# 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

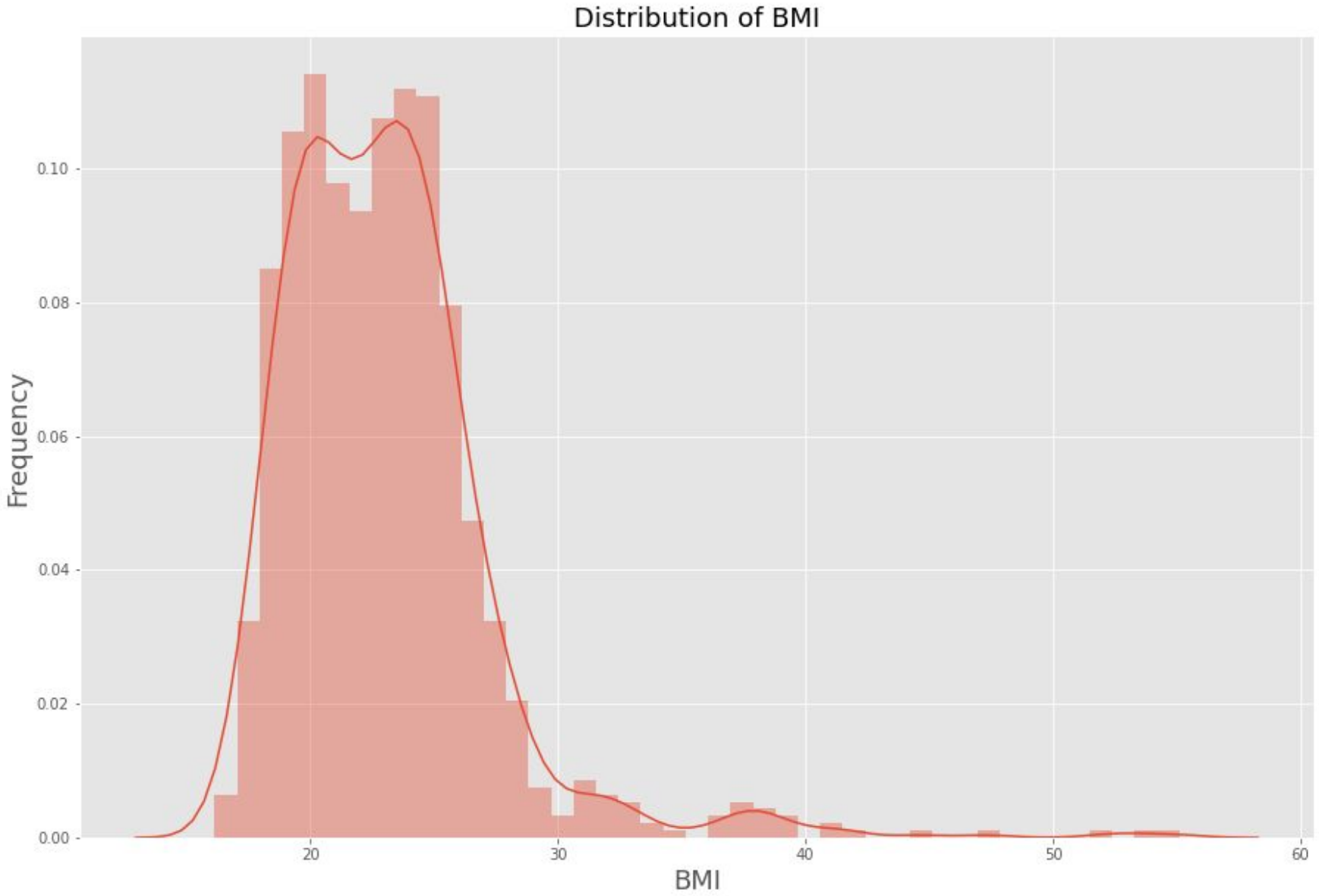
# Train model for BMI, Weight, Height

Sample training: epochs = 500

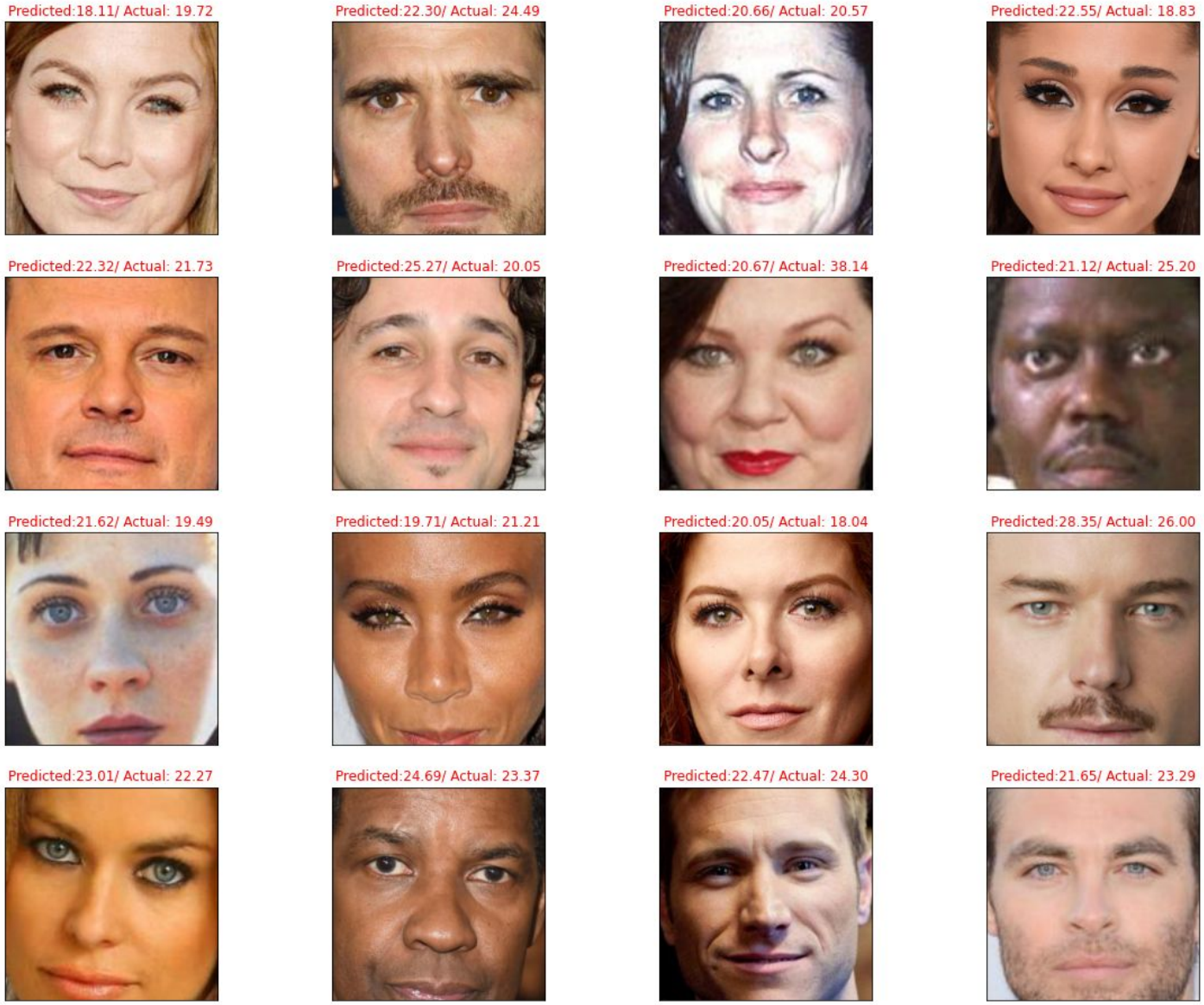
Cross Validation train: 20 times, each with 500 epochs

Final train: epochs = 5000

# Cross validation train for BMI



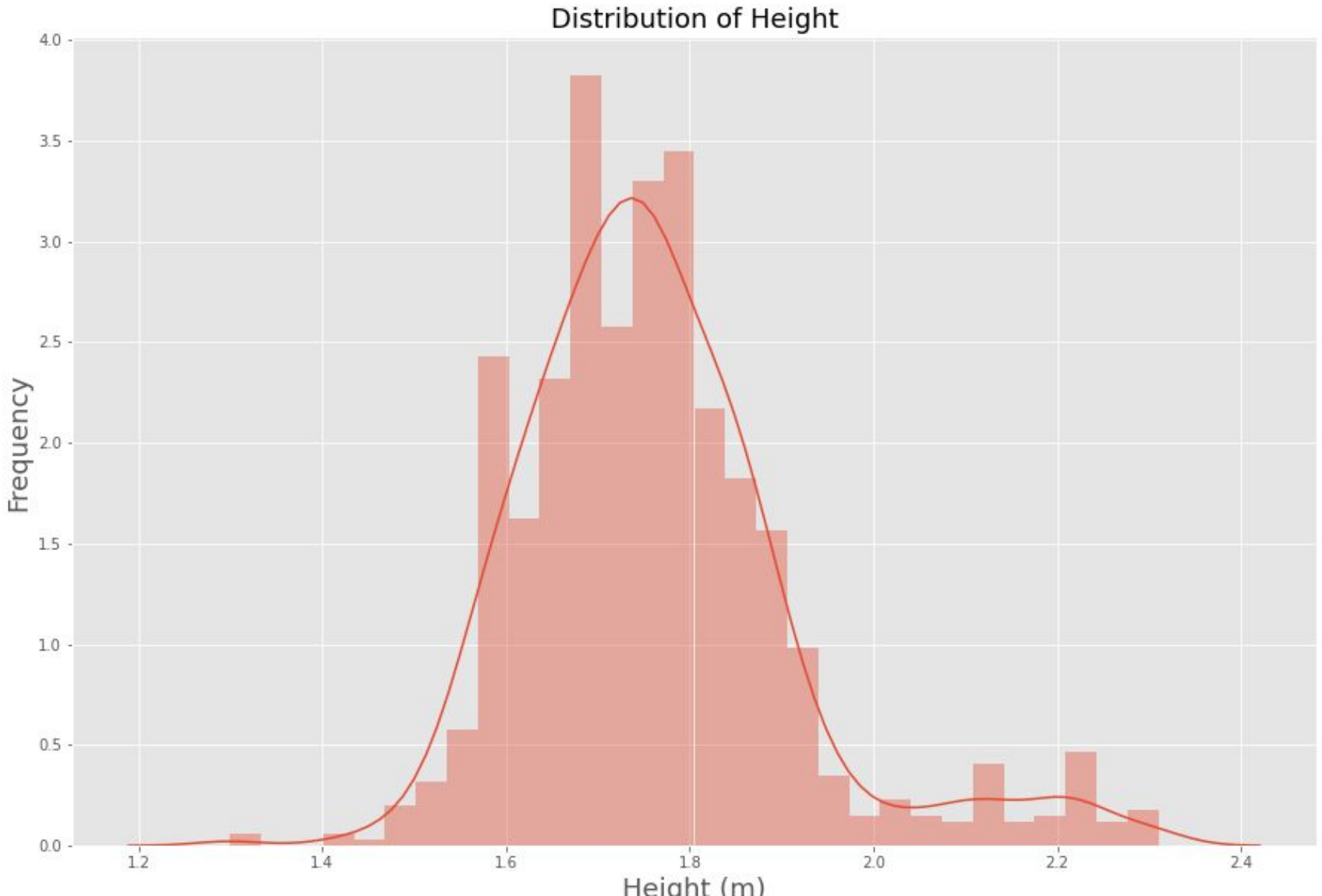
# Prediction for BMI - Sample



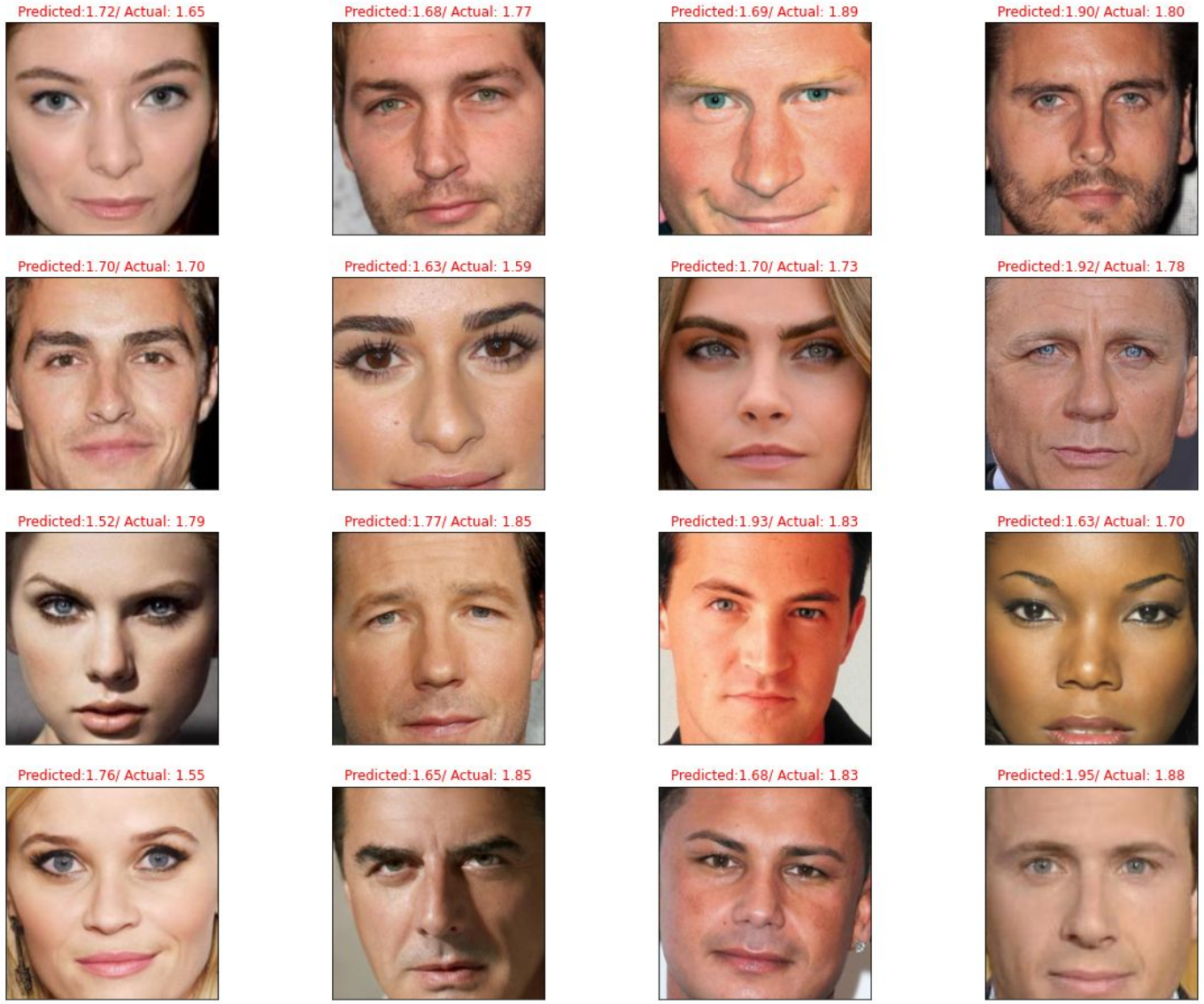
# Testing result distribution for cross validation on BMI

