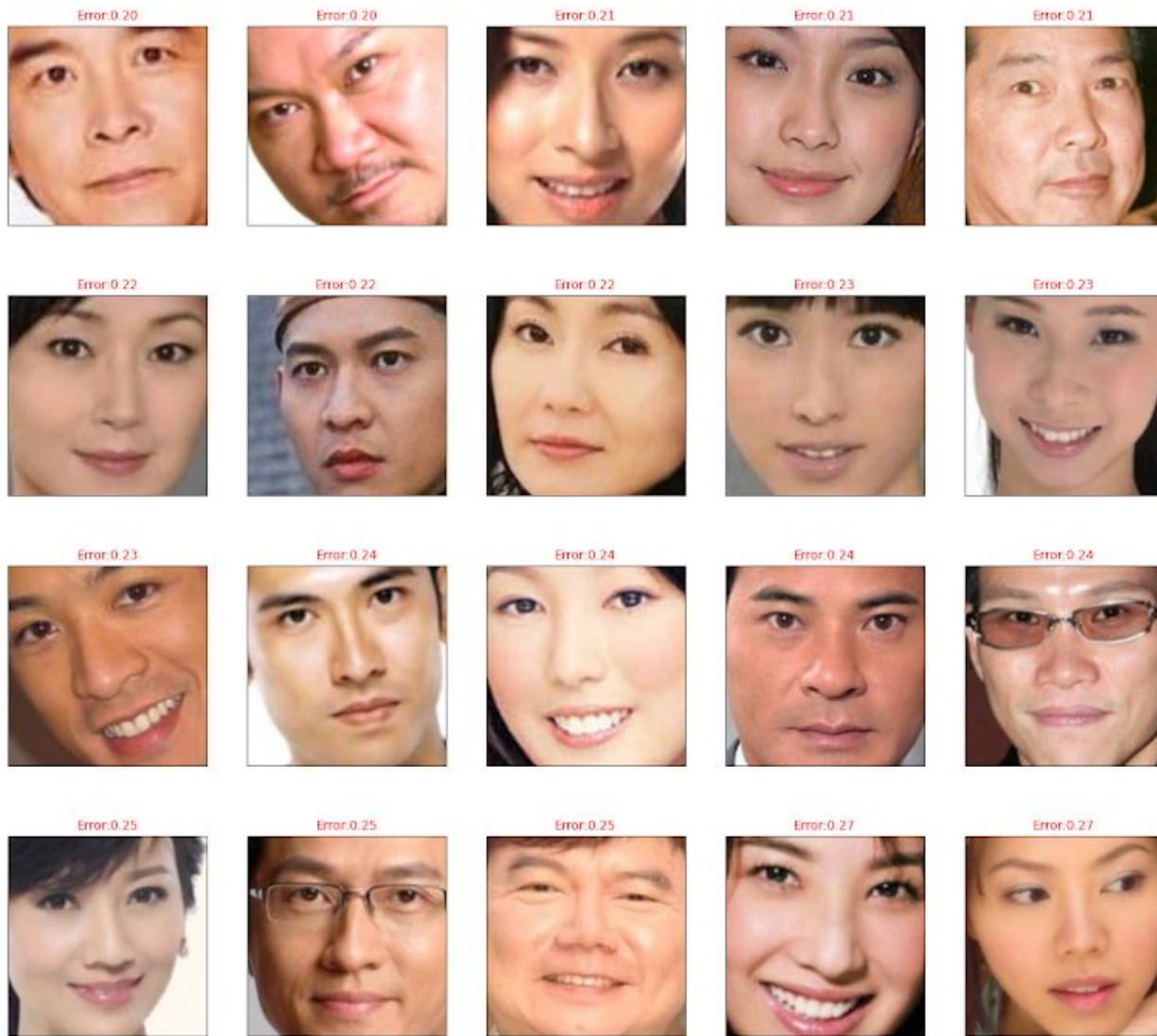
# Height error distribution West vs Asia



