

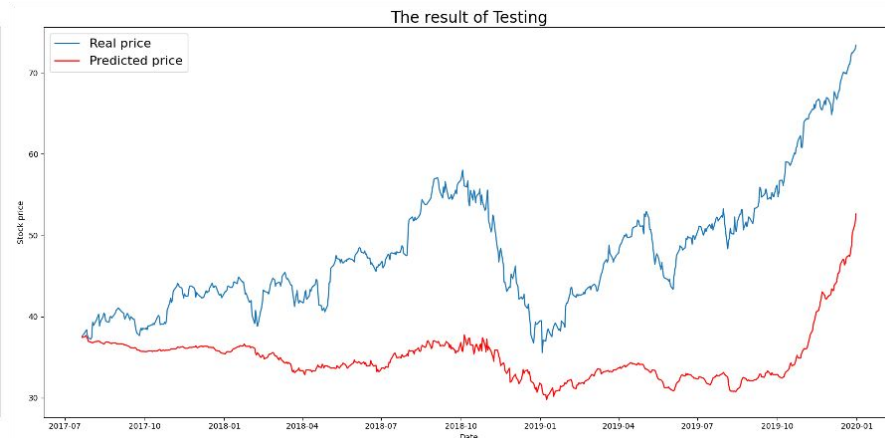
Week 10

What we have tried this week - Stateful

Baseline model - LSTM



RMSE: 15.93
(include 2020)



RMSE: 14.74
(remove 2020 data)

The result was worse, so we decided not to use stateful in GAN model.

What we tried this week - Pre-trained Generator

```
def build_encoder(input_dim, output_dim, feature_size) -> tf.keras.models.Model:  
    model = Sequential()  
    model.add(GRU(units=512, return_sequences=True, input_shape=(input_dim, feature_size)))  
    model.add(GRU(units=256, return_sequences=True, recurrent_dropout=0.01, dropout=0.01))  
    model.add(GRU(128, kernel_regularizer=regularizers.l2(1e-3)))  
    model.add(Dense(64, kernel_regularizer=regularizers.l2(1e-3)))  
    model.add(Dense(32, kernel_regularizer=regularizers.l2(1e-3)))  
    model.add(Dense(16, kernel_regularizer=regularizers.l2(1e-3)))  
    model.add(Dense(units=output_dim))  
    model.compile(optimizer=Adam(lr=LR), loss='mse')  
    return model
```

```
en = build_encoder(input_dim, output_dim, feature_size)  
en.fit(X_train, y_train, epochs=N_EPOCH, batch_size=BATCH_SIZE,  
      validation_data=(X_test, y_test), verbose=2, shuffle=True)  
en.save("gru_encoder.h5")
```

No improvements!

```
def Generator(en, output_dim):  
    inter_output_model = Model(inputs=en.input, outputs=en.layers[-4].output)  
    inter_output_model.trainable = False  
  
    model = Sequential()  
    model.add(inter_output_model)  
    model.add(Dense(64, kernel_regularizer=regularizers.l2(1e-3)))  
    model.add(Dense(32, kernel_regularizer=regularizers.l2(1e-3)))  
    model.add(Dense(units=output_dim))  
    return model
```

Final model

Generator: GRU

Discriminator: CNN

Many to one prediction: time step 3, output 1

Many to many prediction: time step 30, output 3

Final model (time step 3, output 1)

Baseline model - LSTM

The result of Testing with 2020



RMSE: 4.72
(include 2020)

The result of Testing

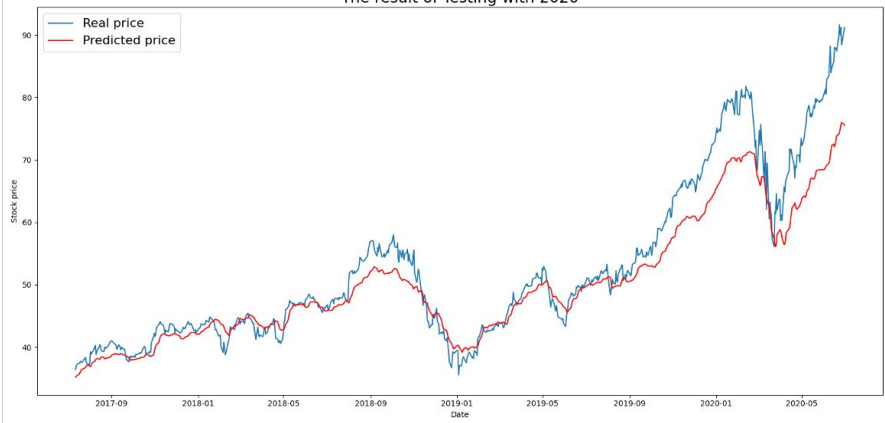


RMSE: 2.79
(remove 2020 data)