Still training

# Cross validation train for Height



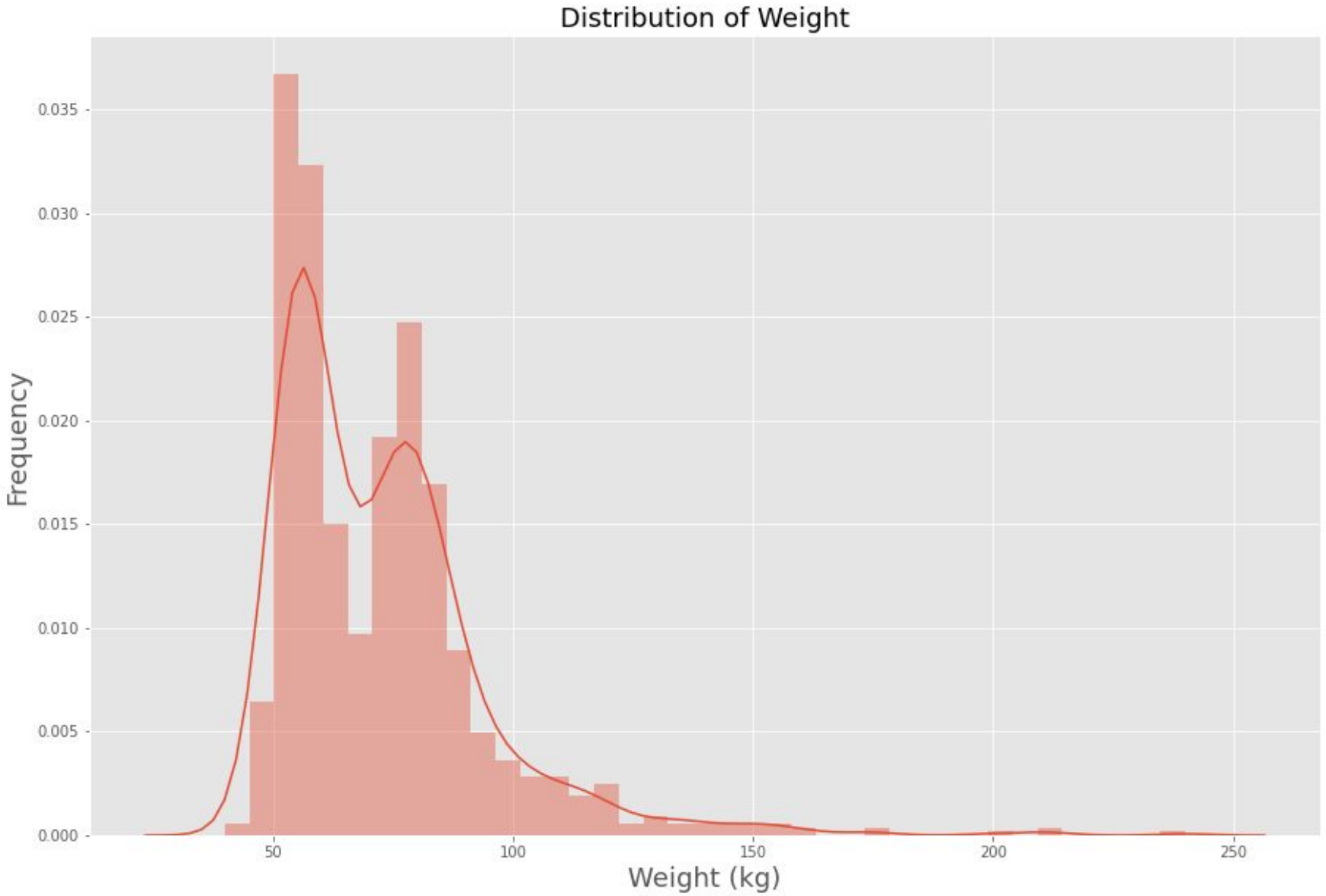
# Prediction for Height - Sample



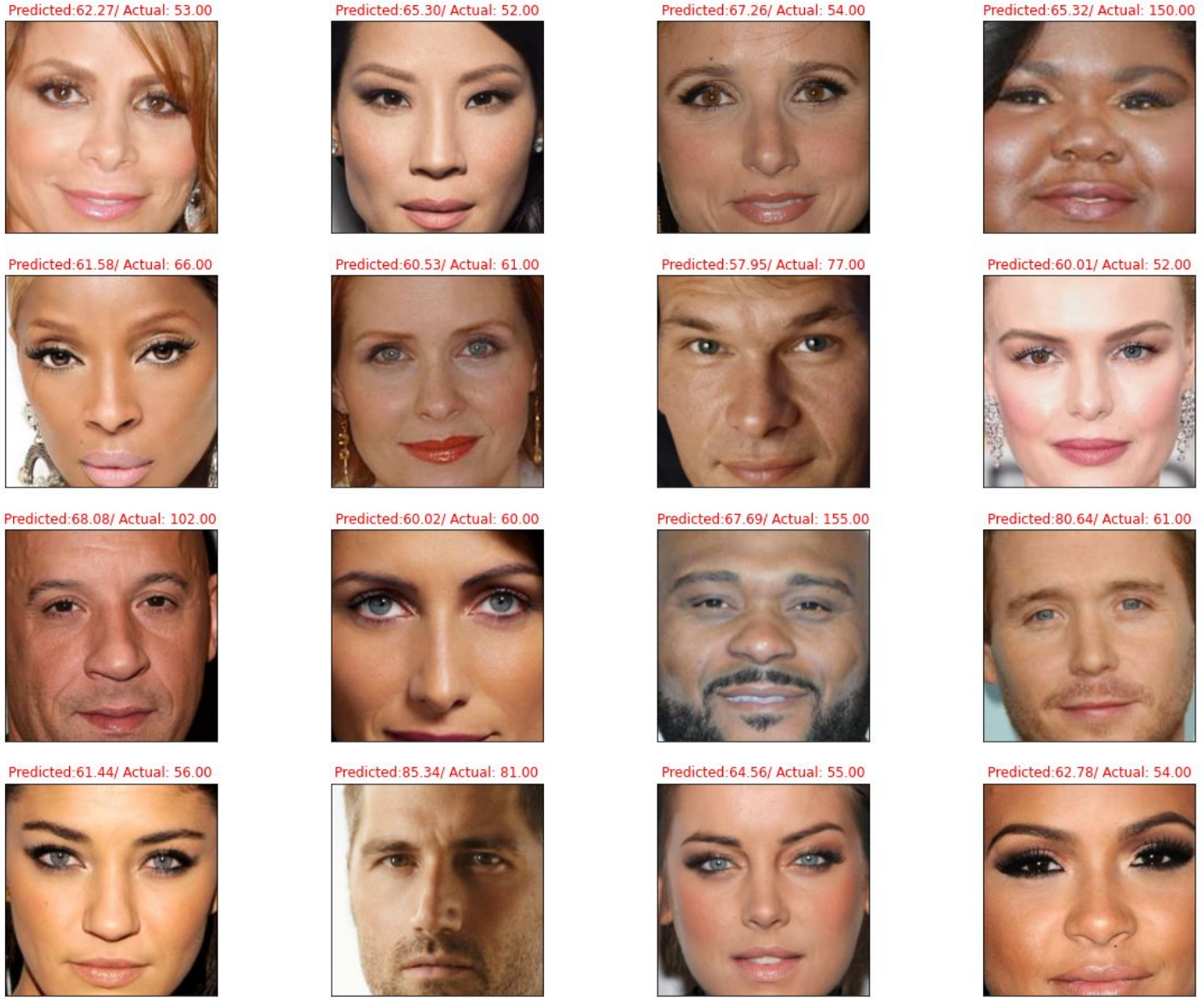
# Testing result distribution for cross validation on Height

Still training

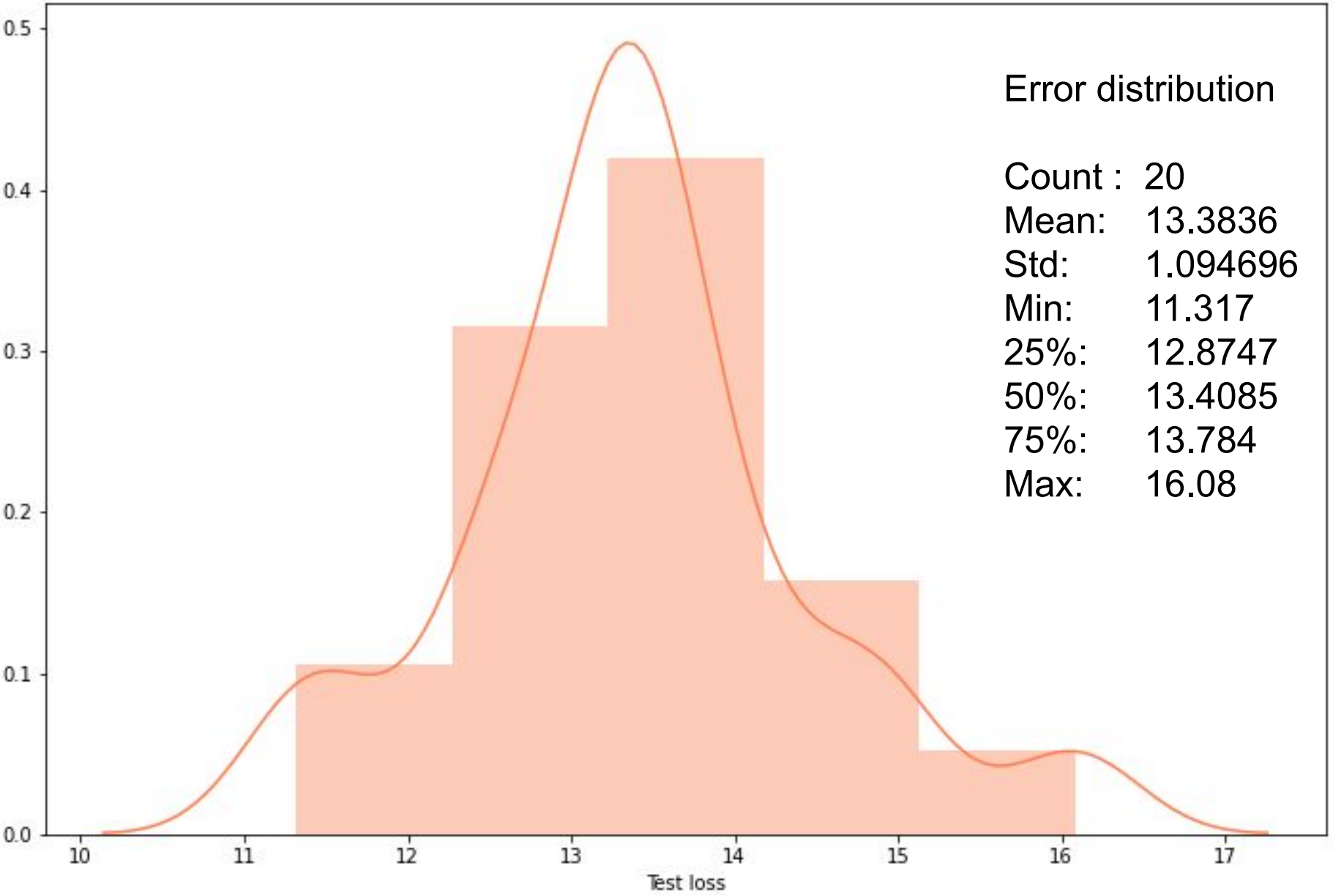
# Cross validation train Weight



# Prediction for Weight - Sample



# Testing error distribution for cross validation on Weight



# Fixing crop face function

New crop no margin/ Average Error: 3.170

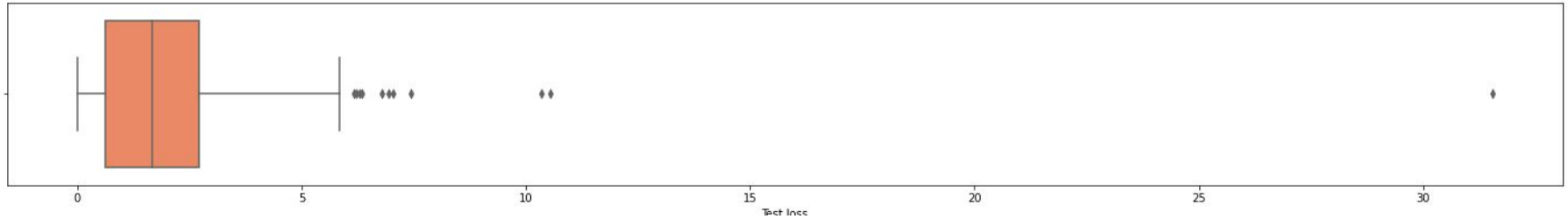
Old crop with 10% margin/ Average Error: 3.273

# Analyze test result of original model

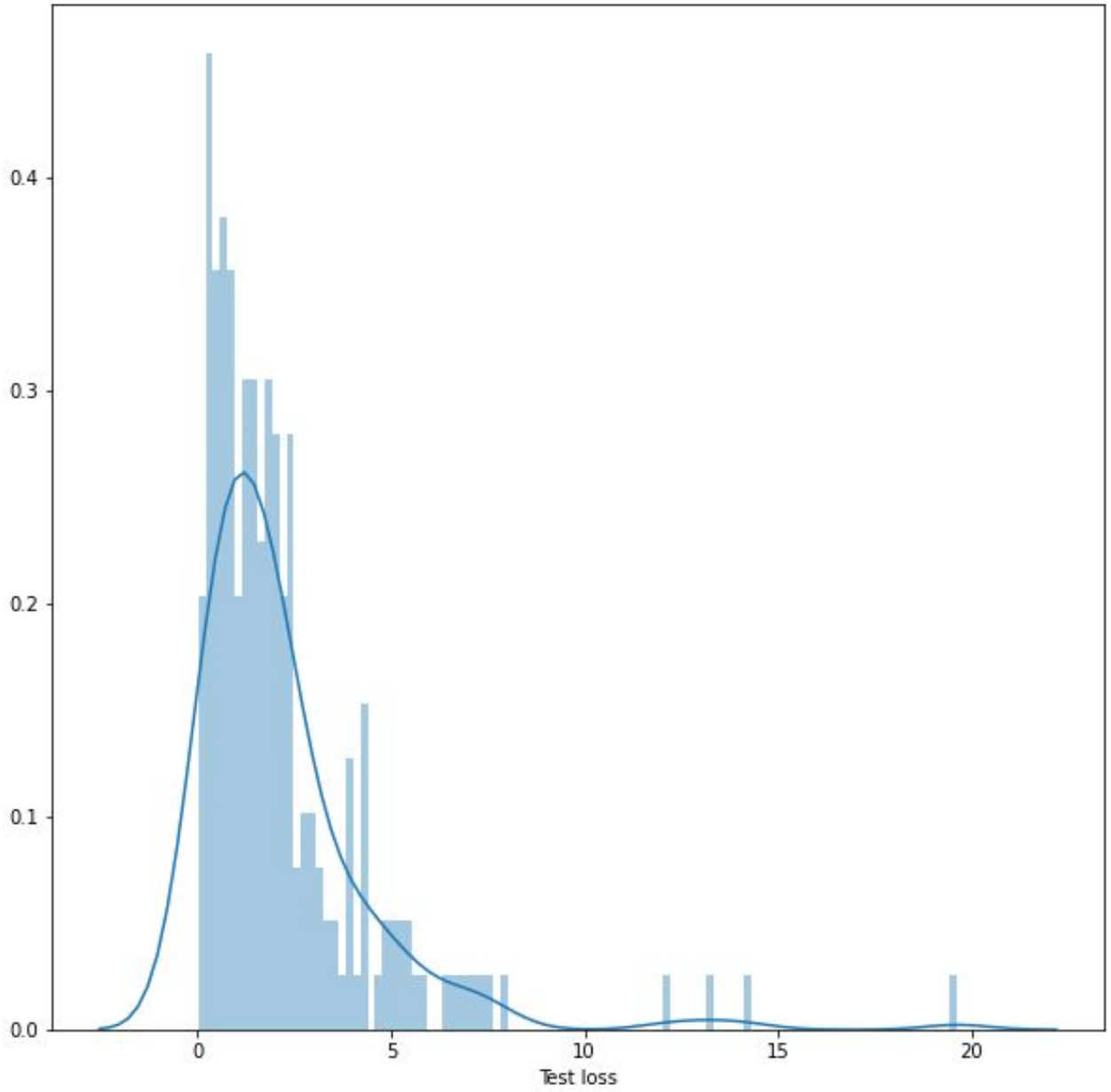
# BMI
# Analyze test result for western data