# Test result for asian data - Biggest error ( $\geq 0.15$ )



# Test result for asian data - Biggest error ( $\geq 0.15$ )





# Test result for asian data - Biggest error ( $\geq 0.15$ )

Error:0.28



Error:0.28



Error:0.28



Error:0.29



Error:0.30



Error:0.33



Error:0.34



Error:0.34



Error:0.35



Error:0.38



Error:0.40



Error:0.45



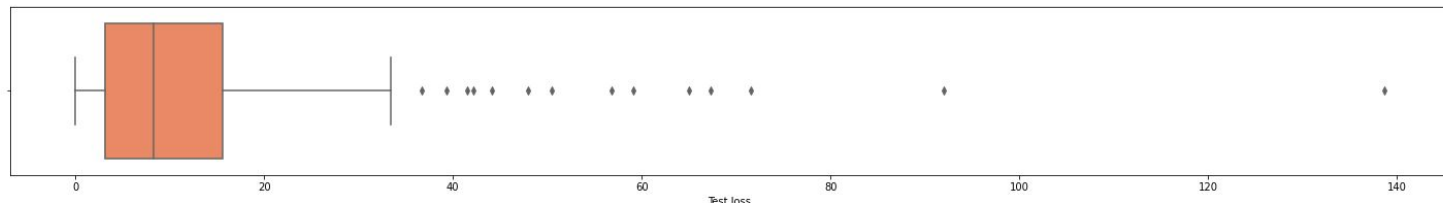
Weight

Analyze test result for western data

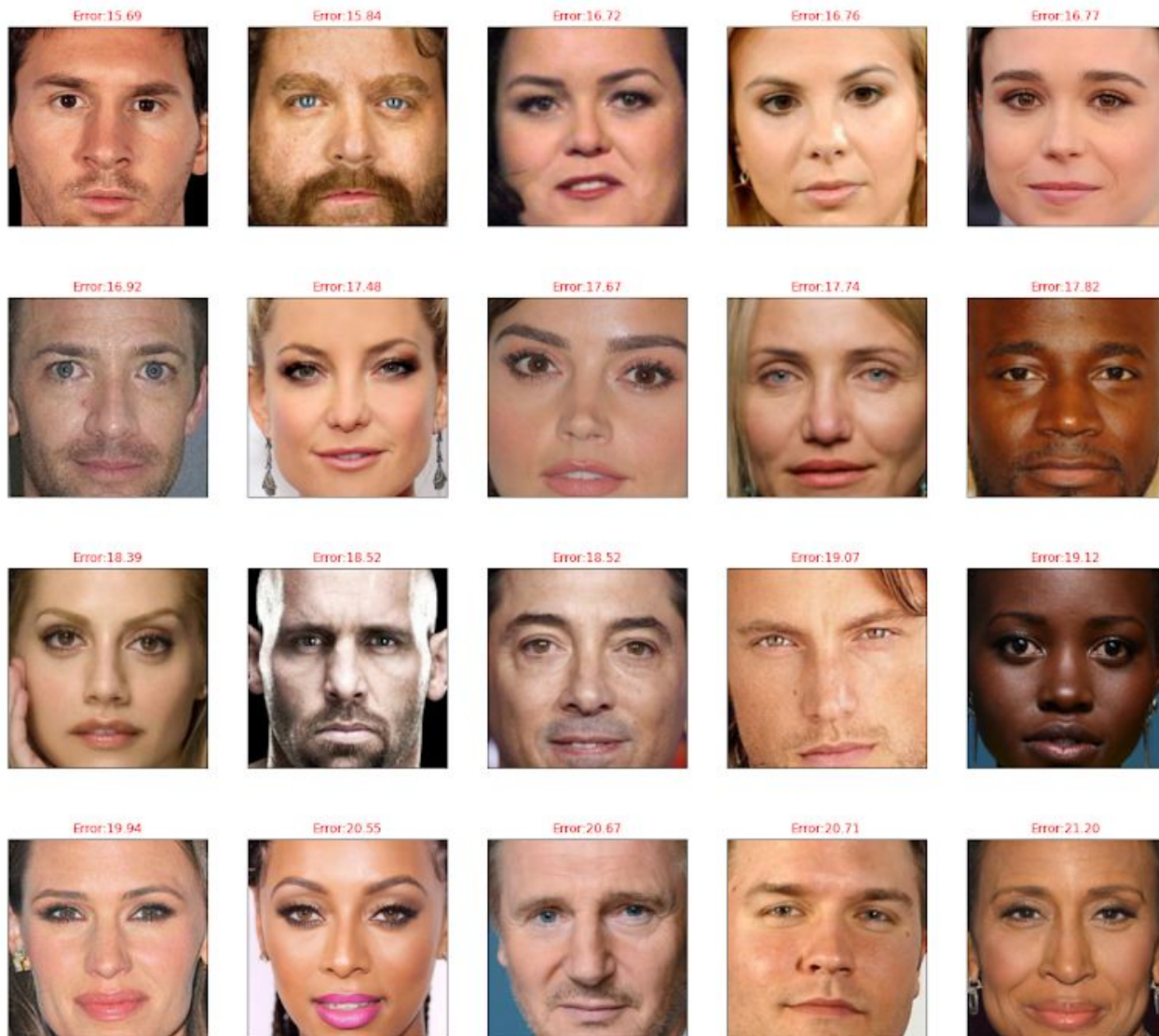


# Analyze Weight test result for western data

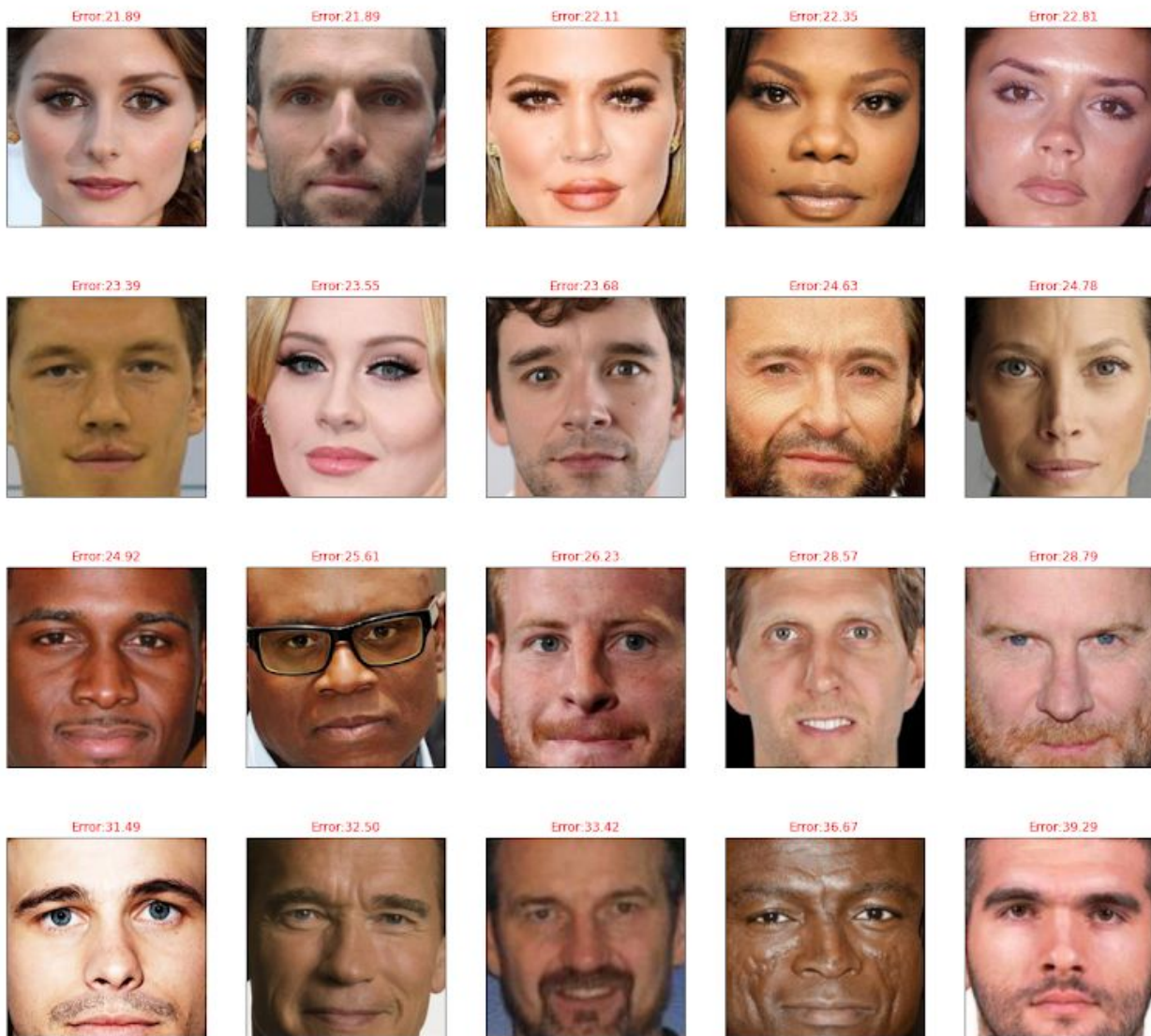
Count: 206  
mean 12.714376  
std 16.437334  
min 0.018837  
25% 3.136052  
50% 8.266600  
75% 15.654055  
max 138.629791



# Test result for western data - Biggest error ( $\geq 15.65$ )



# Test result for western data - Biggest error ( $\geq 15.65$ )



# Test result for western data - Biggest error ( $\geq 15.65$ )

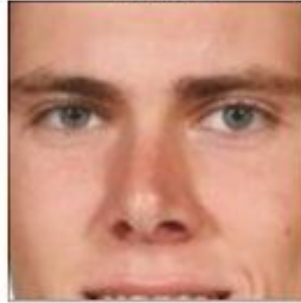
Error:41.49



Error:42.19



Error:44.08



Error:48.01



Error:50.43



Error:56.79



Error:59.06



Error:65.03



Error:67.34



Error:71.57



Error:91.96



Error:138.63

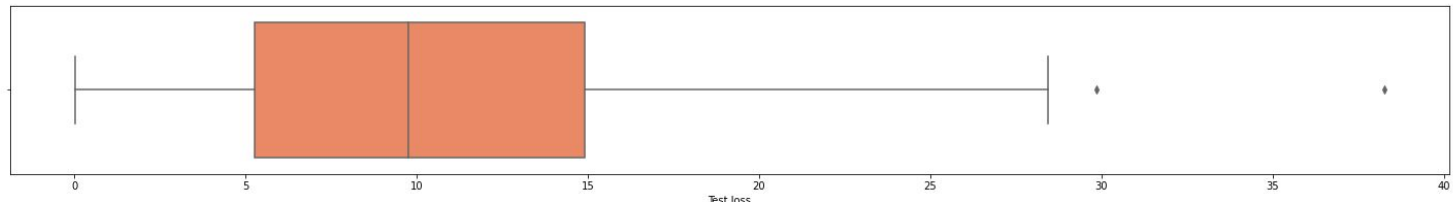


Weight

Analyze test result for Asian data

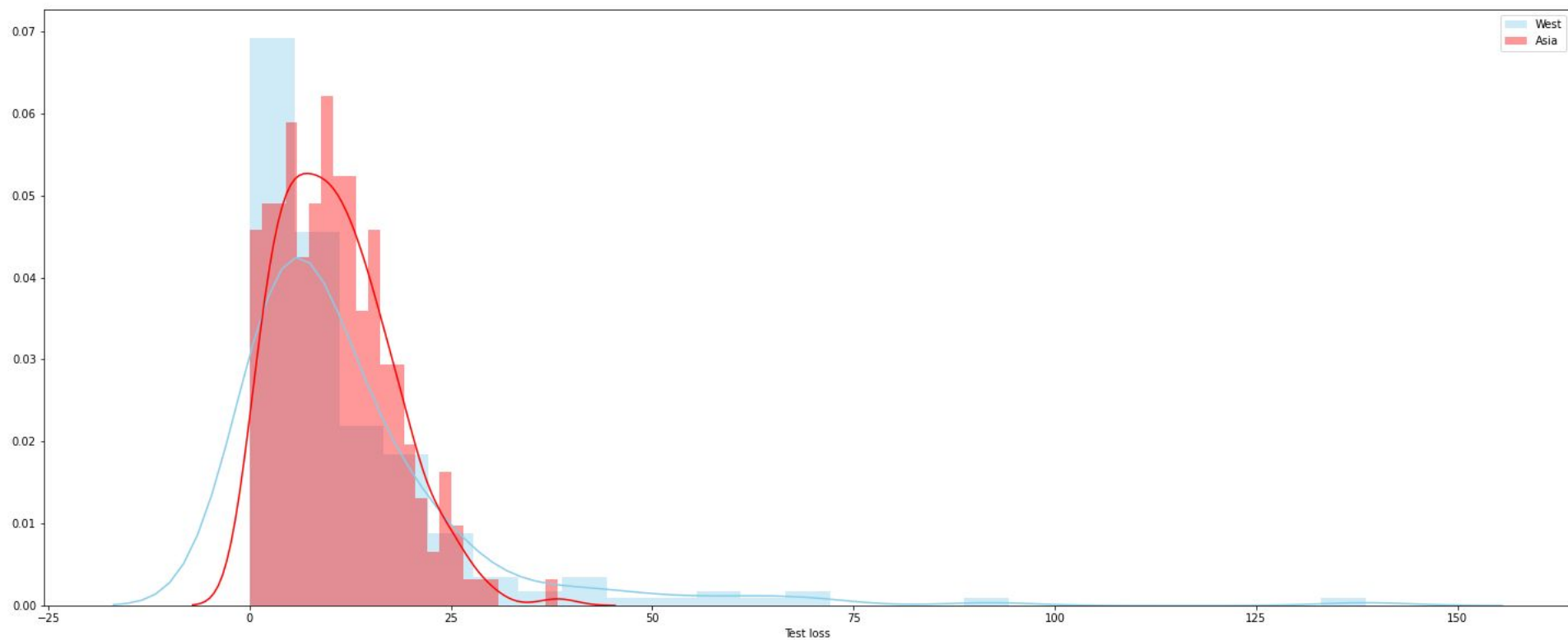
# Analyze test result for asian data

count	208.000000
mean	10.661611
std	6.928674
min	0.039642
25%	5.282686
50%	9.760532
75%	14.908416
max	38.254318