# 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 |



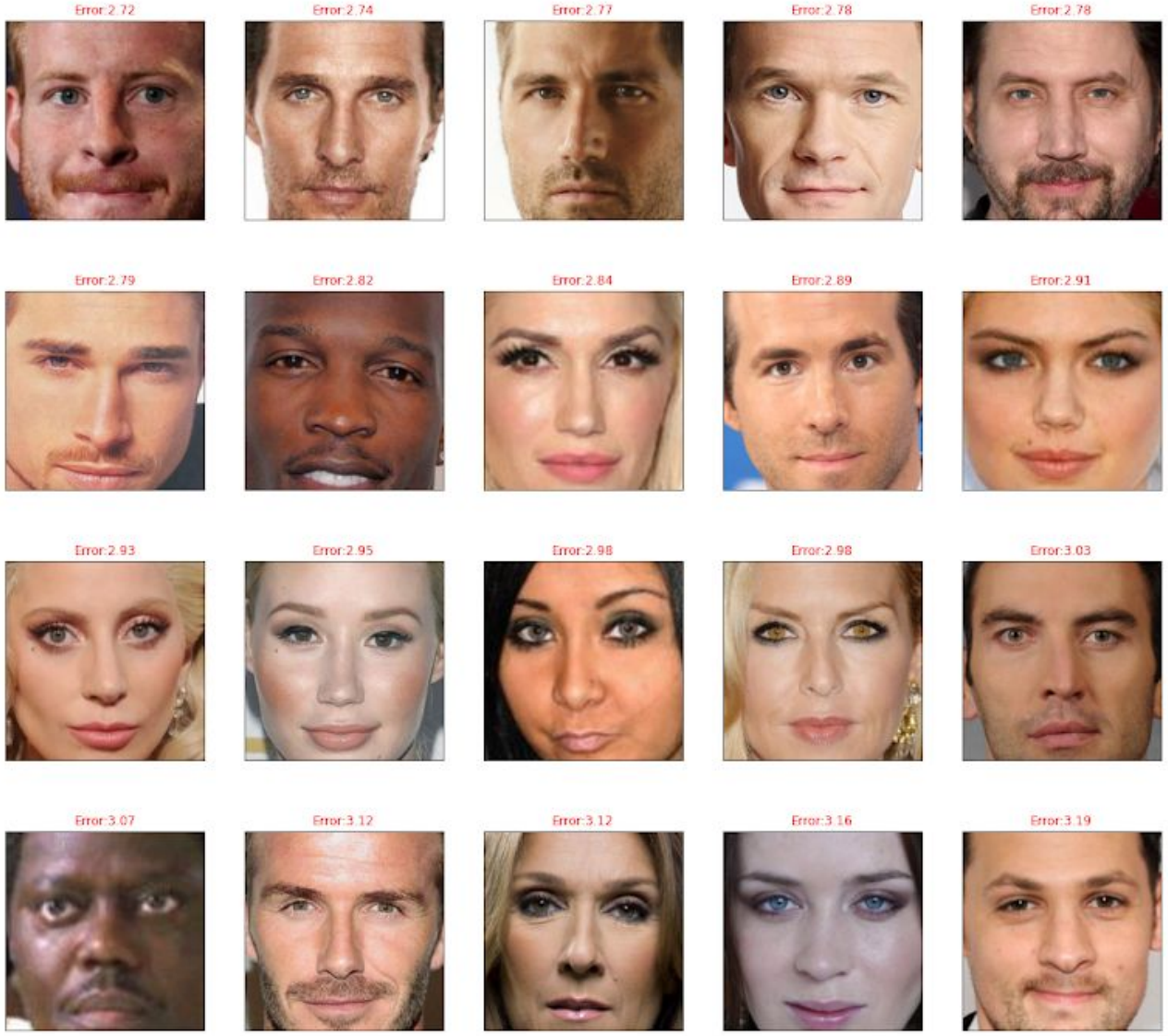
# Analyze test result for western data



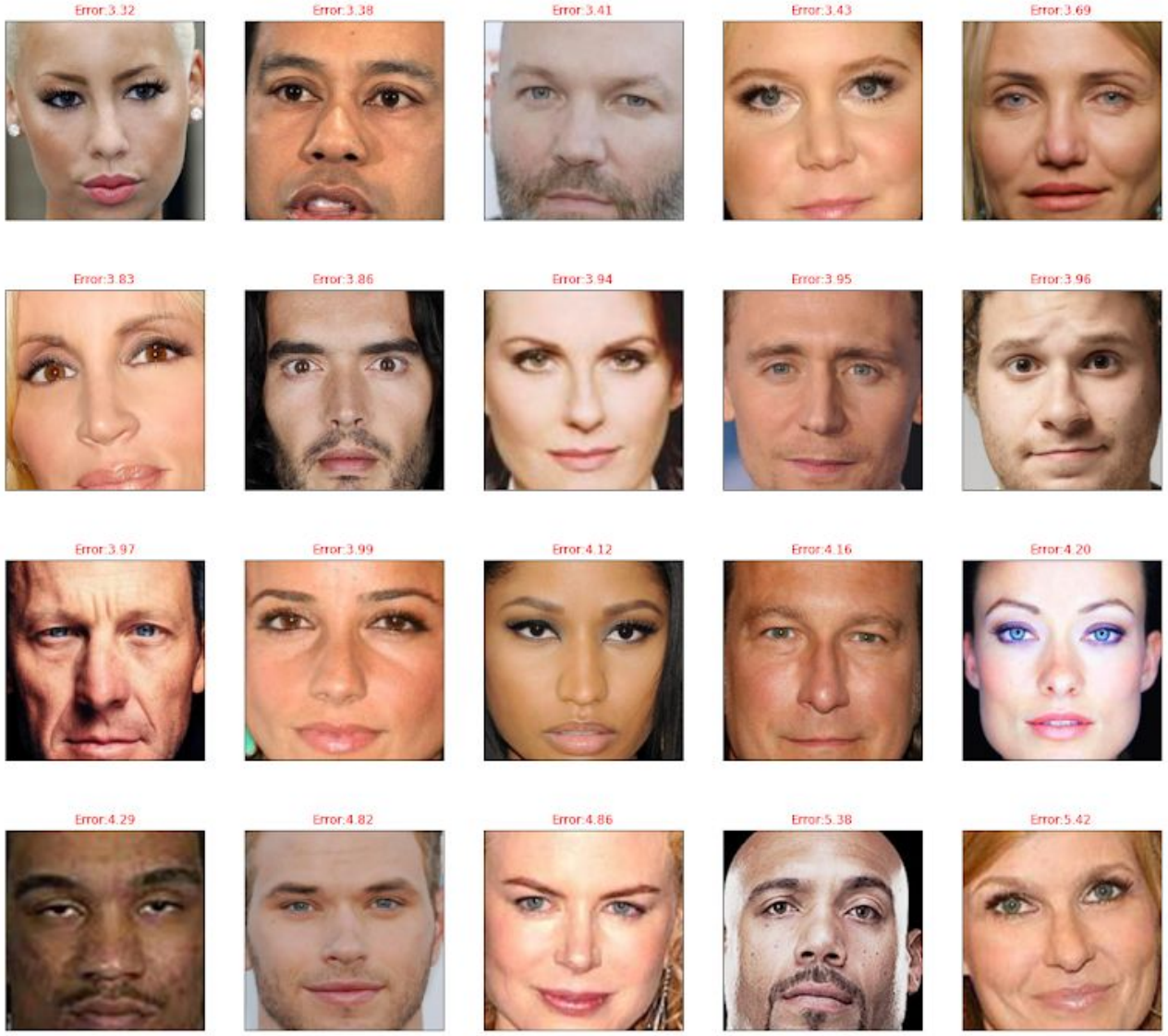

Error distribution

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

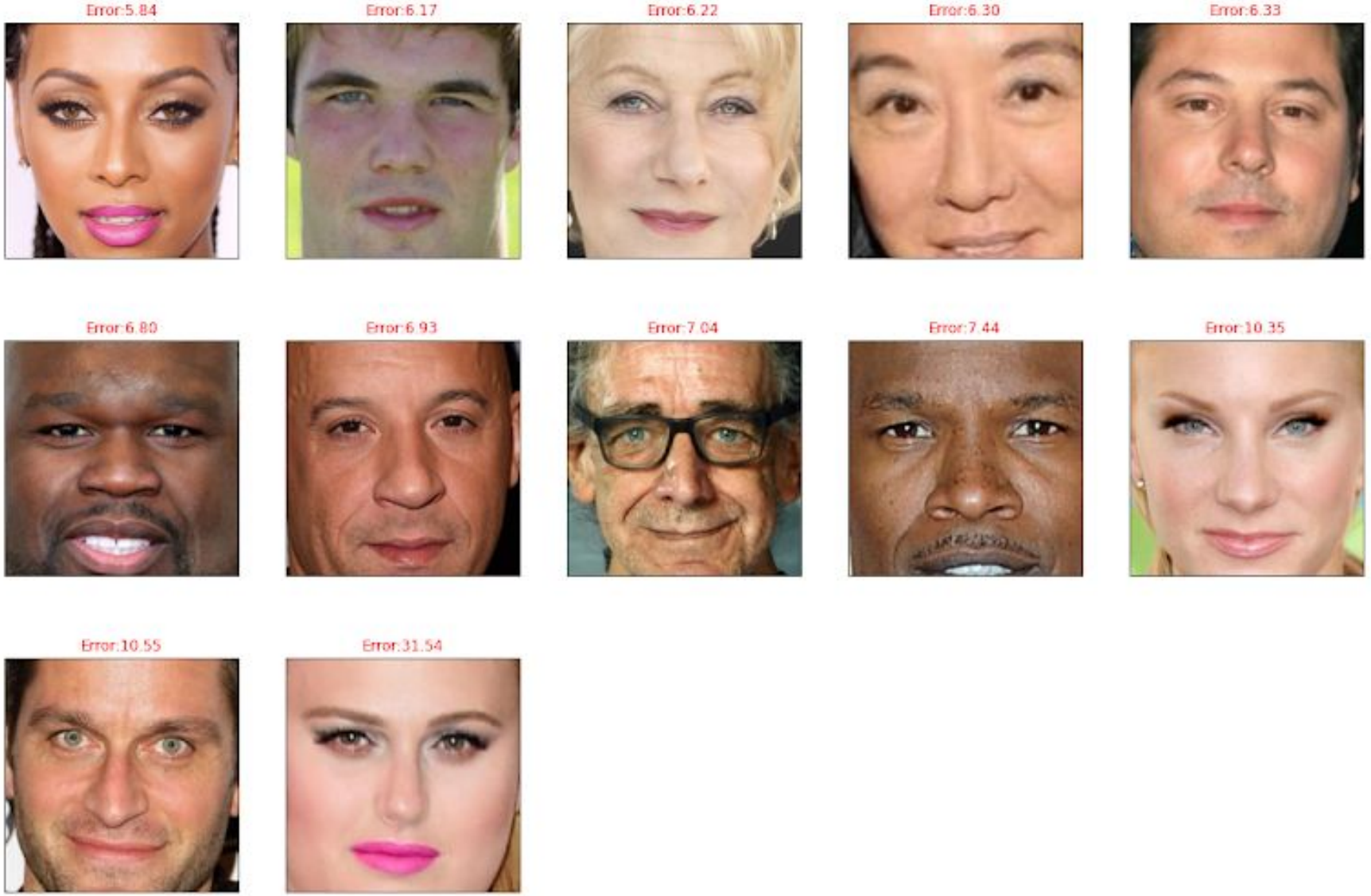
# Test result for western data - Biggest error (>=2.72)



# Test result for western data - Biggest error (>=2.72)



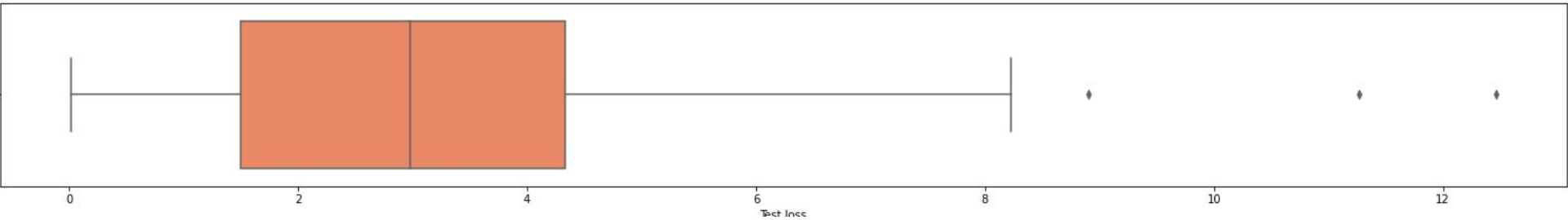
# Test result for western data - Biggest error (>=2.72)



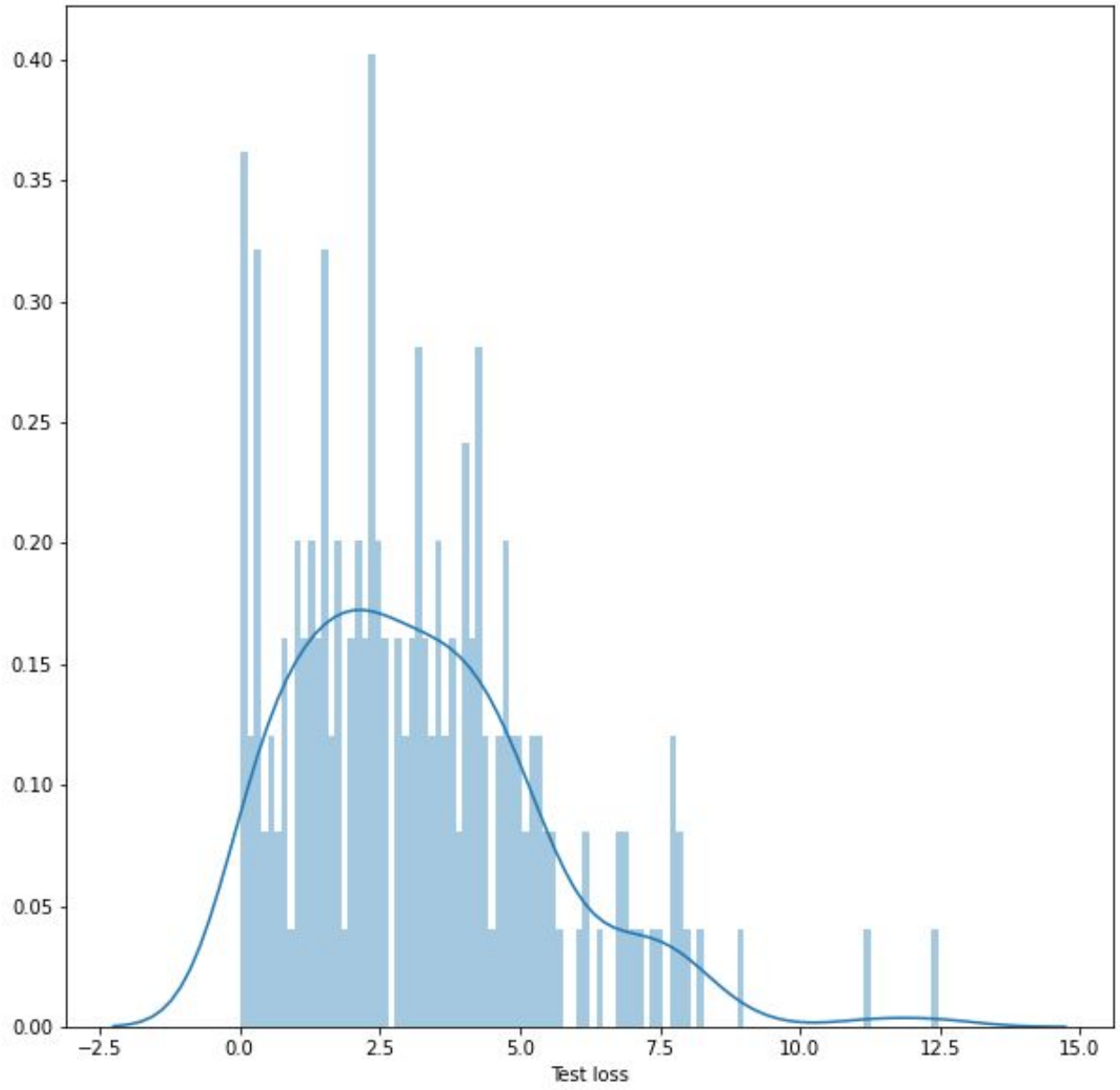
# BMI
# Analyze test result for Asian data