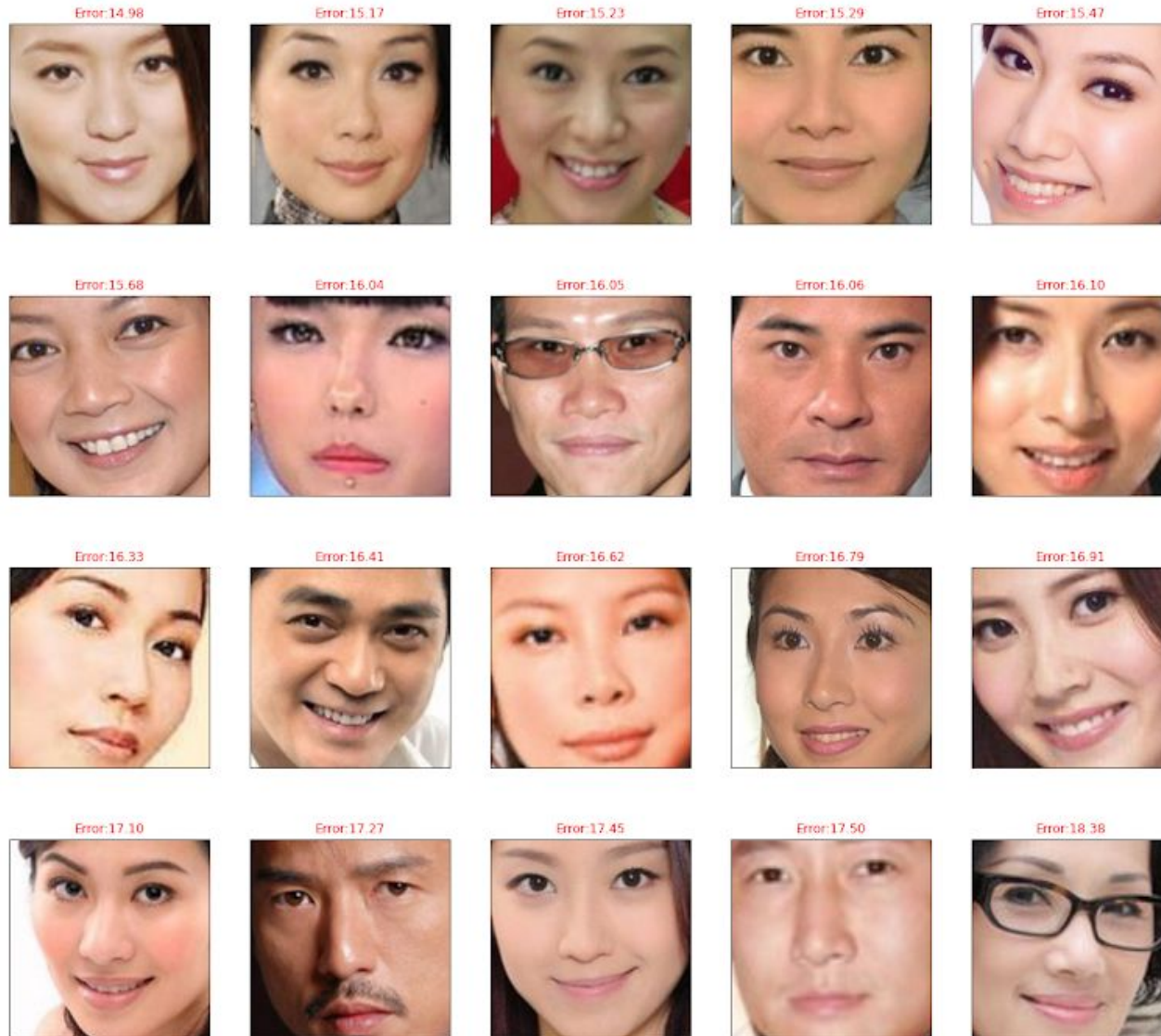


# Weight error distribution West vs Asia

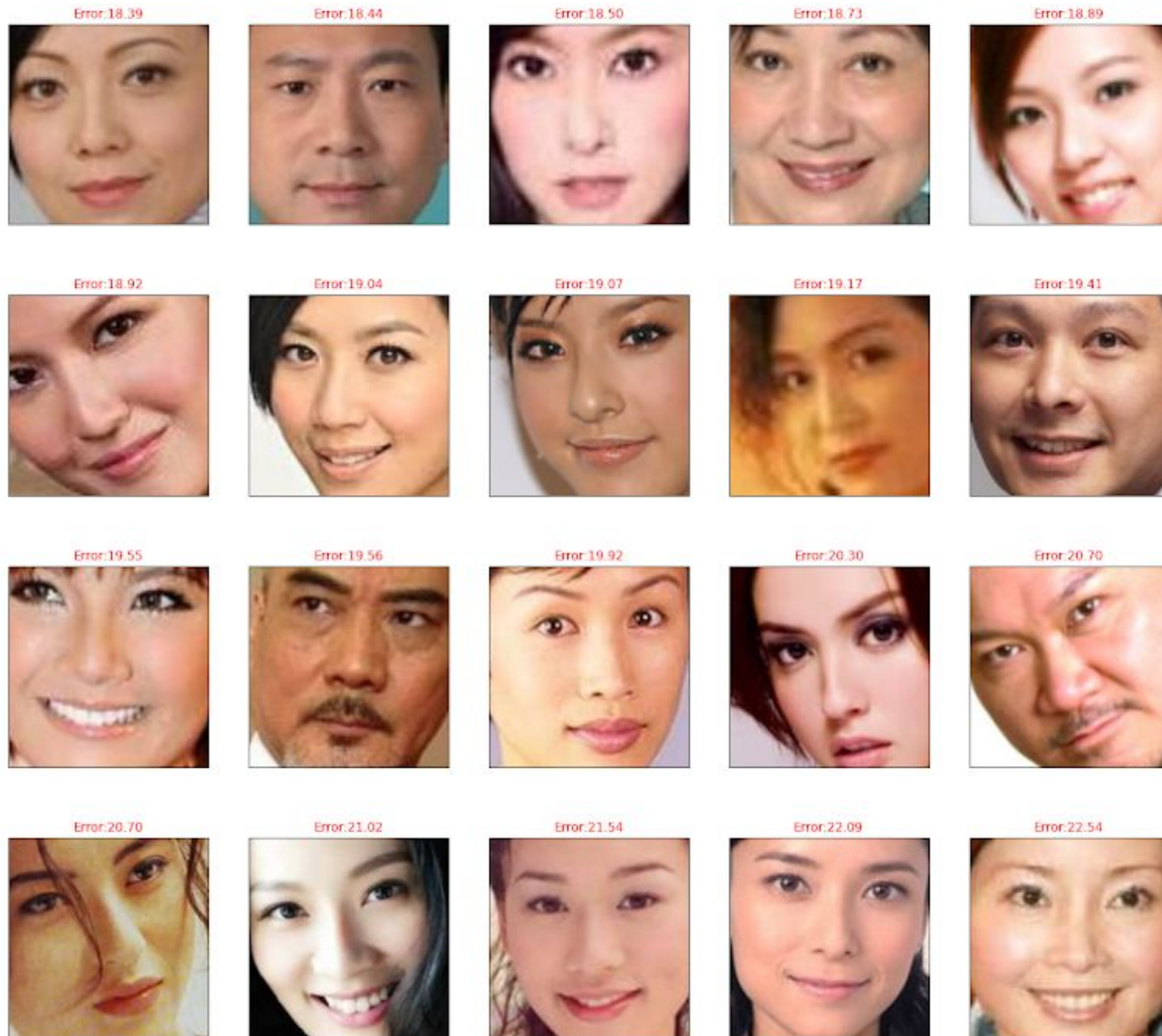




# Test result for asian data - Biggest error ( $\geq 14.9$ )



# Test result for asian data - Biggest error ( $\geq 14.9$ )



# Test result for asian data - Biggest error ( $\geq 14.9$ )

Error:23.79



Error:23.82



Error:23.95



Error:24.37



Error:24.41



Error:25.03



Error:25.05



Error:25.89



Error:27.35



Error:28.45



Error:29.85



Error:38.25