# 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 |



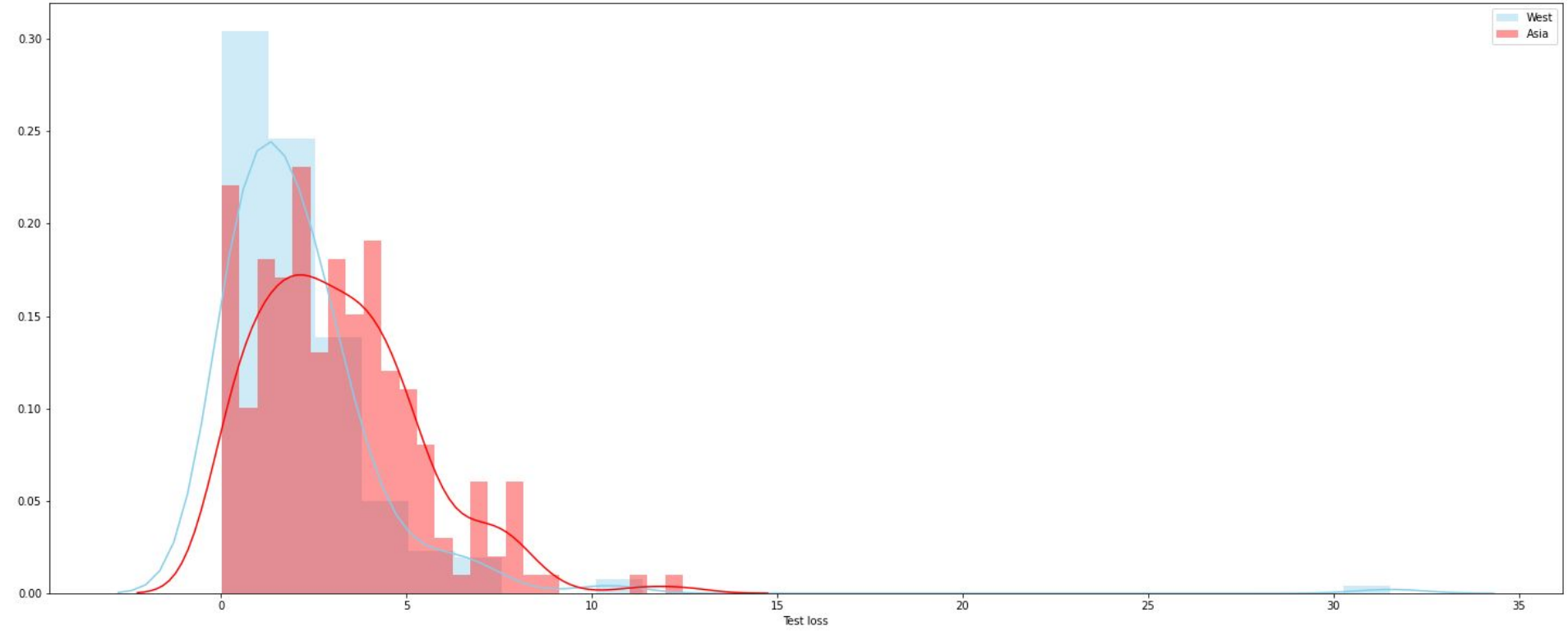
# Analyze test result for asian data



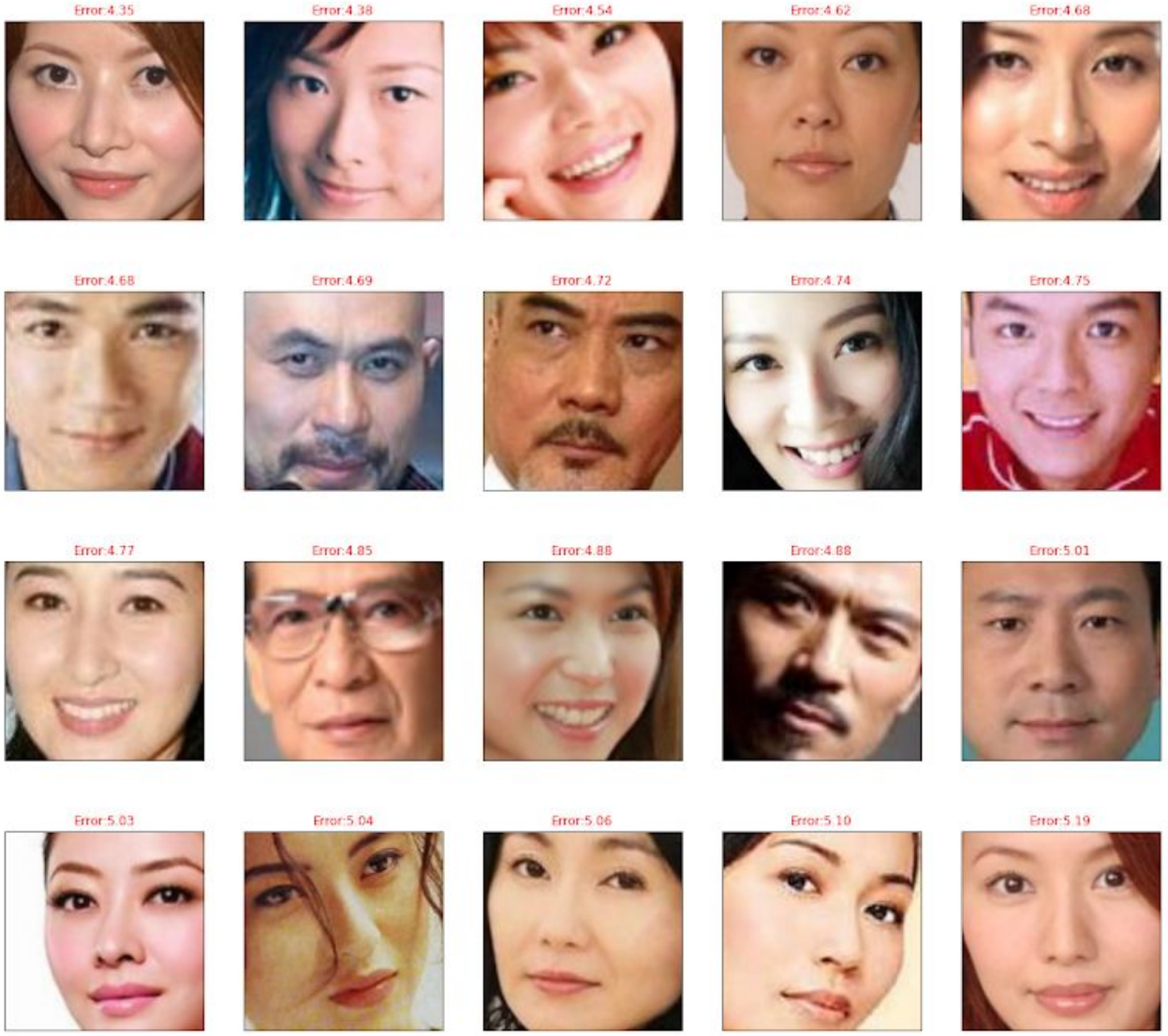

Error distribution

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

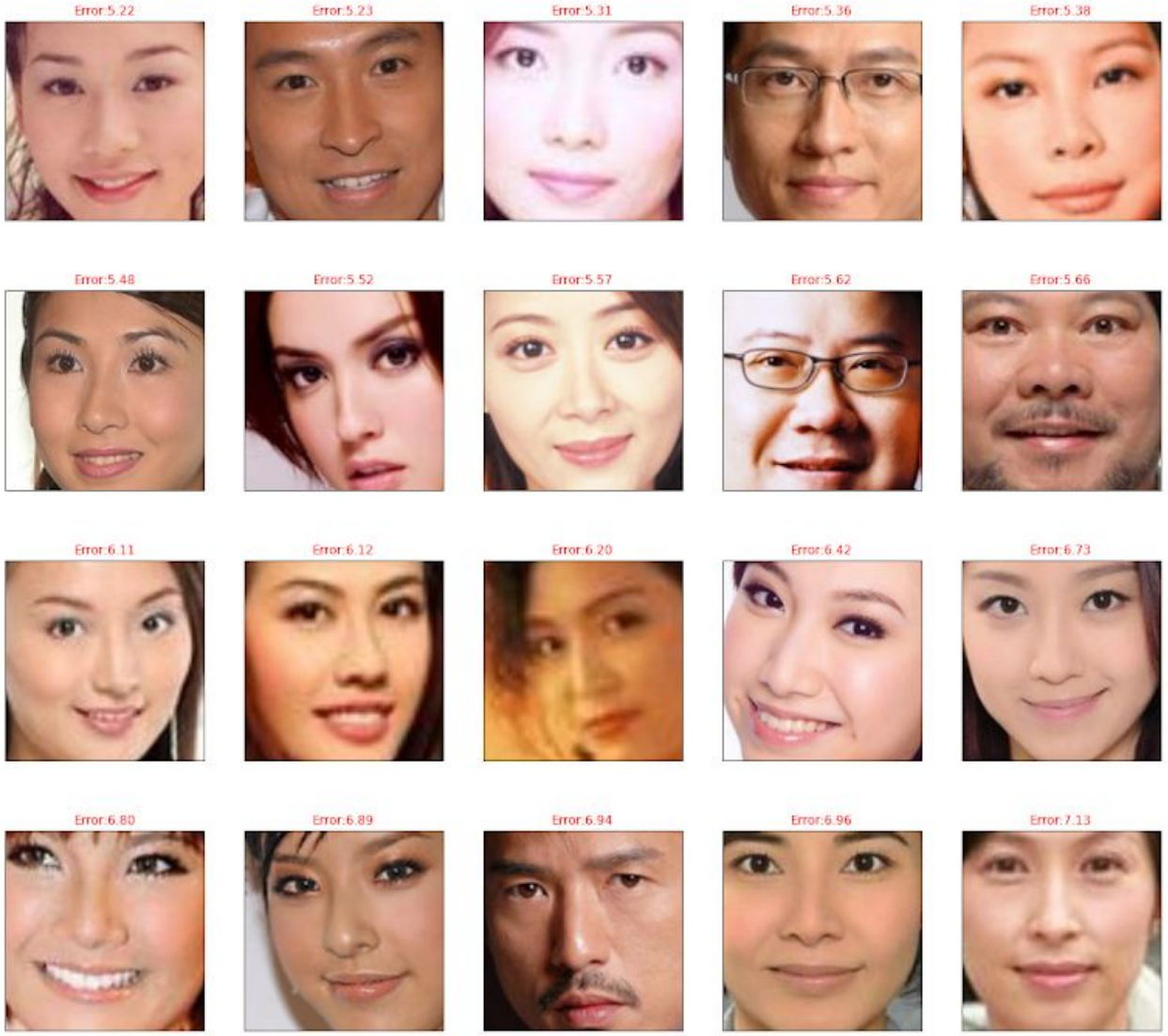
# BMI error distribution West vs Asia



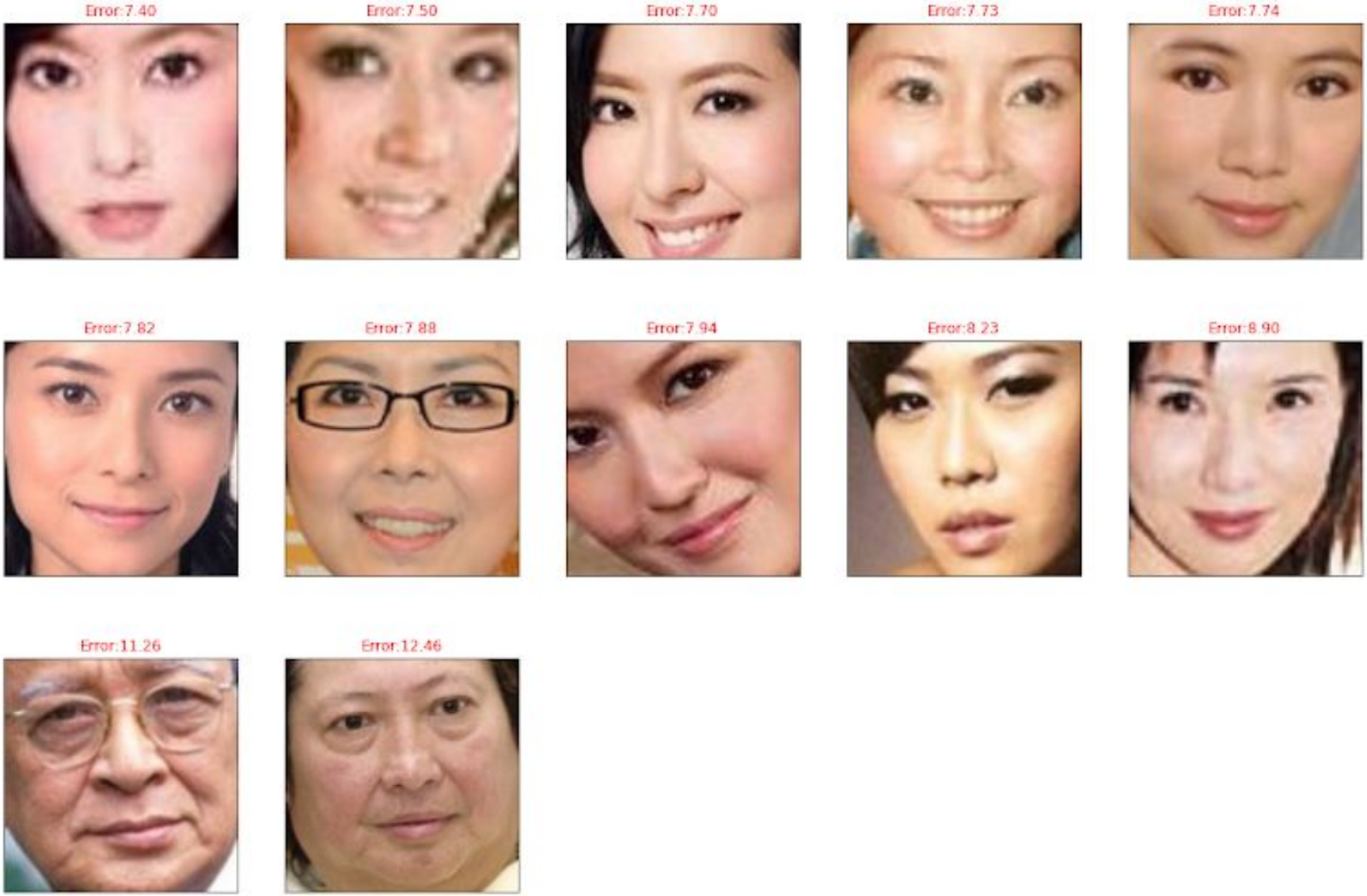
# Test result for asian data - Biggest error (>=4.33)



# Test result for asian data - Biggest error (>=4.33)



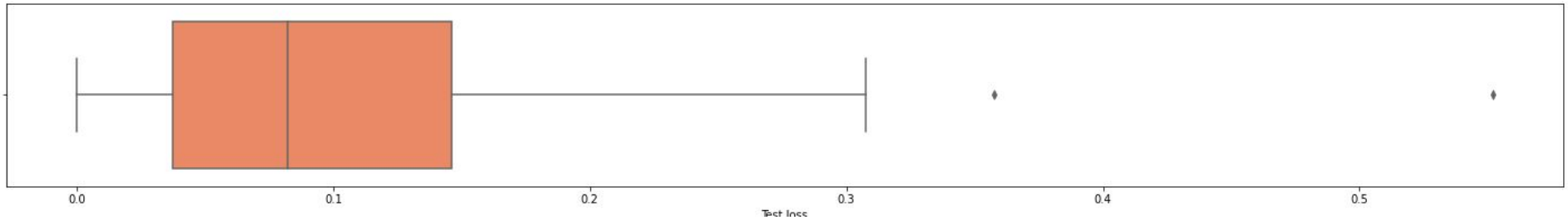
# Test result for asian data - Biggest error (>=4.33)



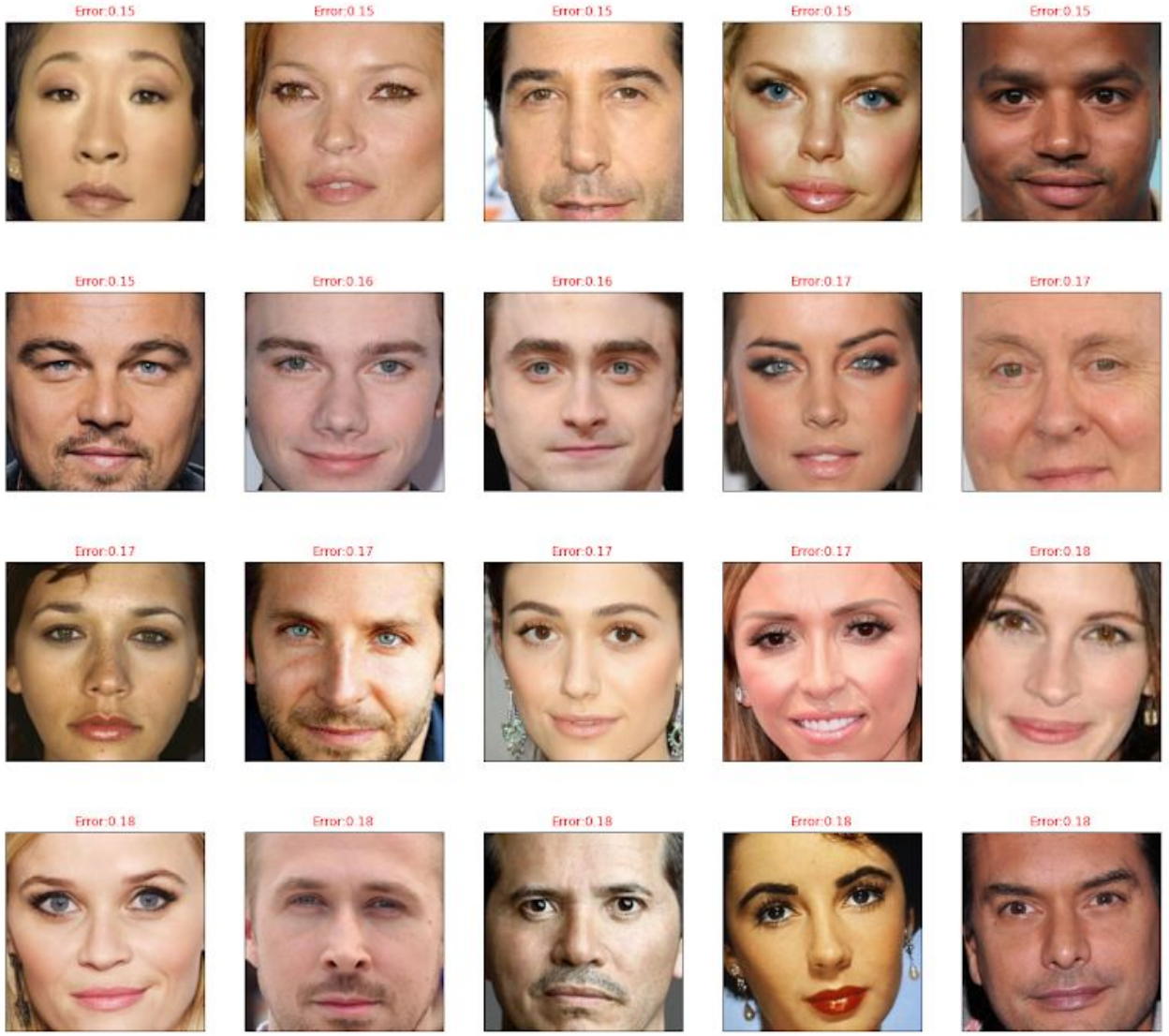
# Height
# Analyze test result for western data

# Analyze Height test result for western data

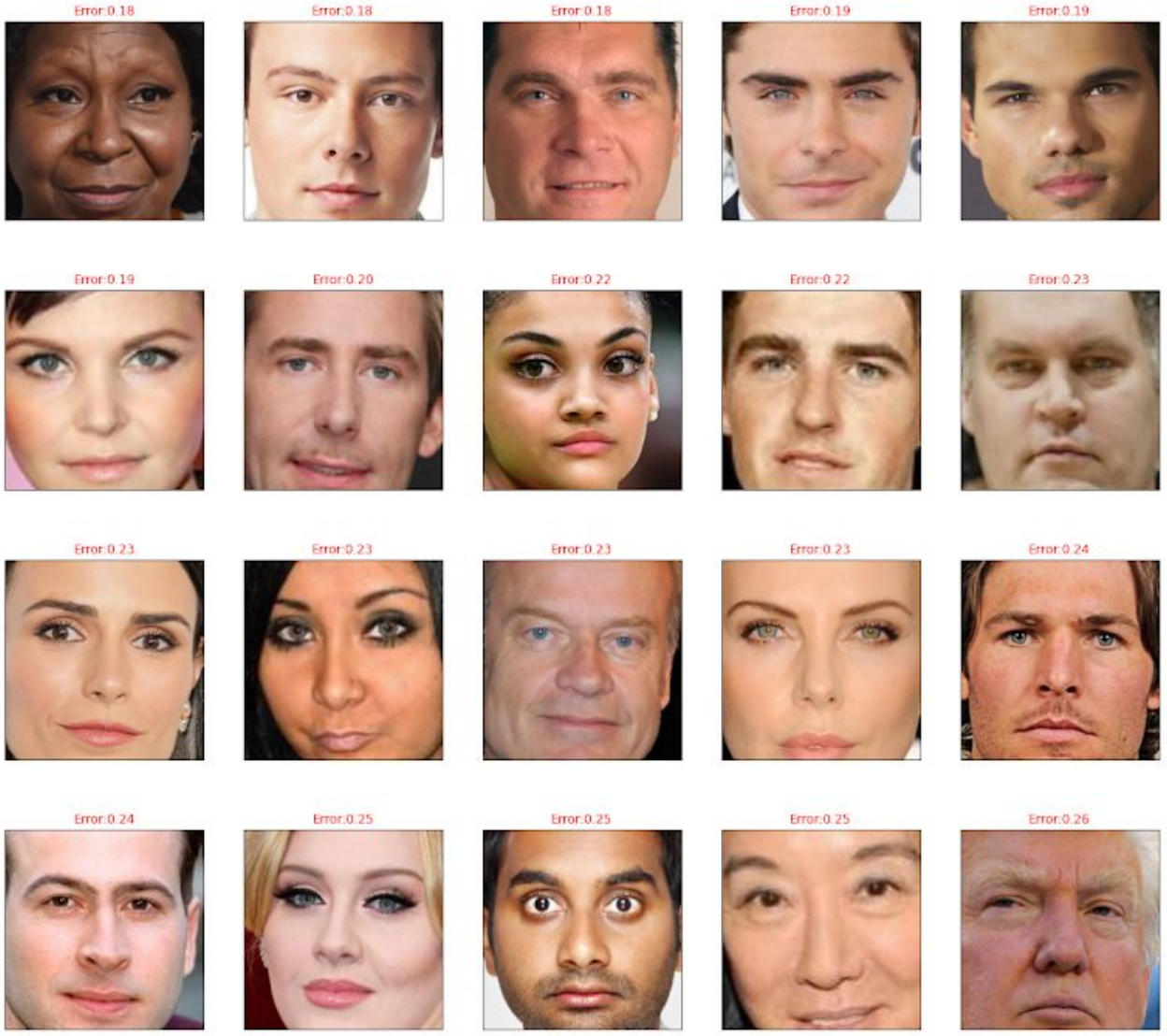
| | |
|---|---|
| Count : | 206 |
| Mean: | 0.101752 |
| Std: | 0.084011 |
| Min: | 0.000150 |
| 25%: | 0.037468 |
| 50%: | 0.082075 |
| 75%: | 0.145986 |
| Max: | 0.551839 |



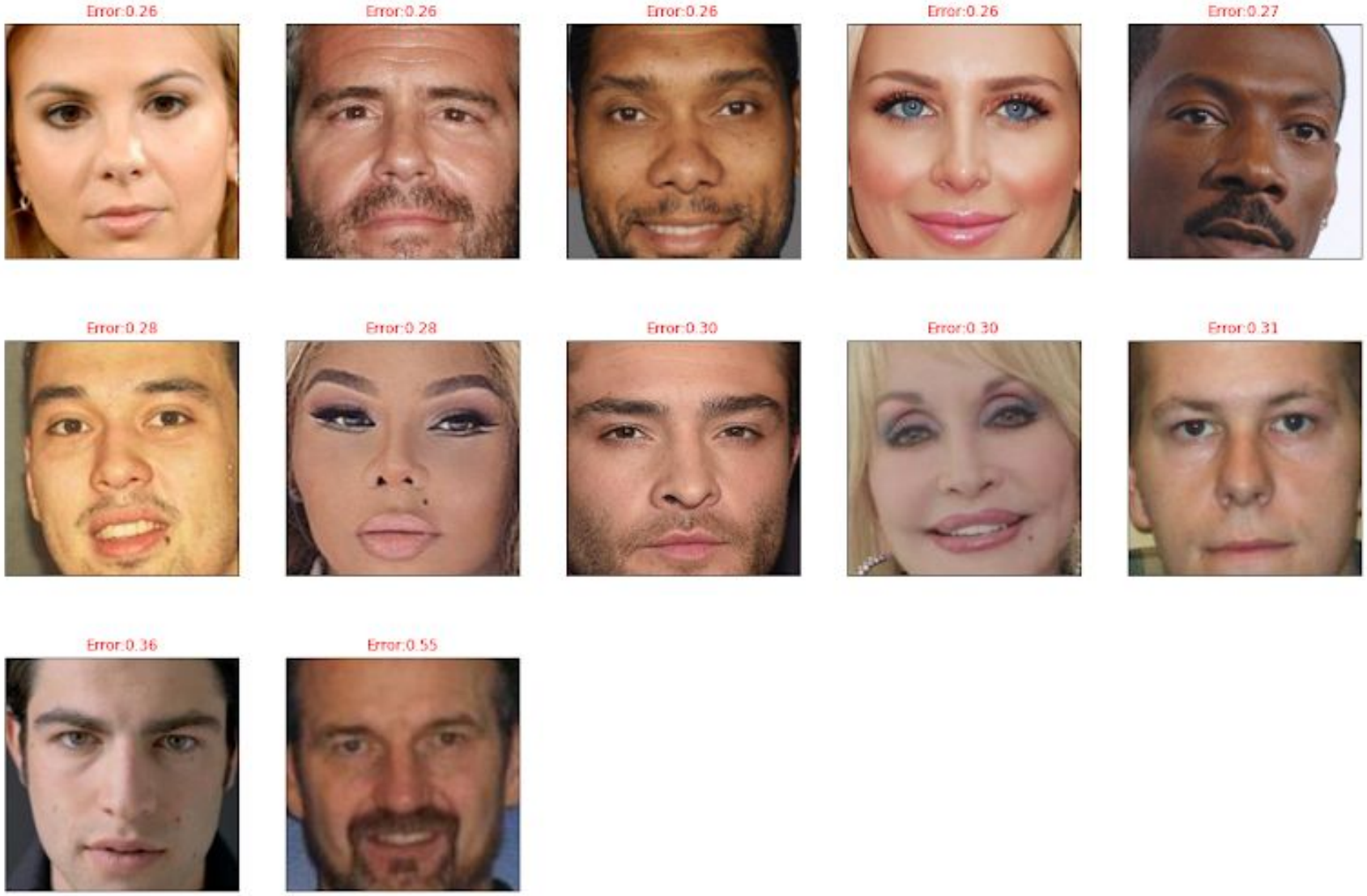
# Test result for western data - Biggest error (>=0.145)



# Test result for western data - Biggest error (>=0.145)



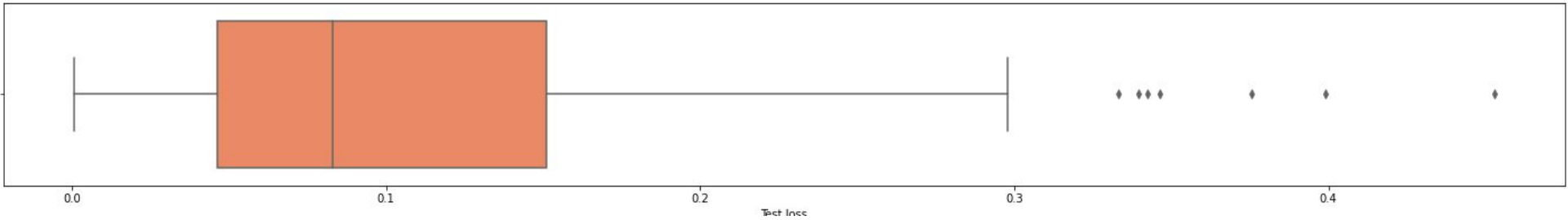
# Test result for western data - Biggest error (>=0.145)



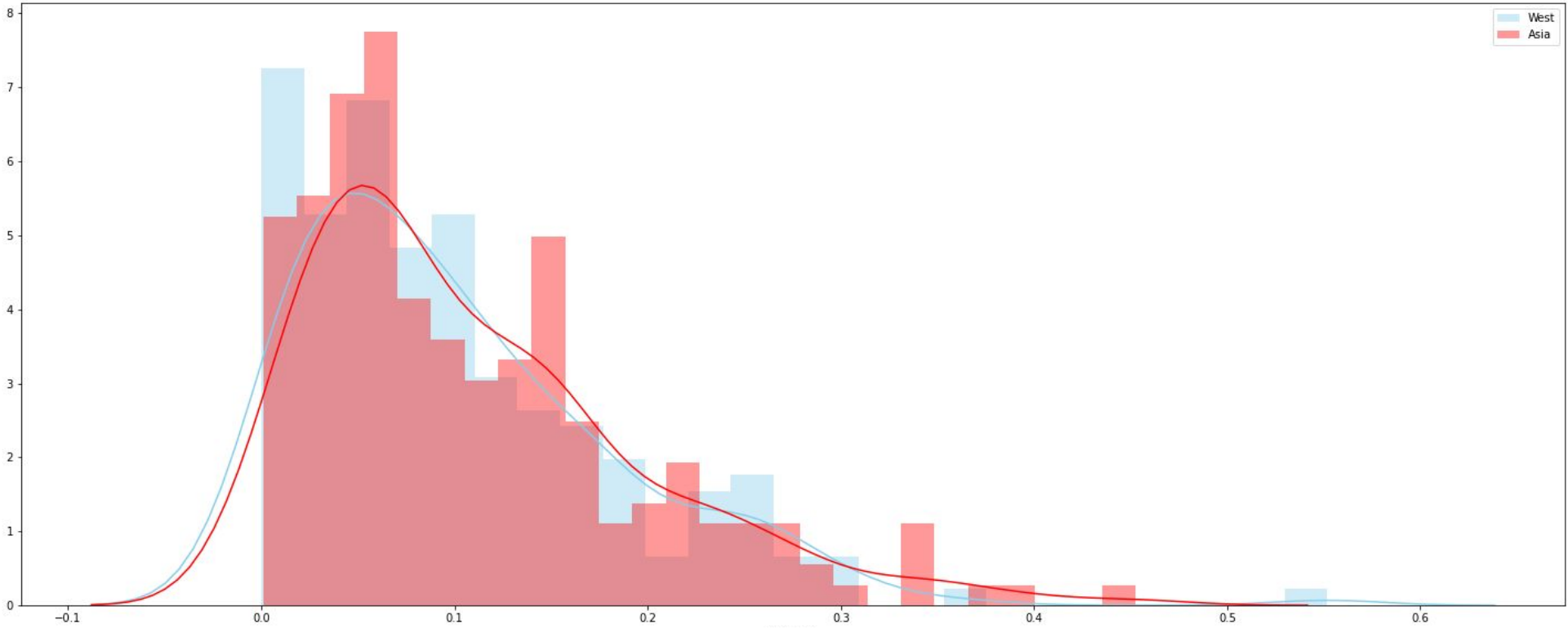
# Height
# Analyze test result for Asian data

# Analyze test result for asian data

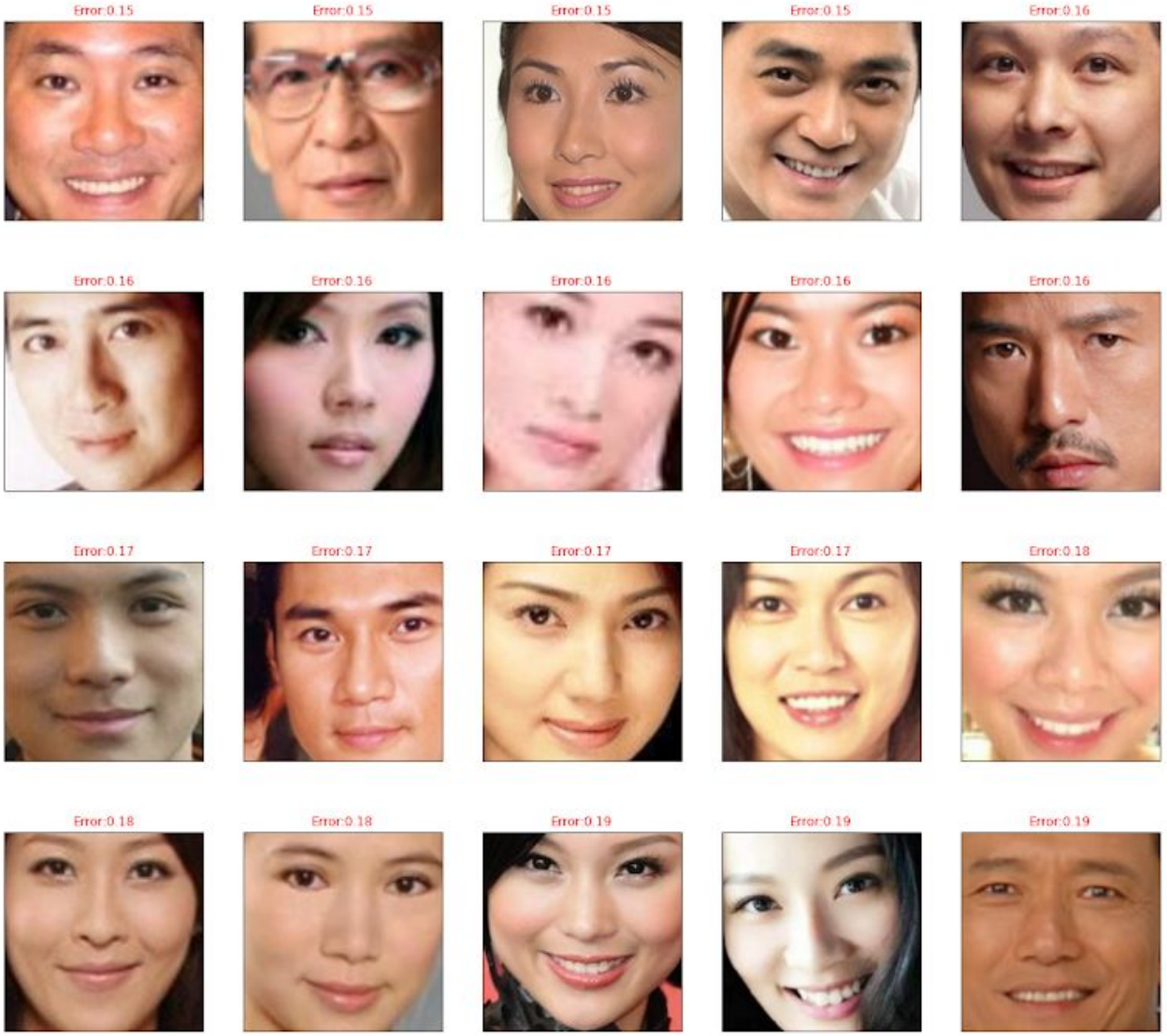
| | |
|---|---|
| Count : | 208 |
| Mean: | 0.109418 |
| Std: | 0.086420 |
| Min: | 0.000916 |
| 25%: | 0.046195 |
| 50%: | 0.083020 |
| 75%: | 0.150958 |
| Max: | 0.452671 |



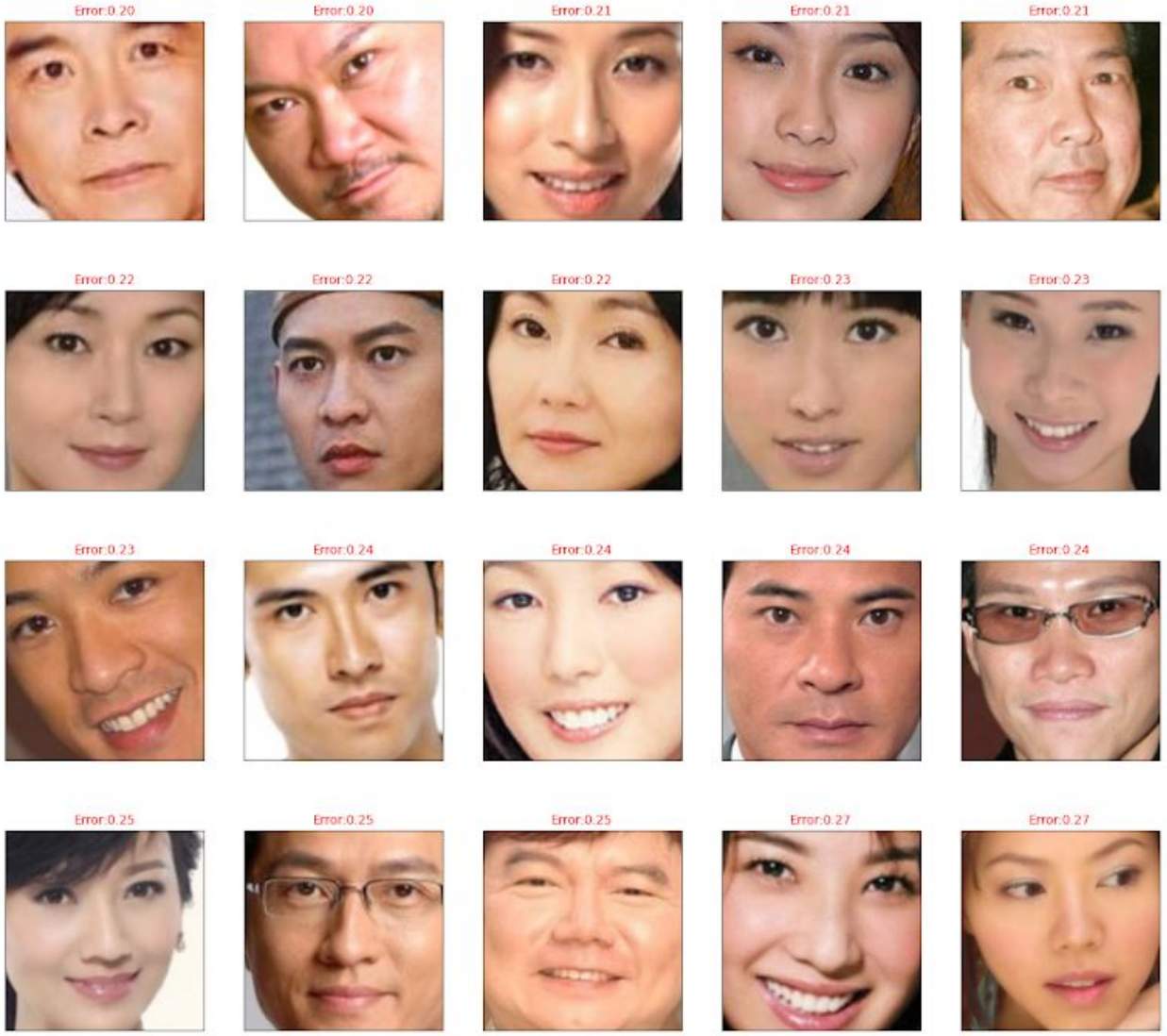
# Height error distribution West vs Asia



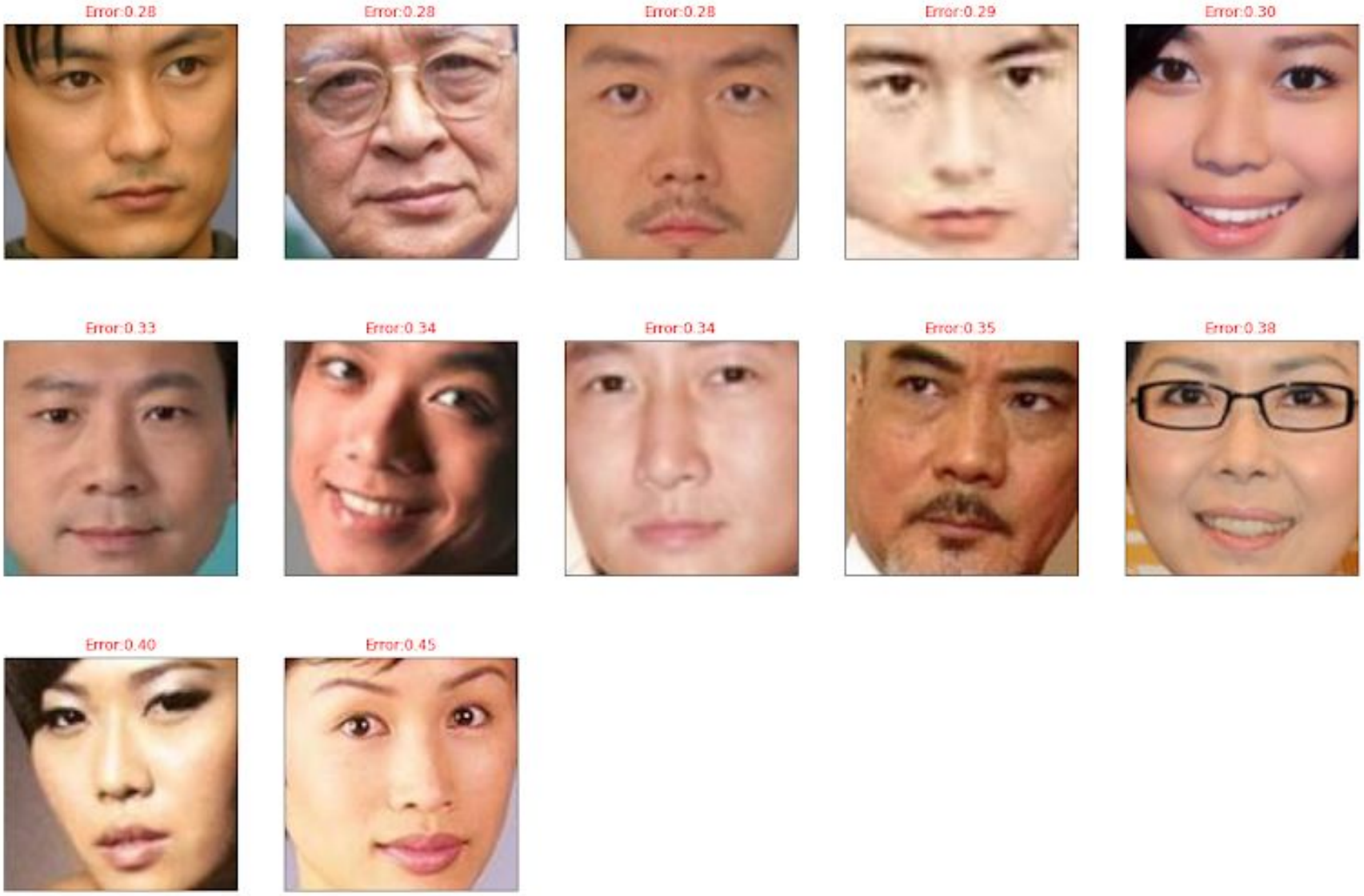
# Test result for asian data - Biggest error (>=0.15)



# Test result for asian data - Biggest error (>=0.15)



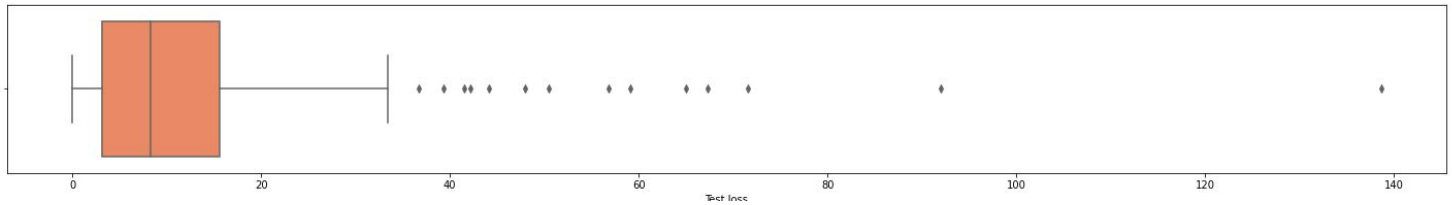
# Test result for asian data - Biggest error (>=0.15)



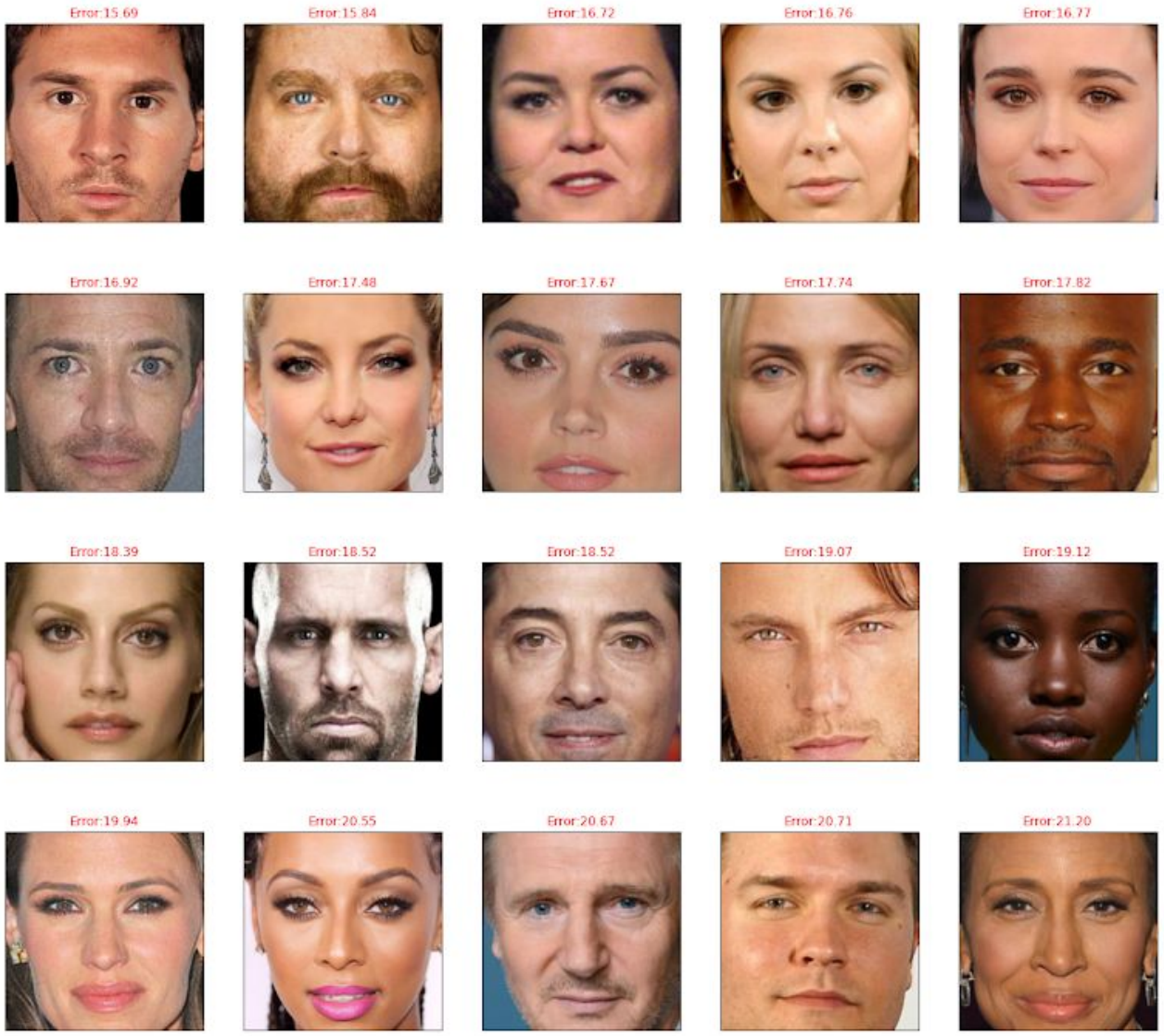
# Weight
# Analyze test result for western data