# Analyze test result for western data - Biggest error

Reasons for error:

1. Bad image: not complete face, losing some parts of face, wearing glasses
2. Bad data:
  - a. Image and values are not taken at the same time
  - b. Incorrect data

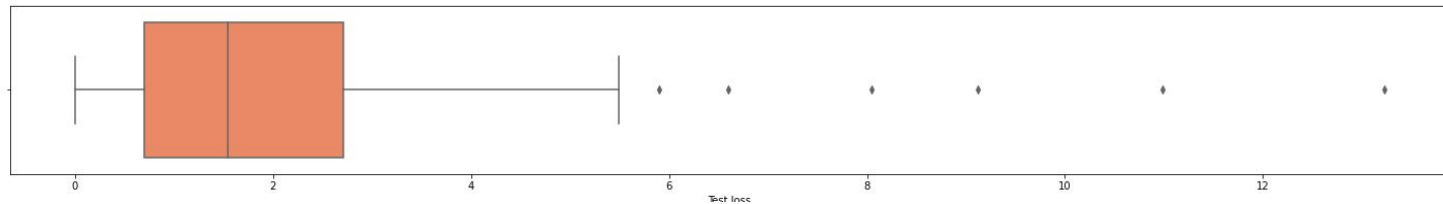
**Main reason: bad data**

Train pretrained model to train  
on asian data

BMI

# Analyze test result for asian data

count	208.000000
mean	1.959250
std	1.818866
min	0.005199
25%	0.694865
50%	1.545342
75%	2.710669
max	13.221609