# Analyze Weight test result for western data

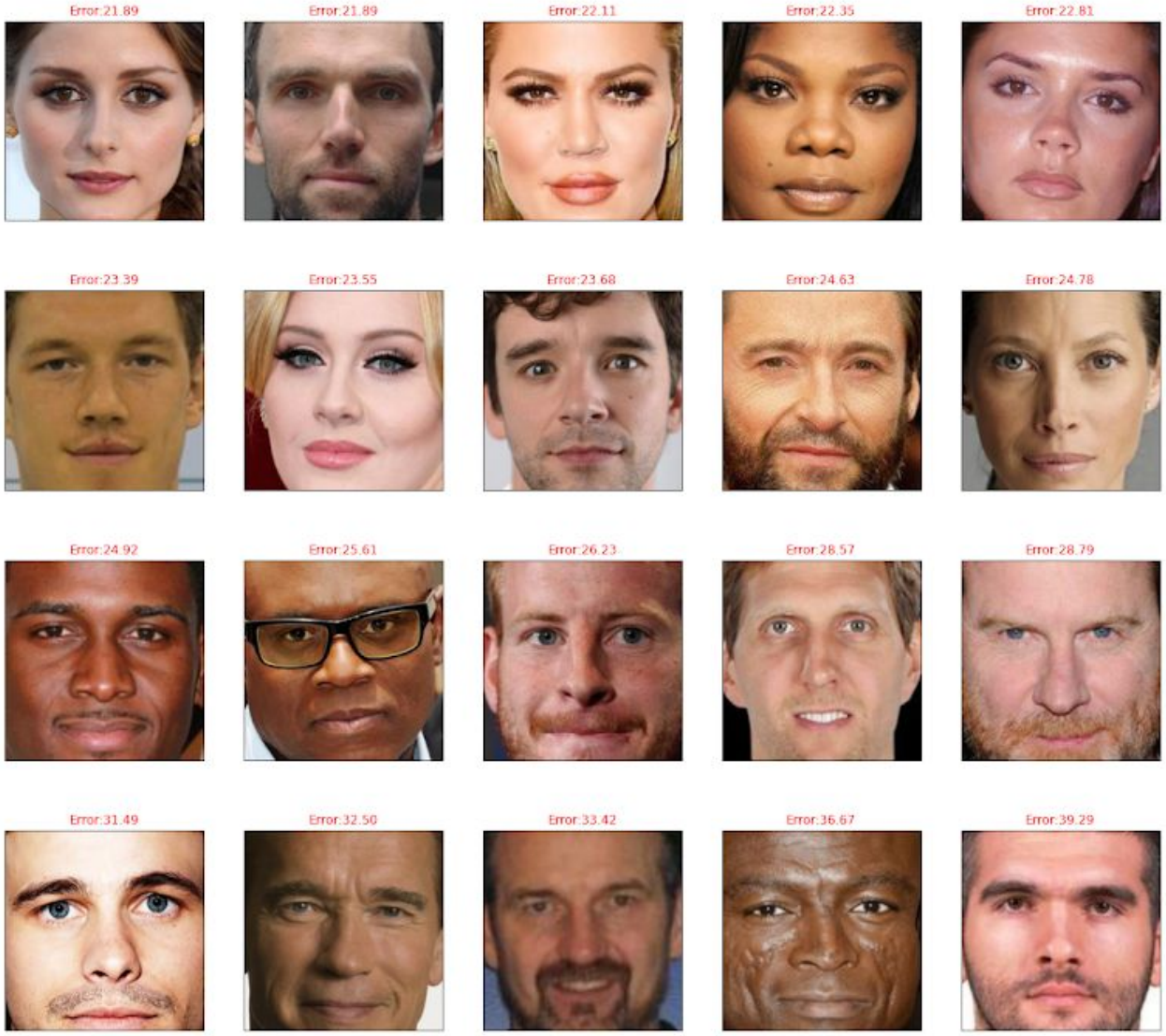
| | |
|---|---|
| Count: | 206 |
| mean | 12.714376 |
| std | 16.437334 |
| min | 0.018837 |
| 25% | 3.136052 |
| 50% | 8.266600 |
| 75% | 15.654055 |
| max | 138.629791 |



# Test result for western data - Biggest error (>=15.65)

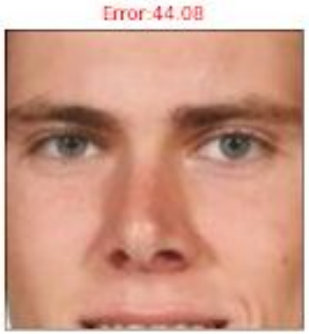


# Test result for western data - Biggest error (>=15.65)



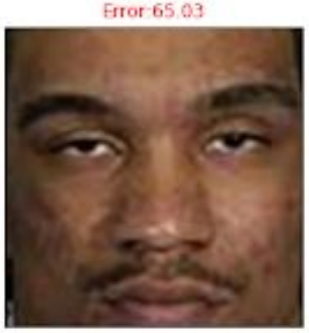
# Test result for western data - Biggest error (>=15.65)





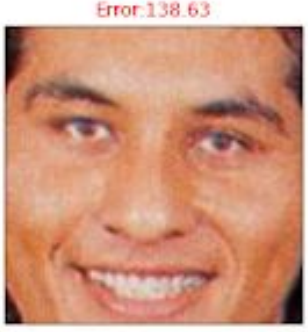






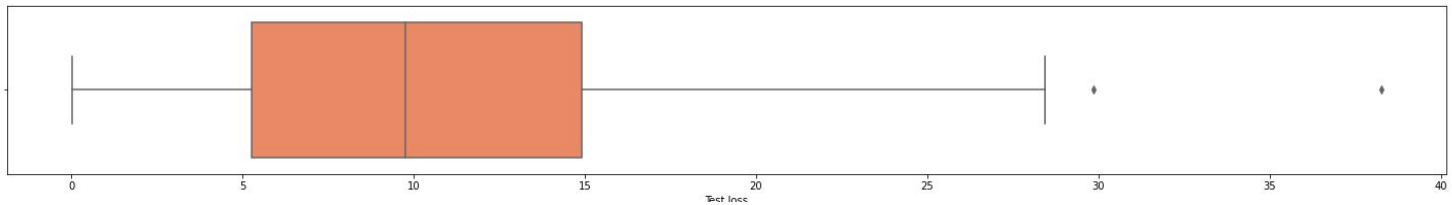




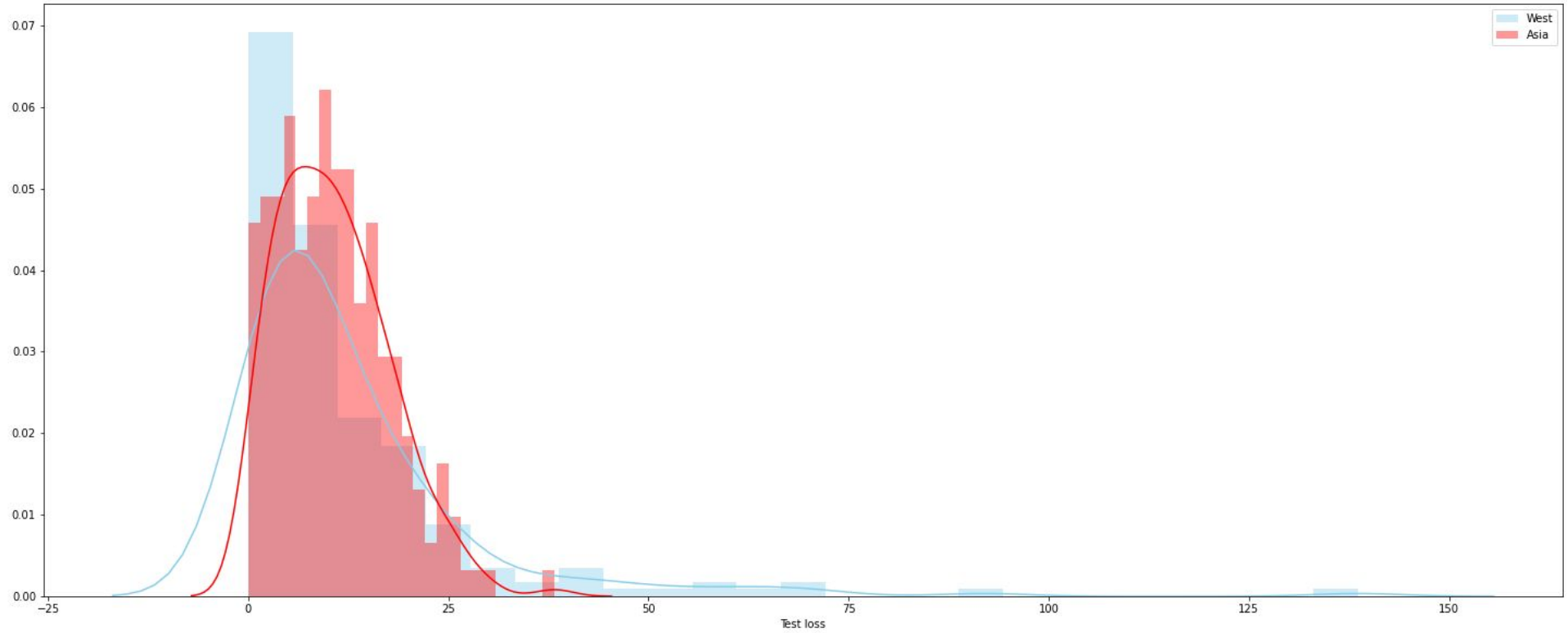
# Weight
# Analyze test result for Asian data

# Analyze test result for asian data

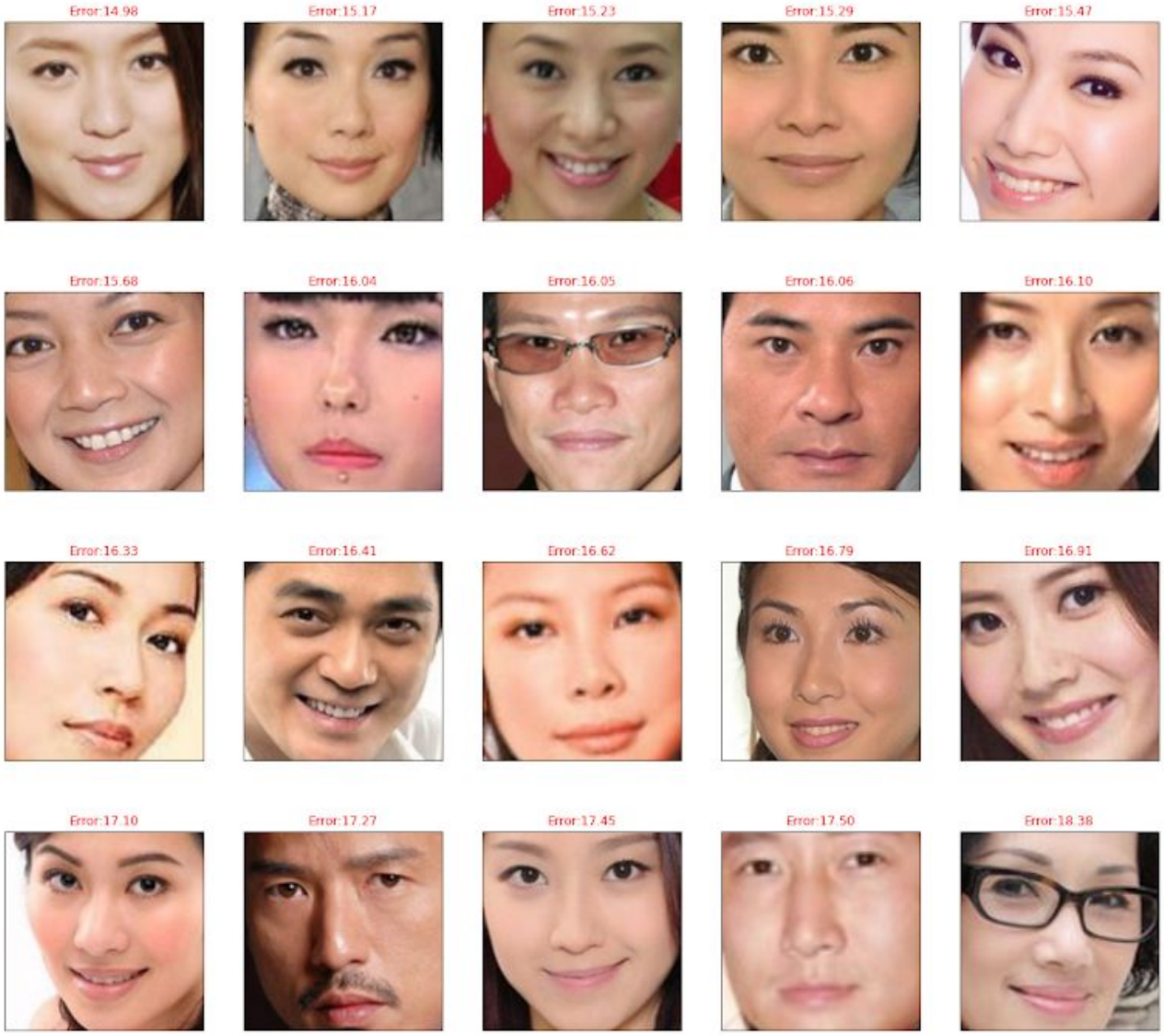
| | |
|---|---|
| count | 208.000000 |
| mean | 10.661611 |
| std | 6.928674 |
| min | 0.039642 |
| 25% | 5.282686 |
| 50% | 9.760532 |
| 75% | 14.908416 |
| max | 38.254318 |



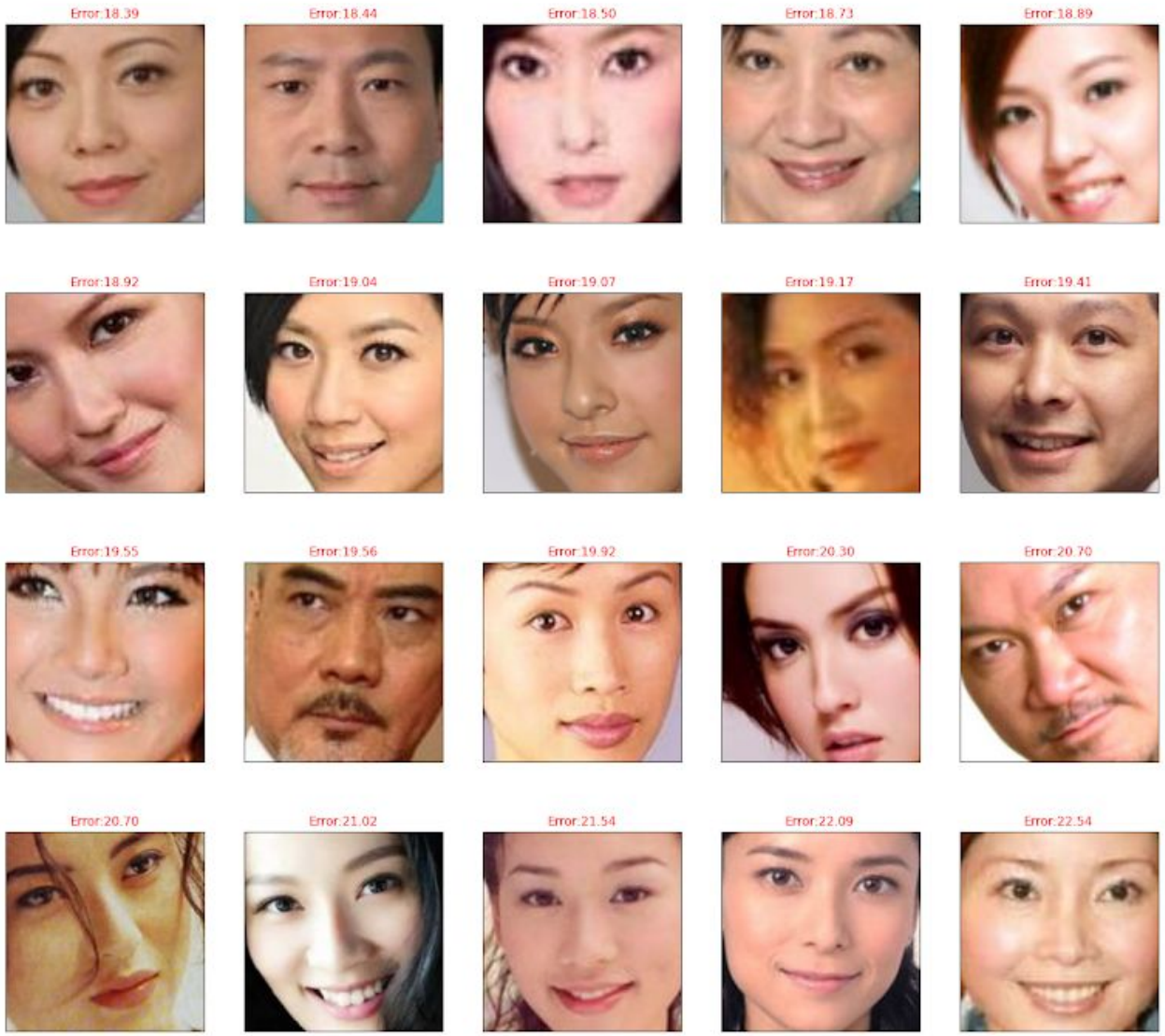
# Weight error distribution West vs Asia



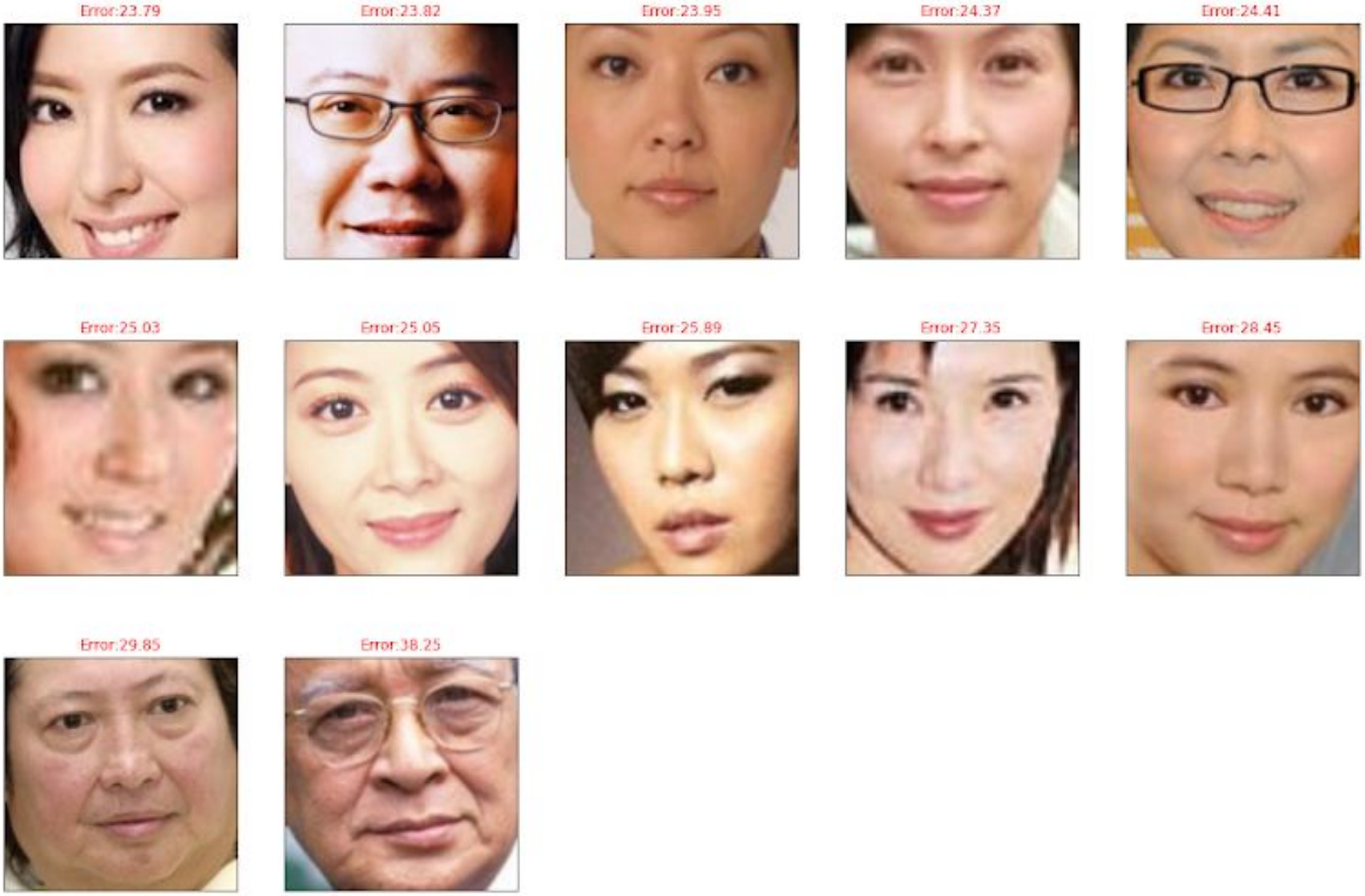
# Test result for asian data - Biggest error (>=14.9)