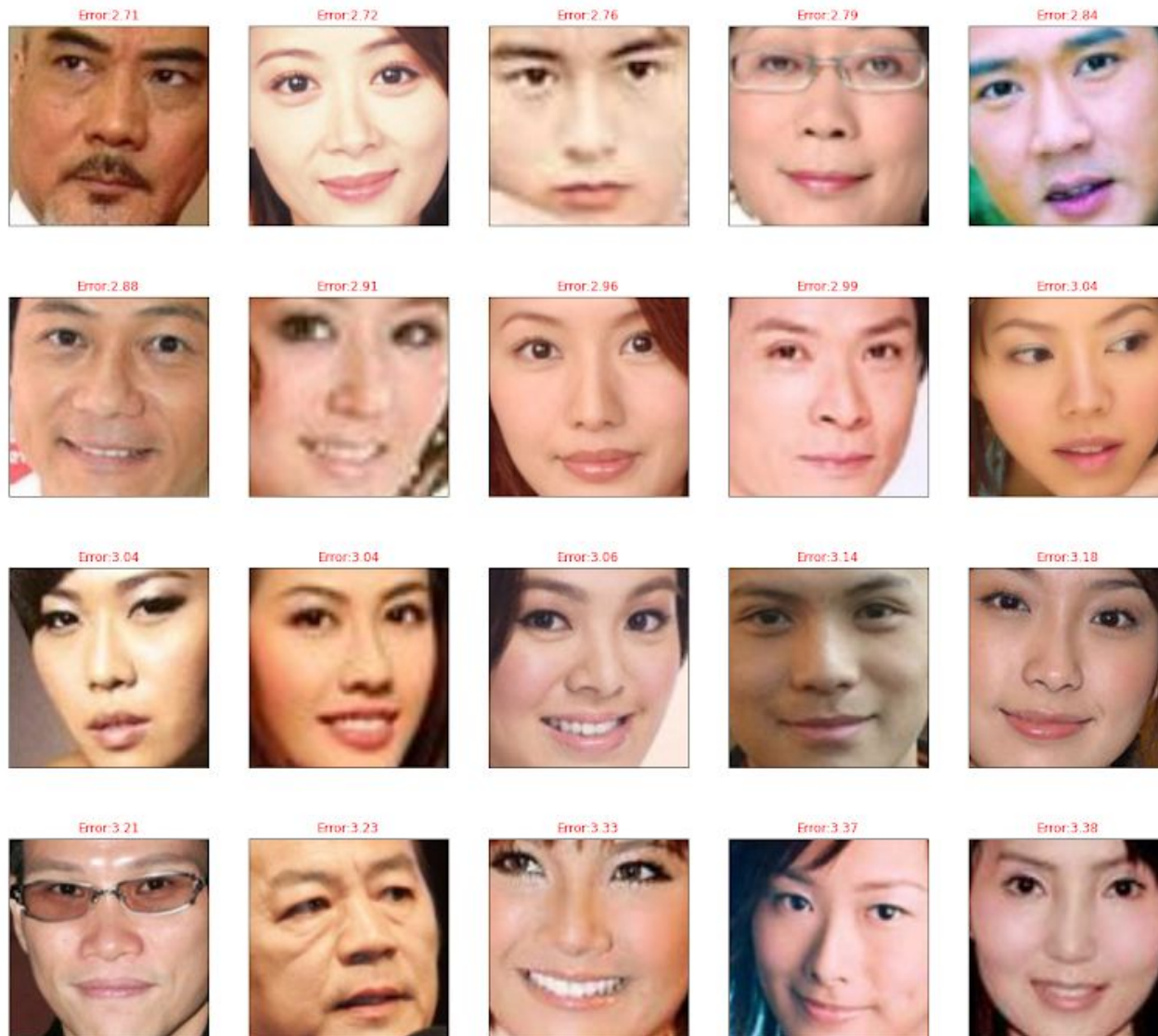




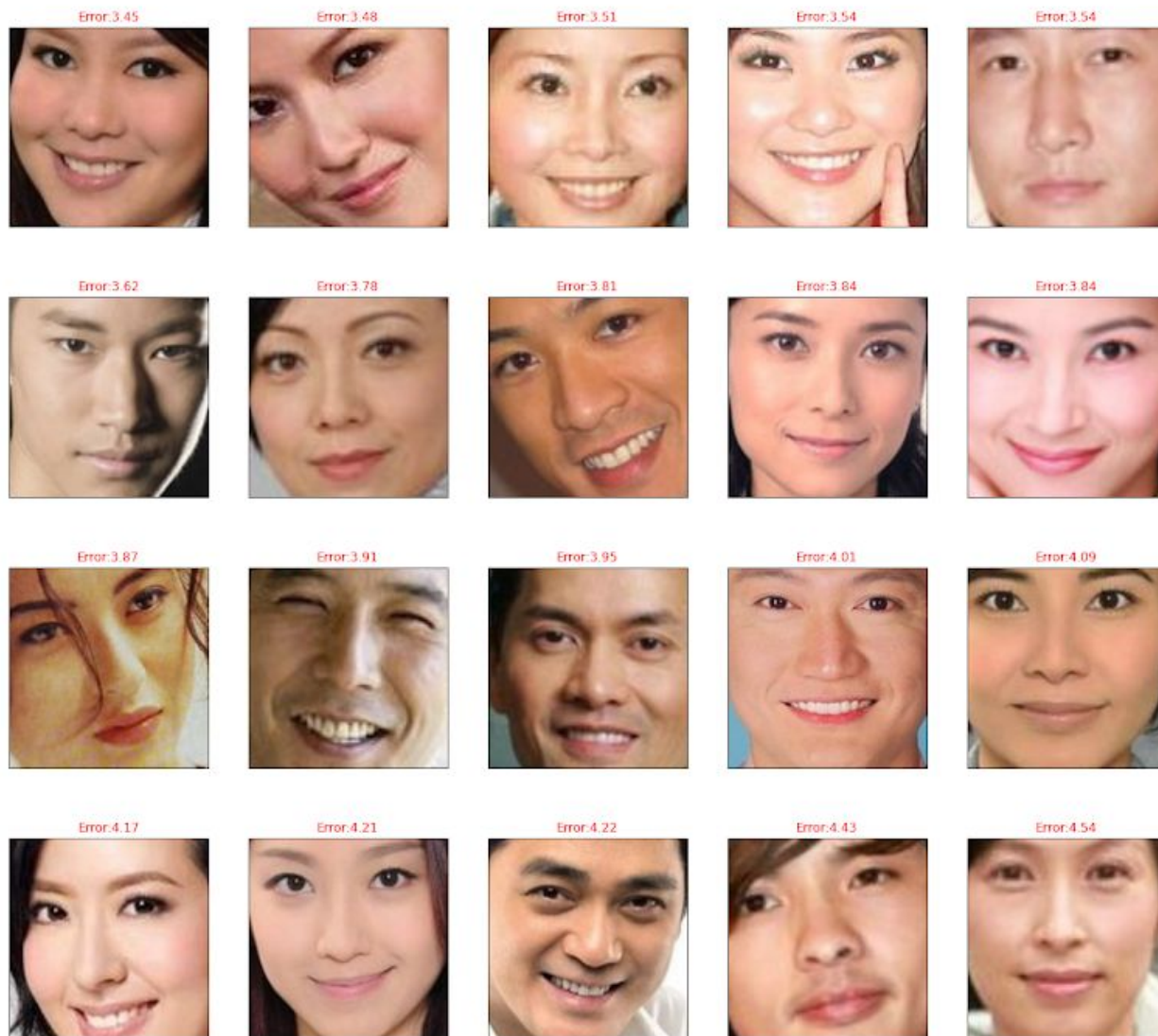
## Model after training on asian data

Testing loss with asia data is: 1.959 (Before training is 3.17)

# Test result for asian data - Biggest error



# Test result for asian data - Biggest error



# Test result for asian data - Biggest error

Error:5.05



Error:5.05



Error:5.13



Error:5.27



Error:5.47



Error:5.50



Error:5.90



Error:6.60



Error:8.05



Error:9.12



Error:10.98



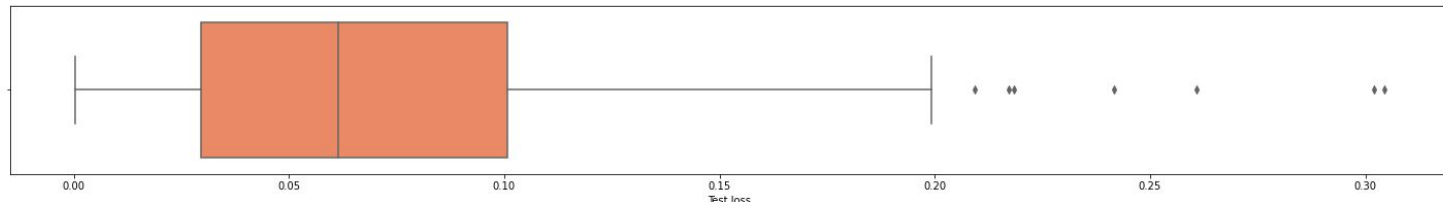
Error:13.22



Height

# Analyze test result for asian data

count	208
mean	0.073468
std	0.058572
min	0.000435
25%	0.029539
50%	0.061470
75%	0.100835
max	0.304327