# Test result for asian data - Biggest error (>=14.9)



# Test result for asian data - Biggest error (>=14.9)



# 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 as the same time
   b. Incorrect data

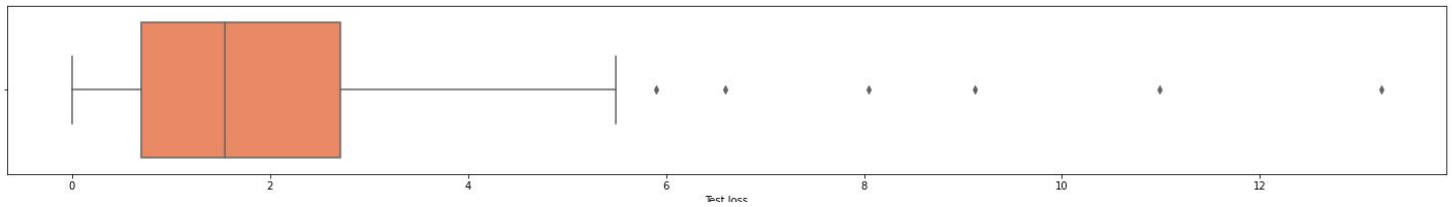
**Main reason: bad data**

# Train pretrained model to train on asian data

# BMI

# Analyze test result for asian data

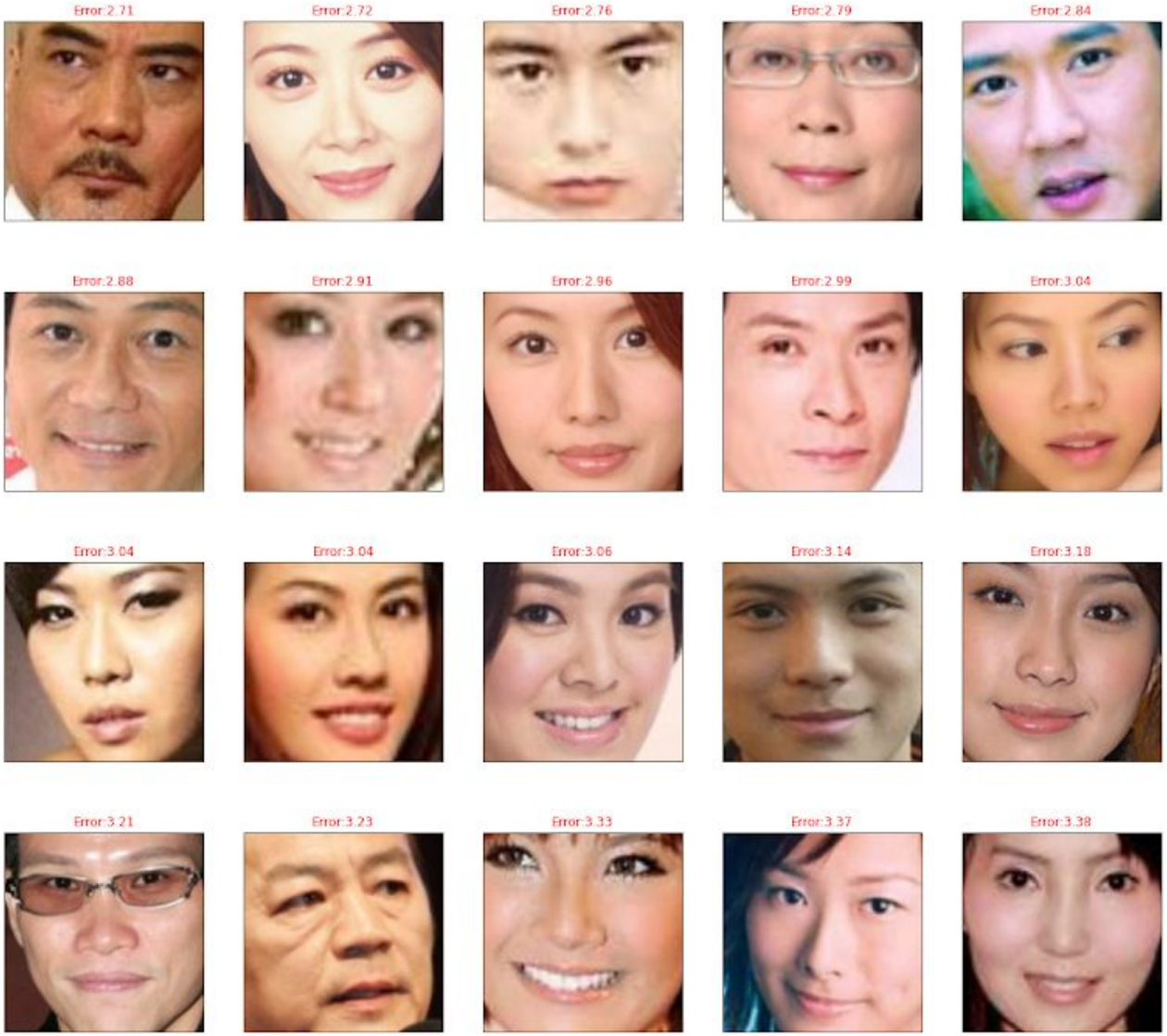
| | |
|---|---|
| count | 208.000000 |
| mean | 1.959250 |
| std | 1.818866 |
| min | 0.005199 |
| 25% | 0.694865 |
| 50% | 1.545342 |
| 75% | 2.710669 |
| max | 13.221609 |



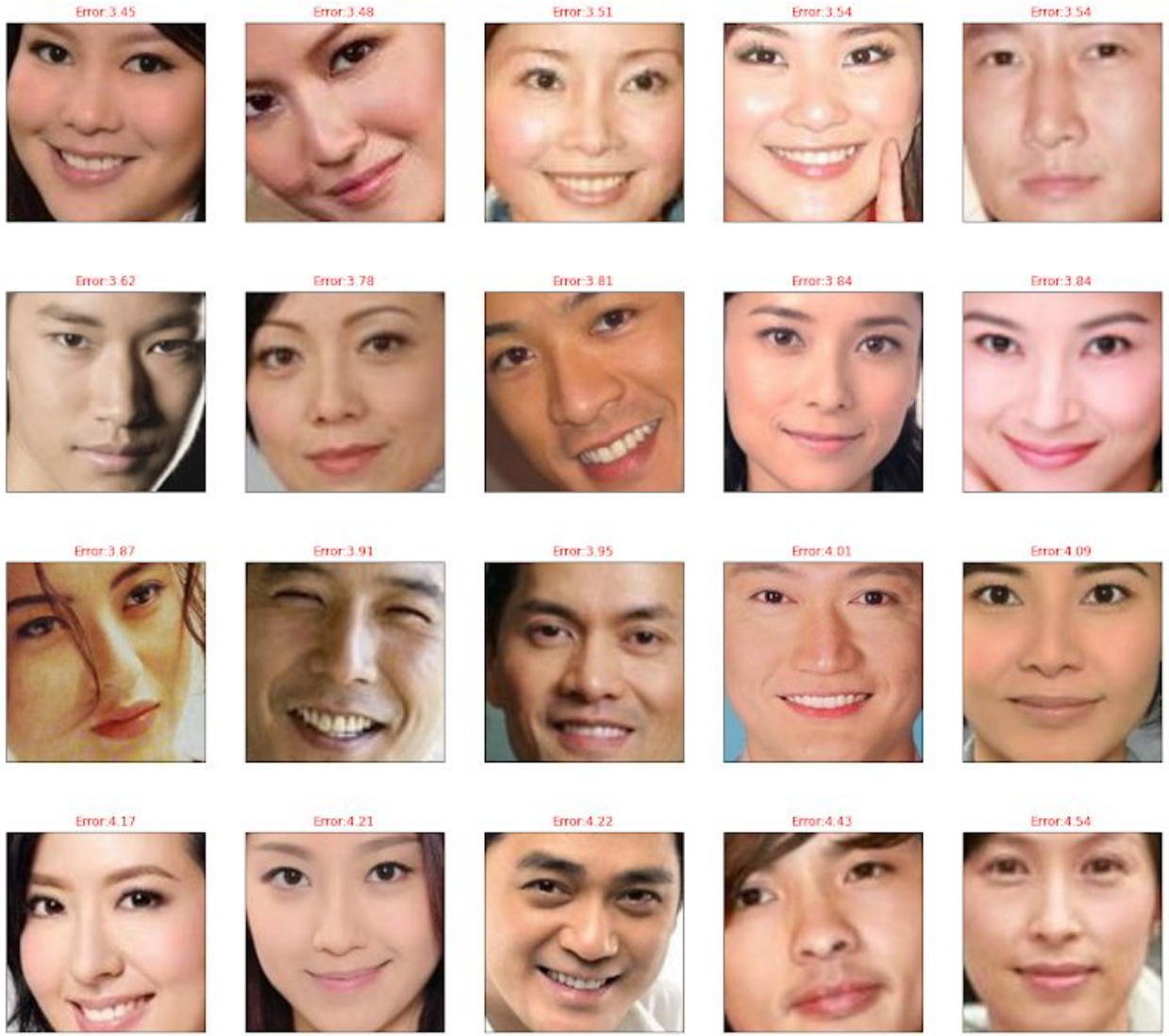
# Model after training on asian data

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

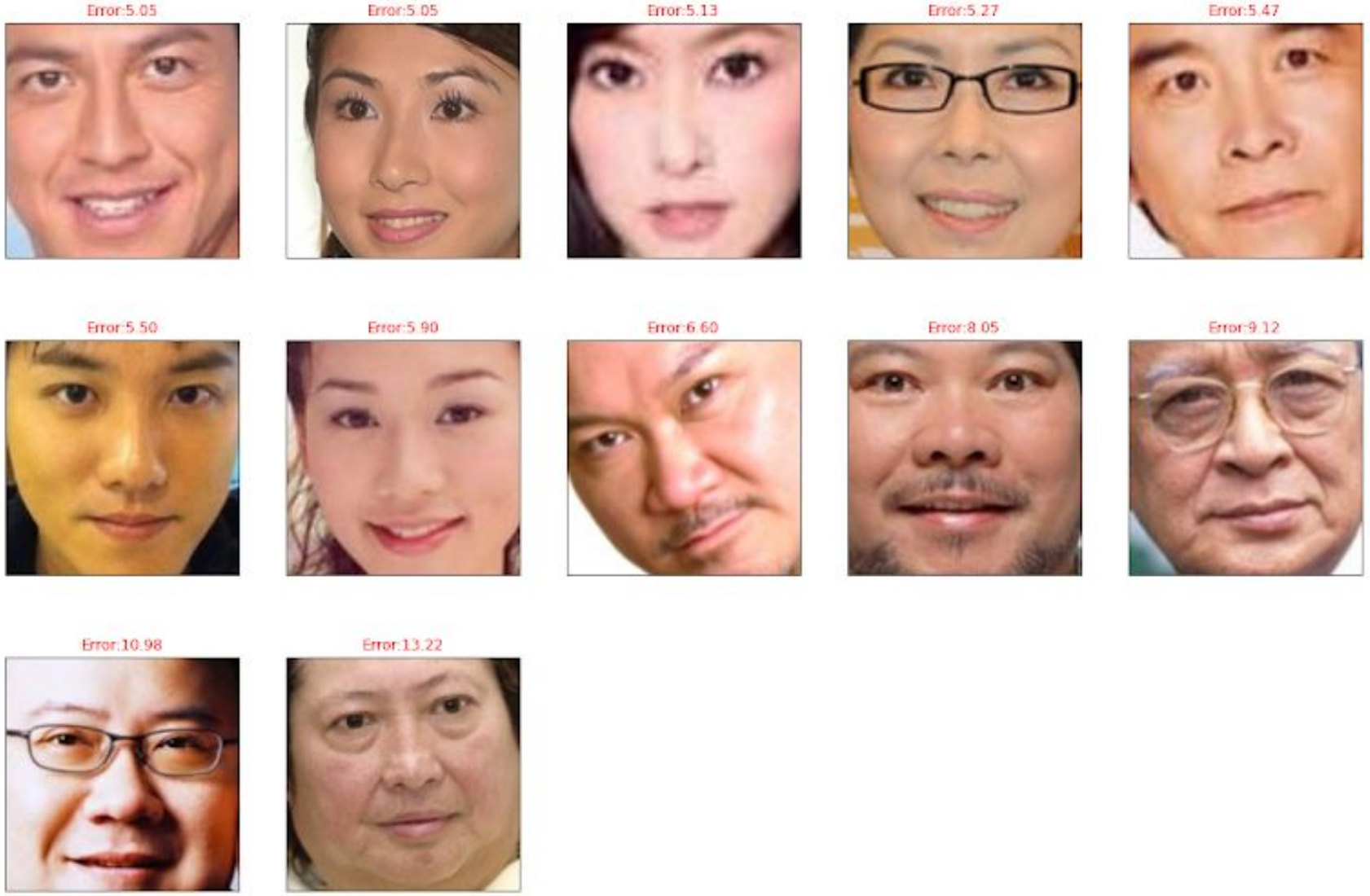
# Test result for asian data - Biggest error



# Test result for asian data - Biggest error



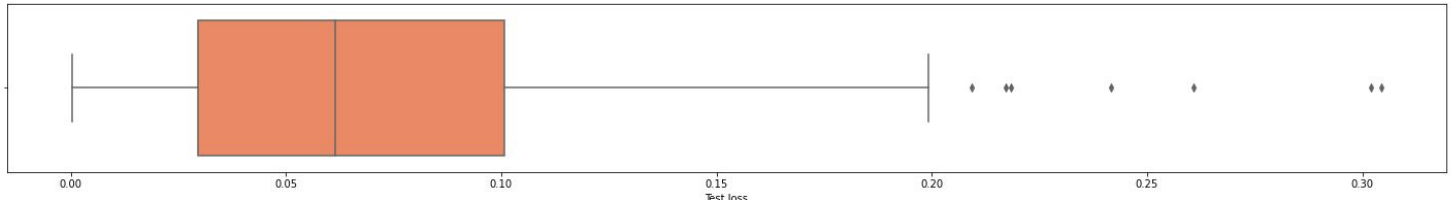
# Test result for asian data - Biggest error



Height

# Analyze test result for asian data

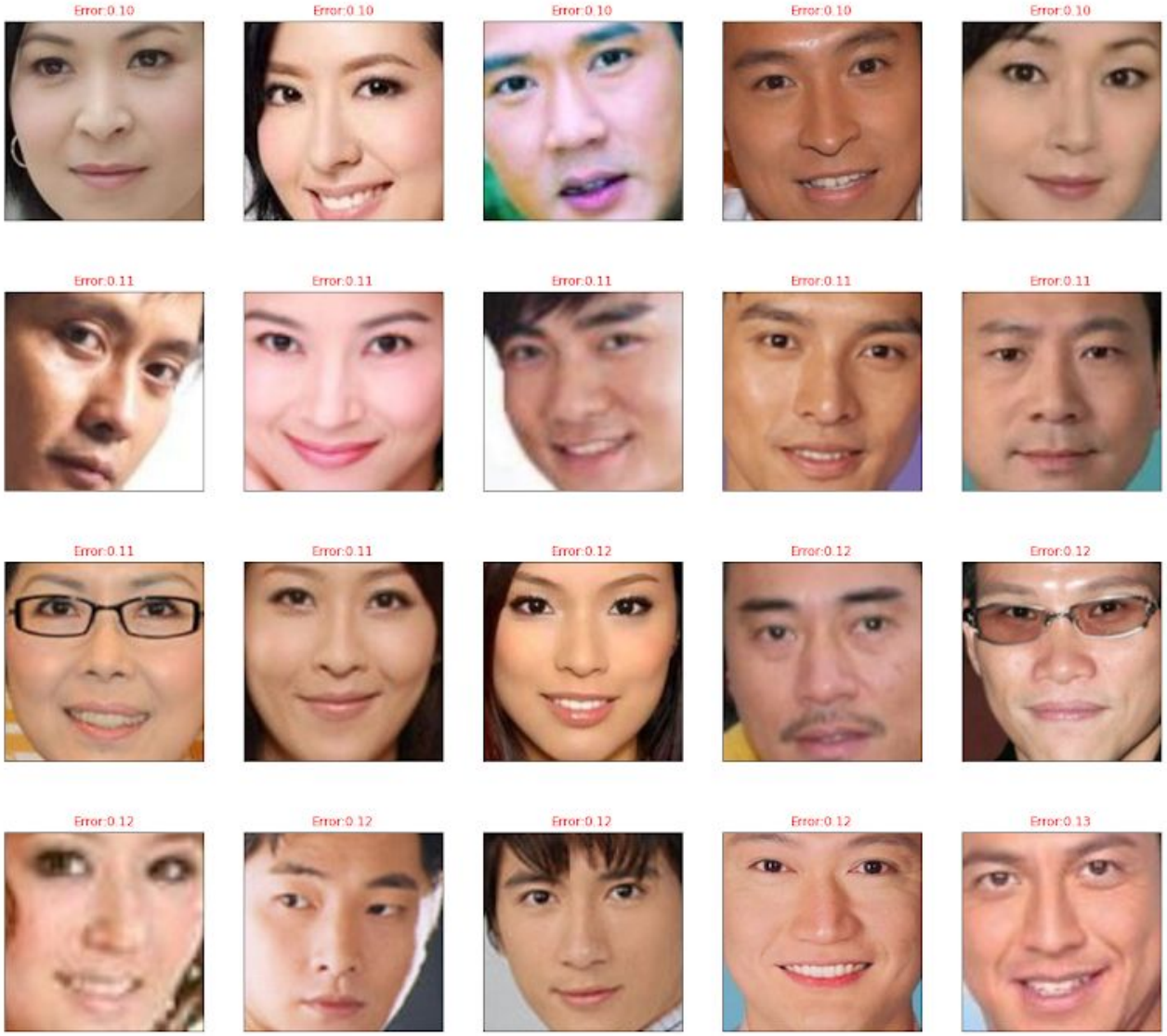
| | |
|---|---|
| count | 208 |
| mean | 0.073468 |
| std | 0.058572 |
| min | 0.000435 |
| 25% | 0.029539 |
| 50% | 0.061470 |
| 75% | 0.100835 |
| max | 0.304327 |