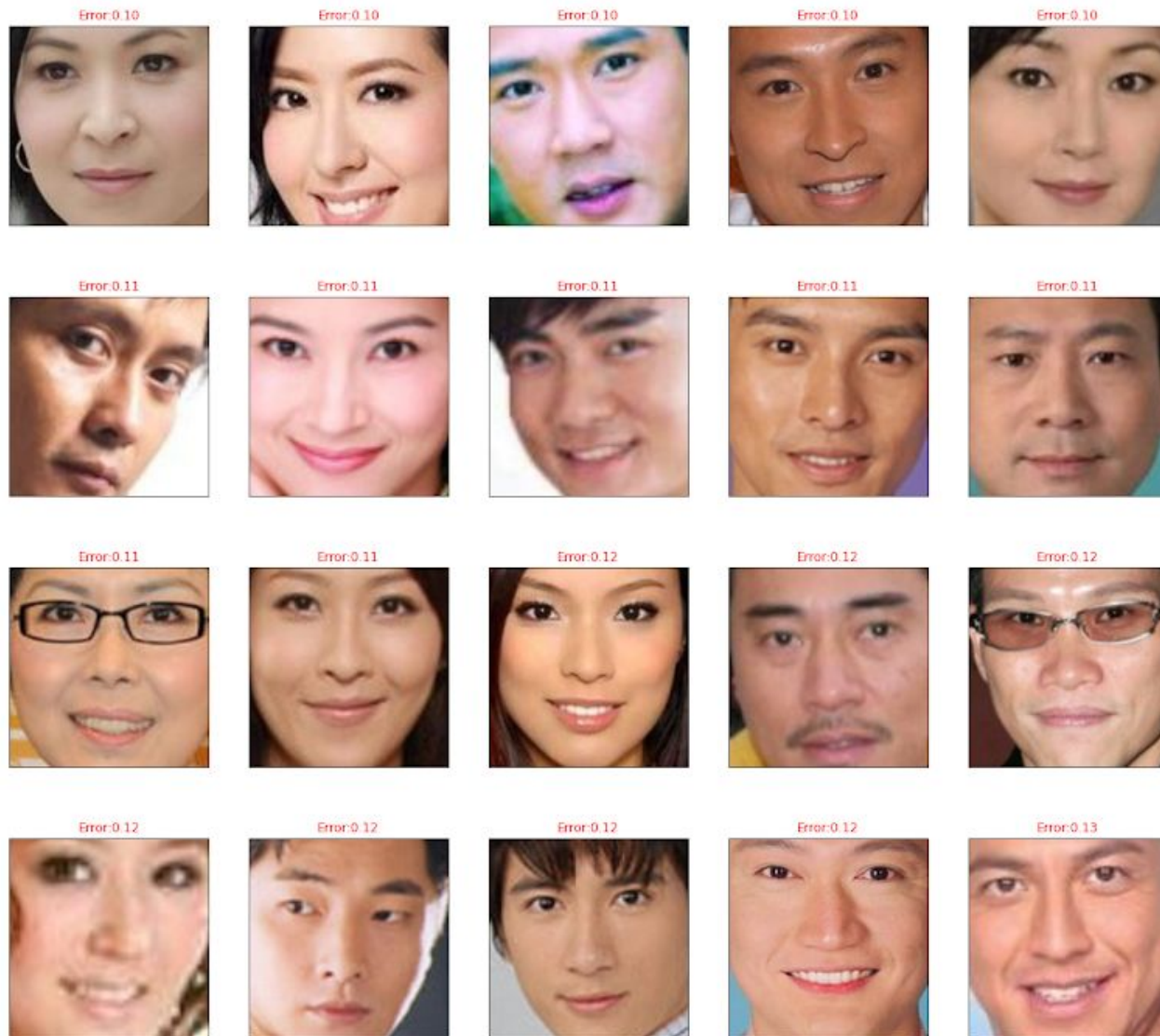


## Model after training on asian data

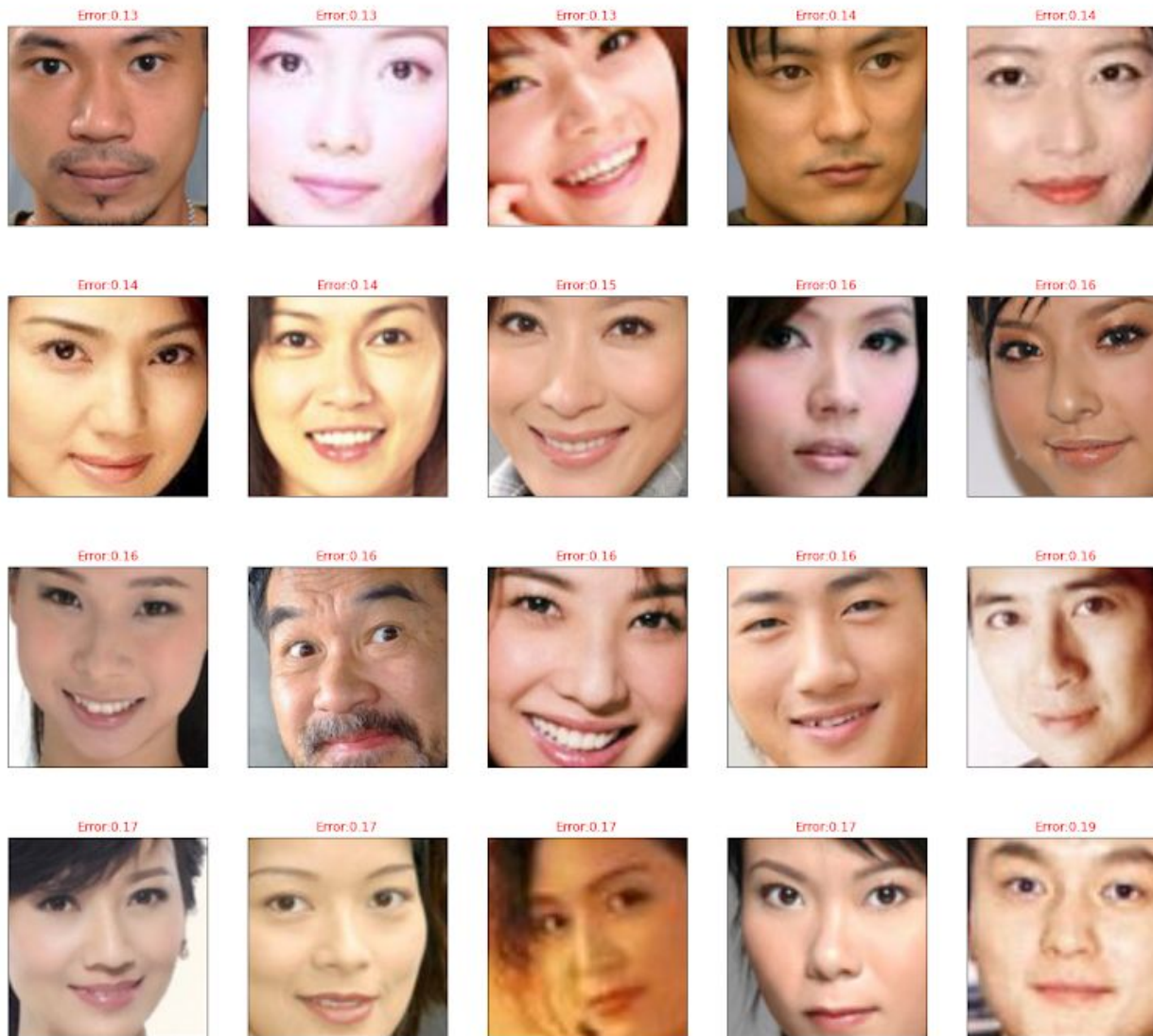
Testing loss with asia data is: 0.073 (Before training is 0.109)



# Test result for asian data - Biggest error



# Test result for asian data - Biggest error



# Test result for asian data - Biggest error

Error:0.19



Error:0.19



Error:0.19



Error:0.20



Error:0.20



Error:0.21



Error:0.22



Error:0.22



Error:0.24



Error:0.26



Error:0.30



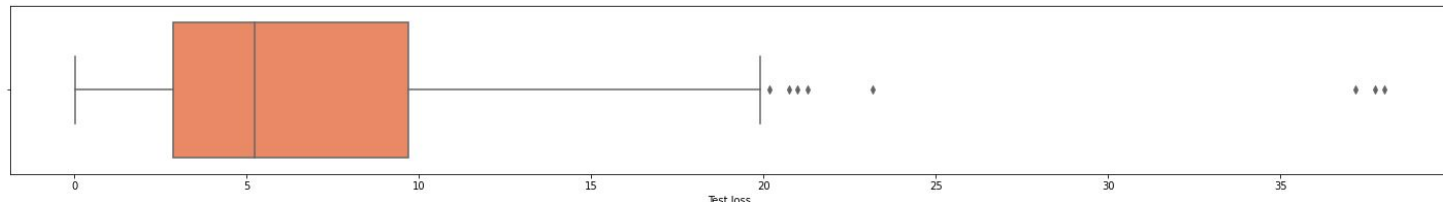
Error:0.30



Weight

# Analyze test result for asian data

count	208.000000
mean	7.205800
std	6.457775
min	0.040497
25%	2.868369
50%	5.244310
75%	9.708841
max	38.003124