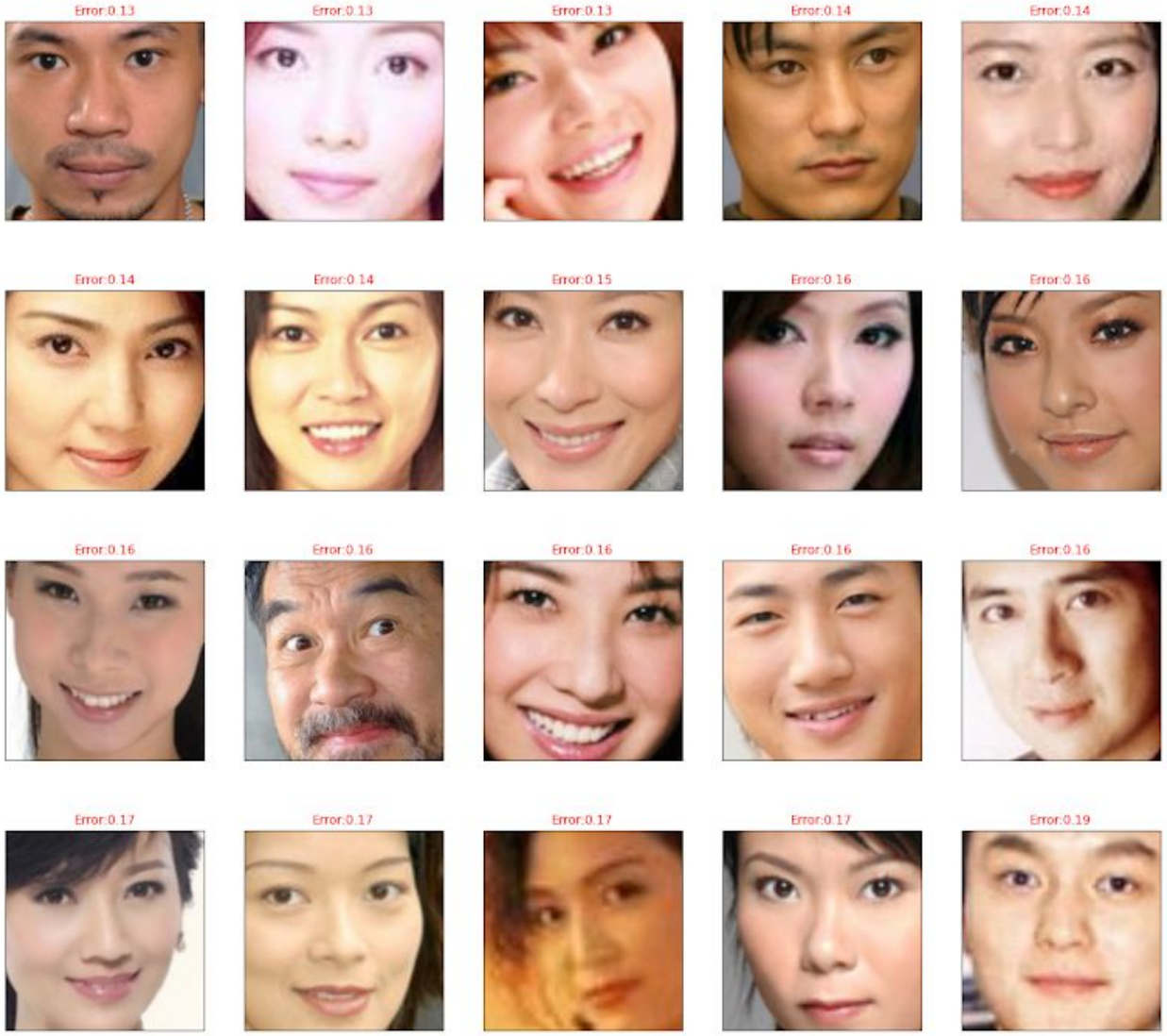
# Model after training on asian data

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

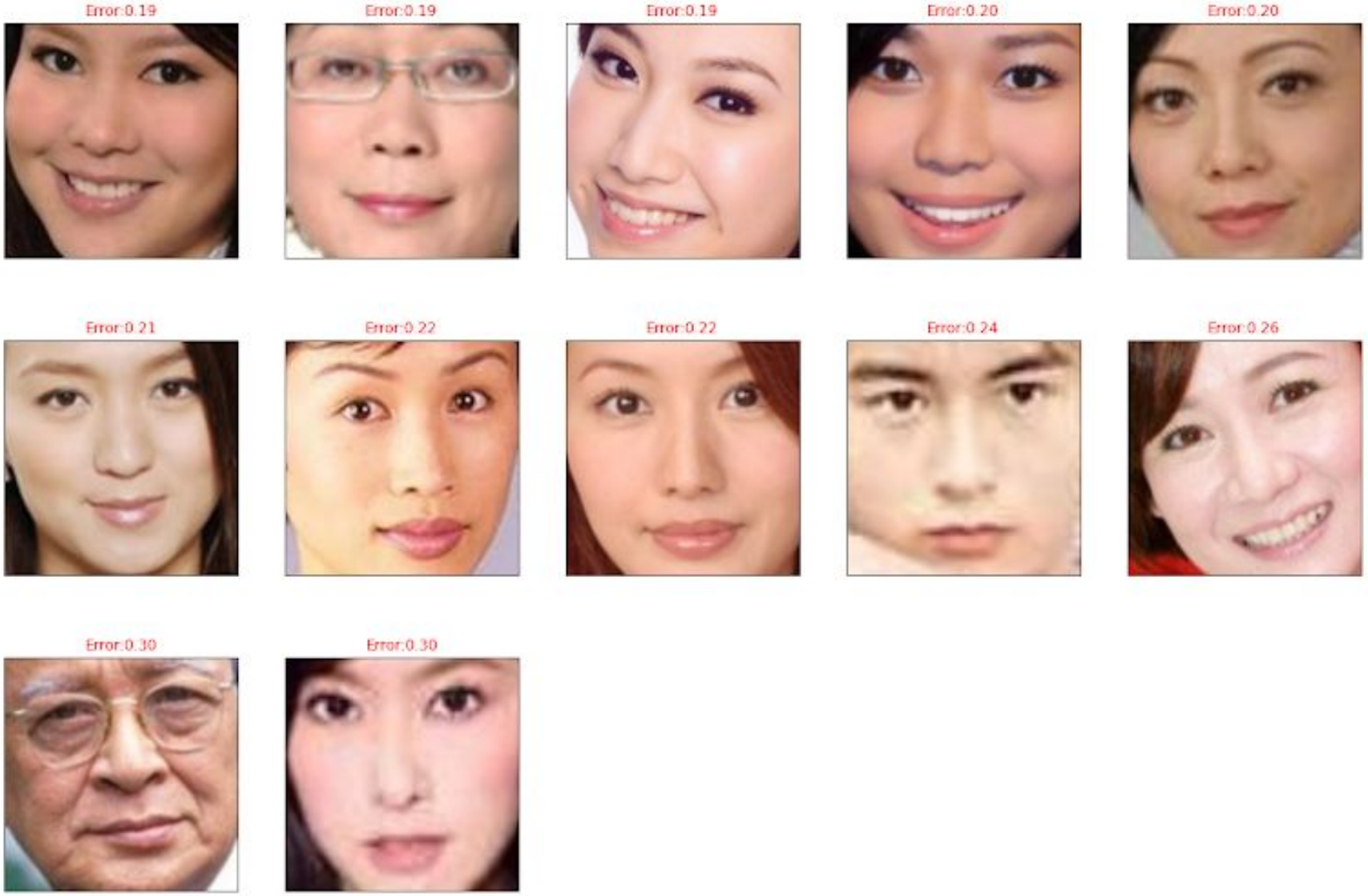
# Test result for asian data - Biggest error



# Test result for asian data - Biggest error



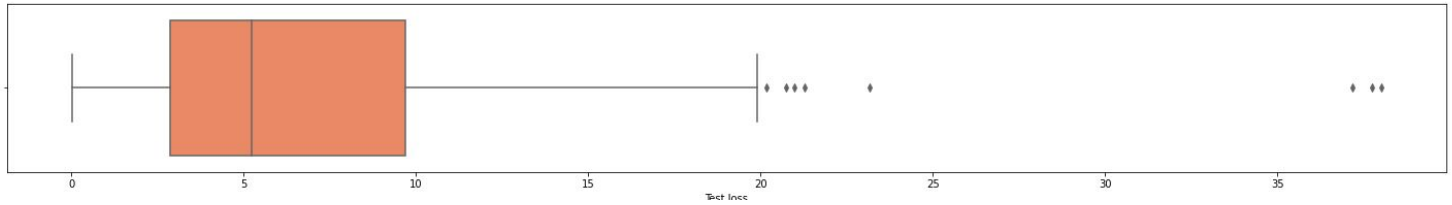
# Test result for asian data - Biggest error



# Weight

# Analyze test result for asian data

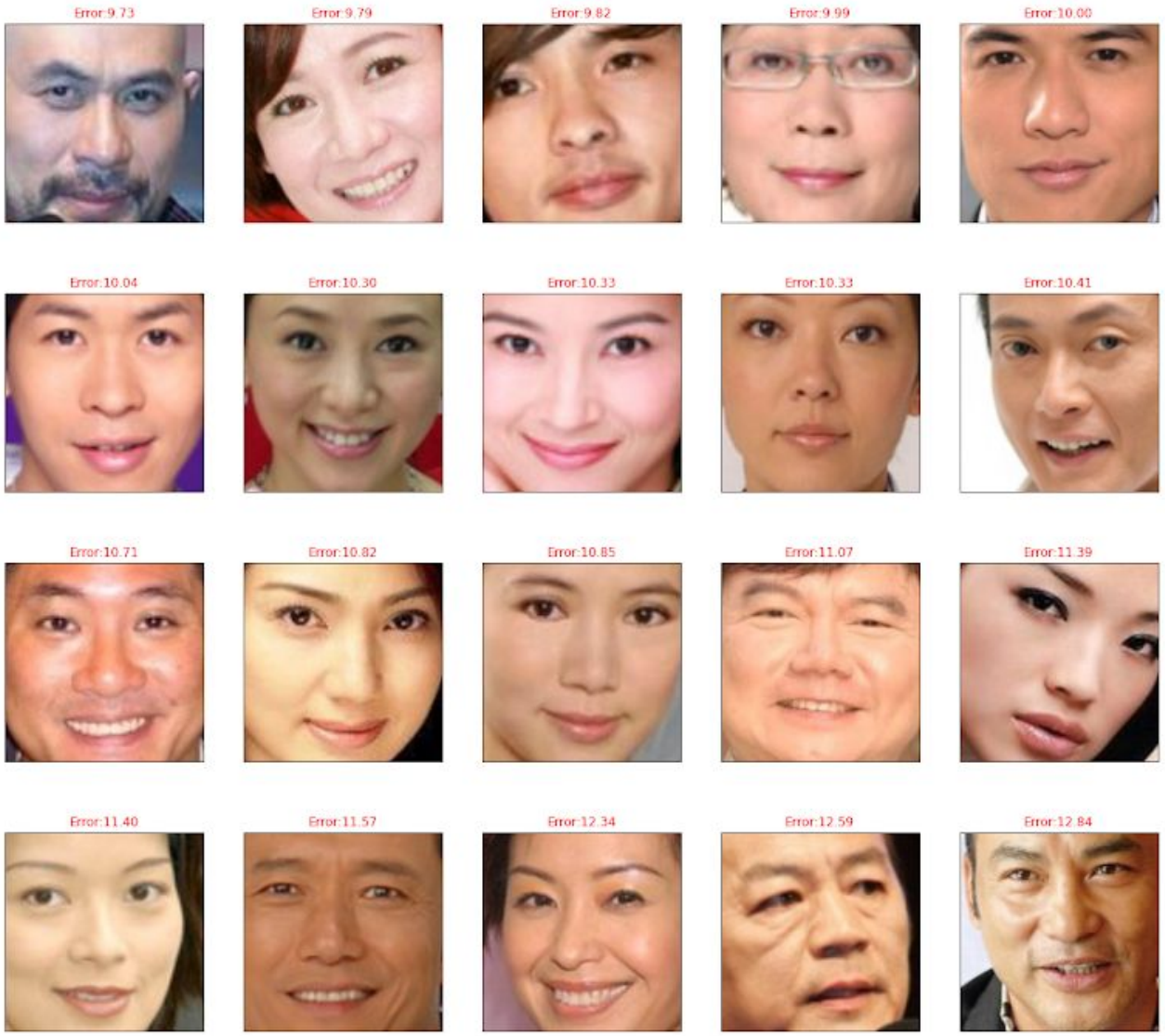
| | |
|---|---|
| count | 208.000000 |
| mean | 7.205800 |
| std | 6.457775 |
| min | 0.040497 |
| 25% | 2.868369 |
| 50% | 5.244310 |
| 75% | 9.708841 |
| max | 38.003124 |



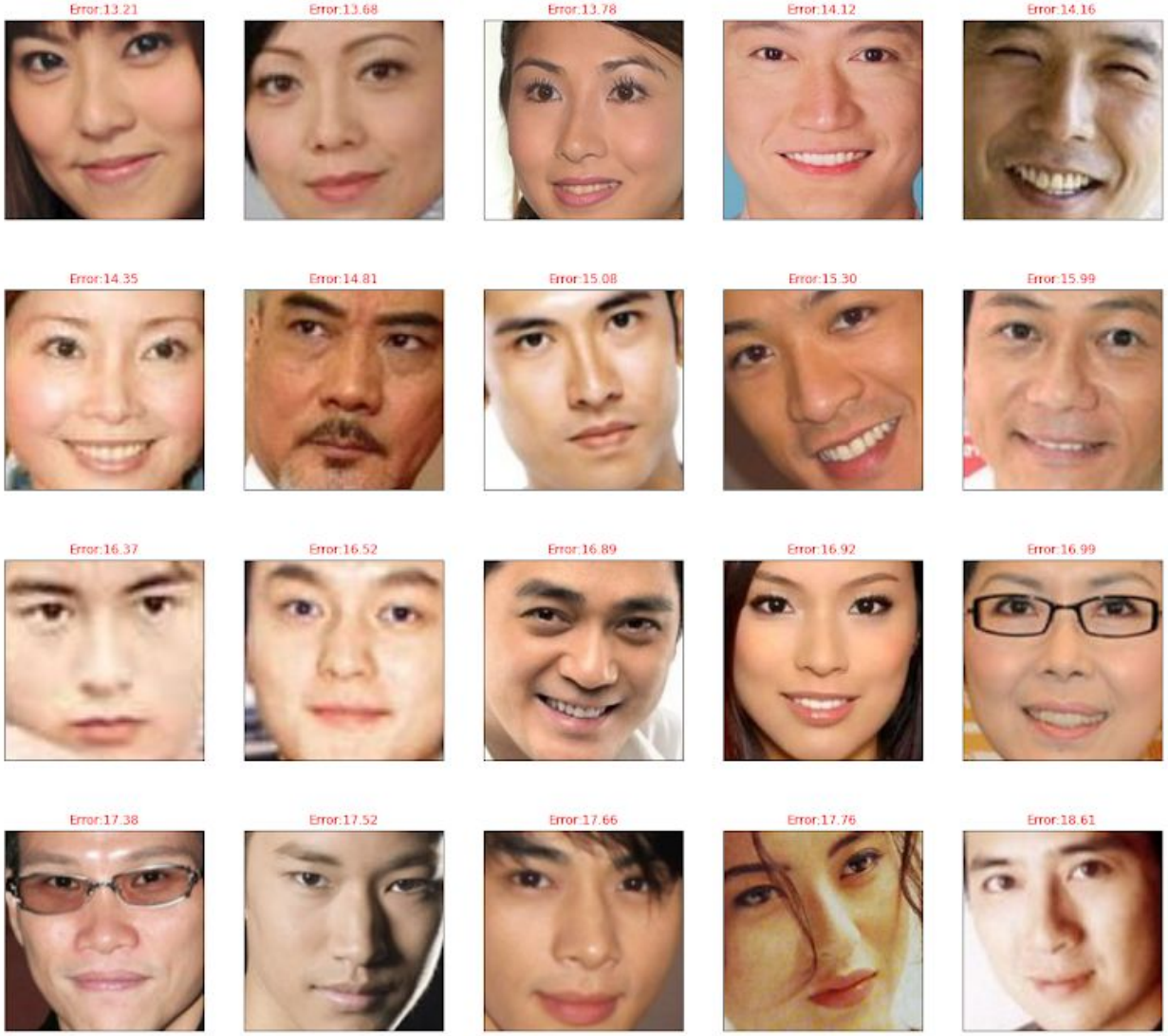
# Model after training on asian data

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

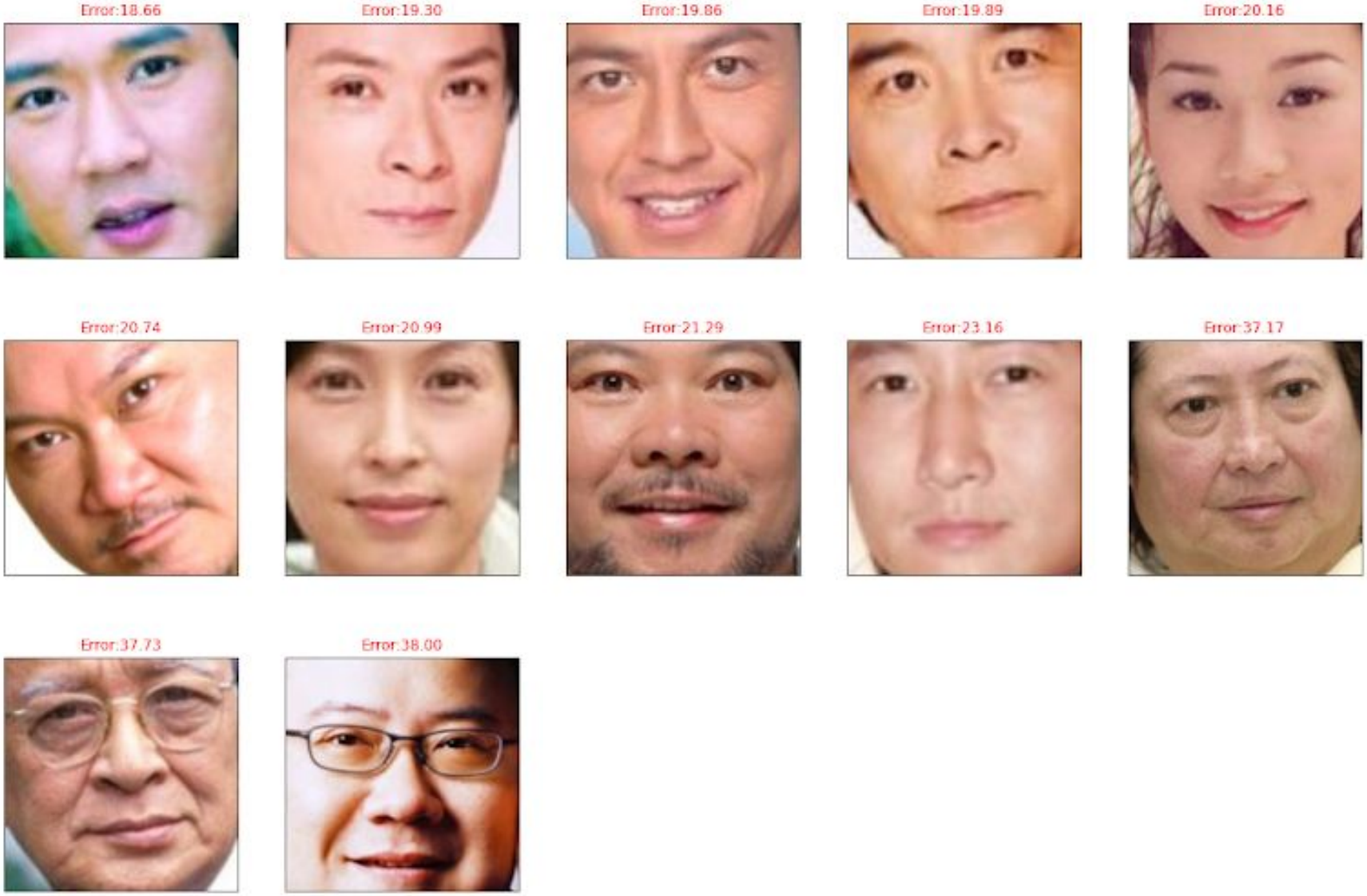
# Test result for asian data - Biggest error



# Test result for asian data - Biggest error



# Test result for asian data - Biggest error



# 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 as 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