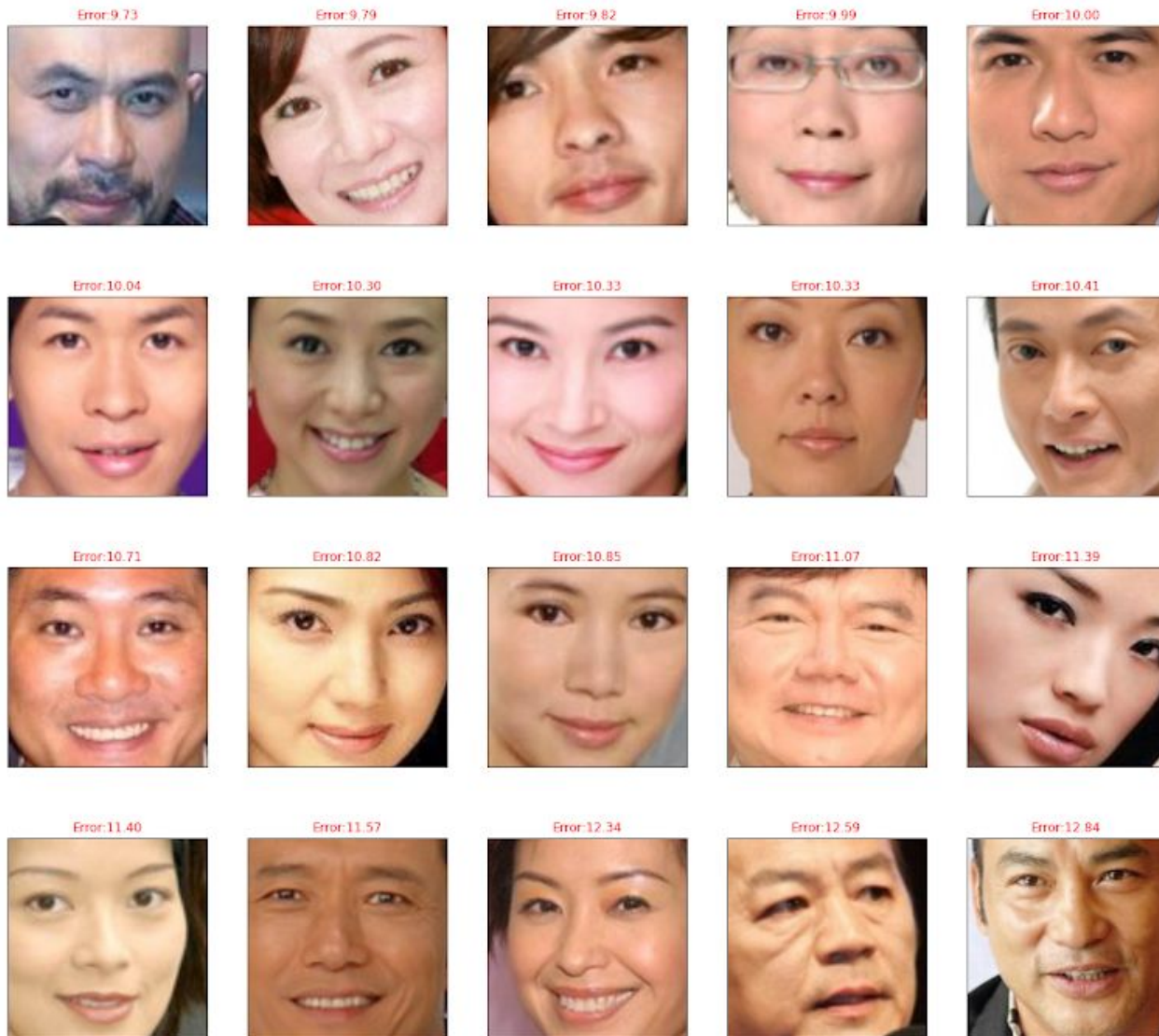


## Model after training on asian data

Testing loss with asia data is: 7.205 (Before training is 10.661)

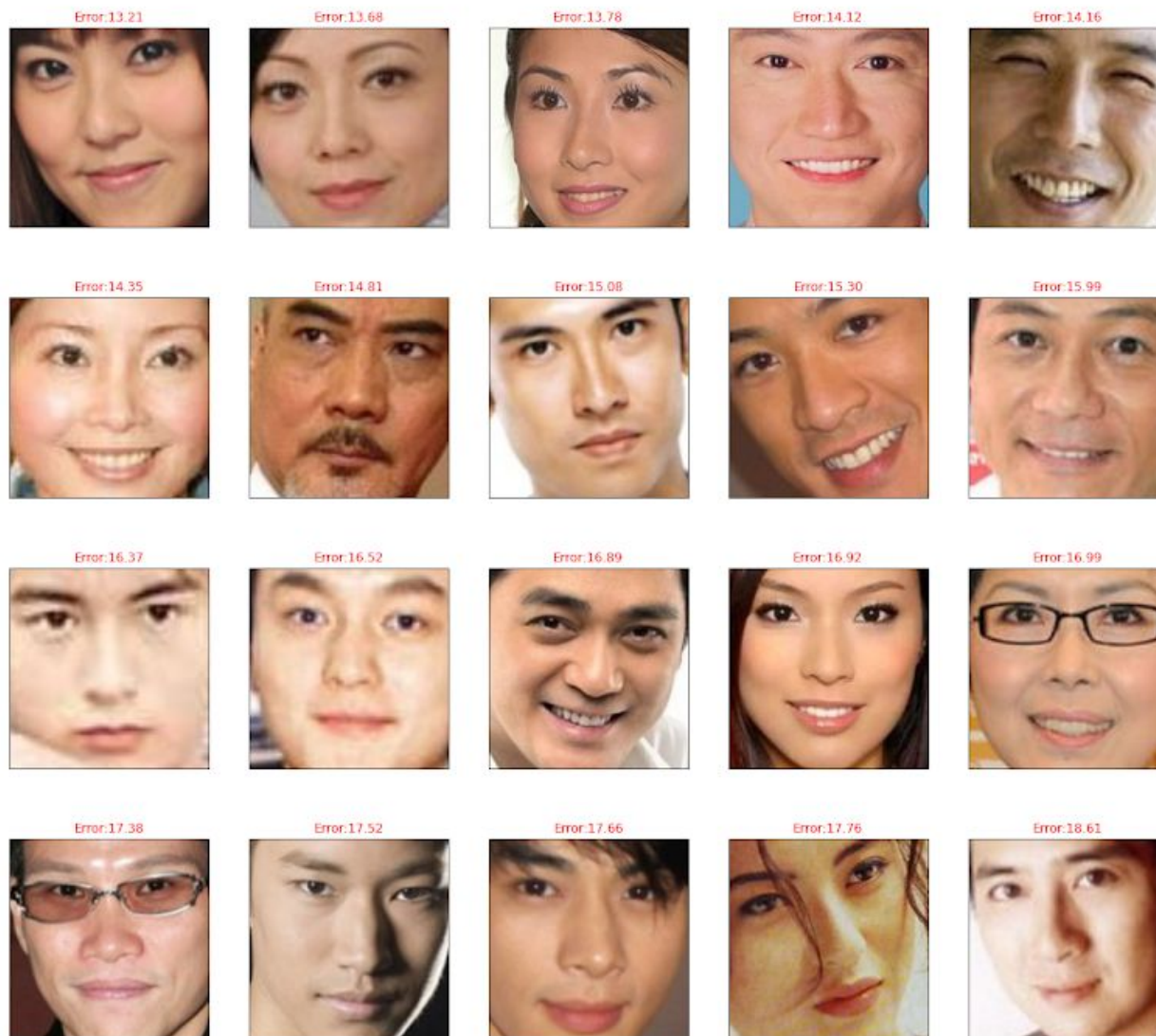


# Test result for asian data - Biggest error





# Test result for asian data - Biggest error



# Test result for asian data - Biggest error

Error:18.66



Error:19.30



Error:19.86



Error:19.89



Error:20.16



Error:20.74



Error:20.99



Error:21.29



Error:23.16



Error:37.17



Error:37.73



Error:38.00



# Analyze test result for western data - Biggest error

Reasons for error:

1. Bad image: not complete face, losing some parts of face, wearing glasses
2. Bad data:
  - a. Image and values are not taken at the same time
  - b. Incorrect data
  - c. Bad data distribution: artist data often have values in good range e.g BMI in [20,25]

**Main reason: bad data**

# Improving Methods

Focus on 3 main methods to reduce error of model

## 1. Training data

- a. More data at ~ 4000 or more
- b. More accurate data: images, weight, height must be taken at the same time
- c. More data for thin, fat people

## 2. Network

- a. ResNext network

## 3. Optimizer

- a. Adam
- b. AdamW

## 4. Loss function