Final model (time step 3, output 1)

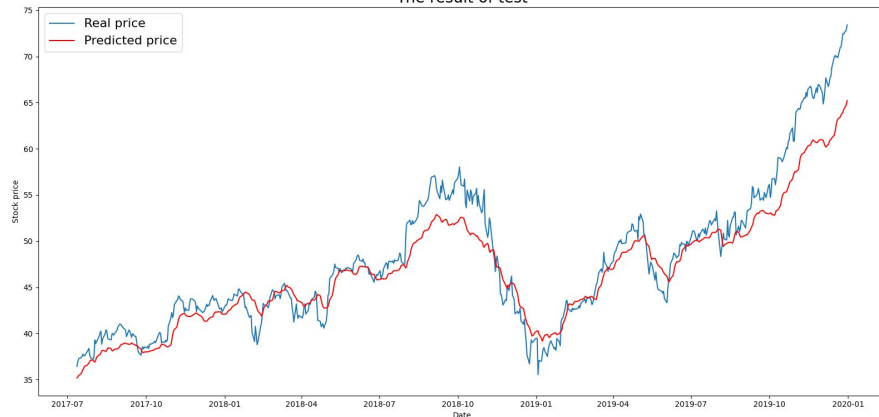
Basic GAN

The result of Testing with 2020



RMSE: 4.67
(include 2020)

The result of test



RMSE: 2.56
(remove 2020 data)

Final model (time step 3, output 1)

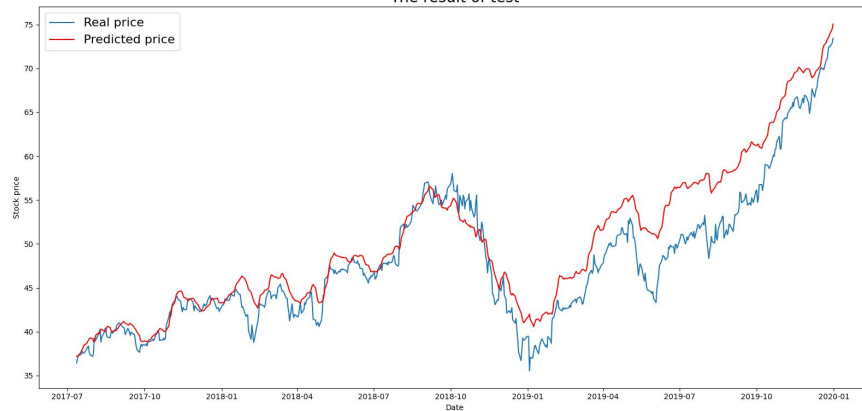
WGAN-GP

The result of test



RMSE: 3.2
(include 2020)

The result of test



RMSE: 3.17
(remove 2020 data)

Model Comparison_(time step3, output 1)

Train dataset

| | Baseline LSTM | Basic GAN | WGAN-GP |
|------|---------------|-----------|---------|
| RMSE | 3.40 | 4.03 | 1.47 |

Test dataset

| | Baseline LSTM | Basic GAN | WGAN-GP |
|------|---------------|-----------|---------|
| RMSE | 4.72 | 4.67 | 3.2 |

When there is unexpected events like Covid-19, WGAN-GP perform much better.

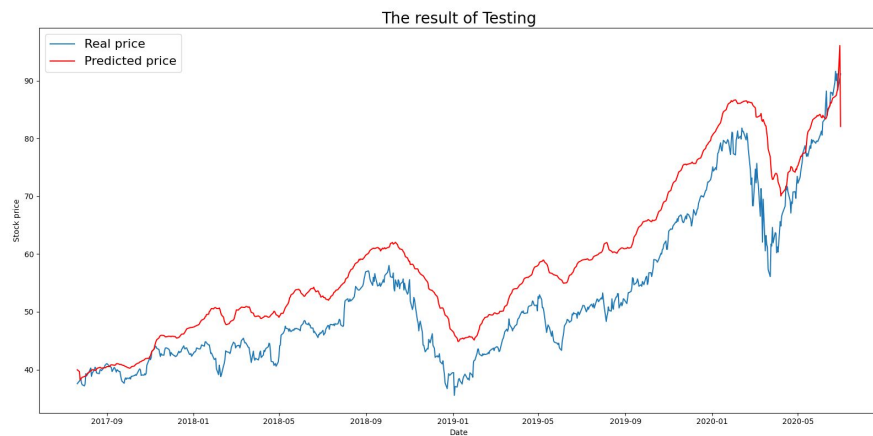
Test dataset (remove year 2020)

| | Baseline LSTM | Basic GAN | WGAN-GP |
|------|---------------|-----------|---------|
| RMSE | 2.79 | 2.56 | 3.18 |

When stock market operate normally, Basic GAN perform better.

Final model (time step 30, output 3)

Baseline model - LSTM



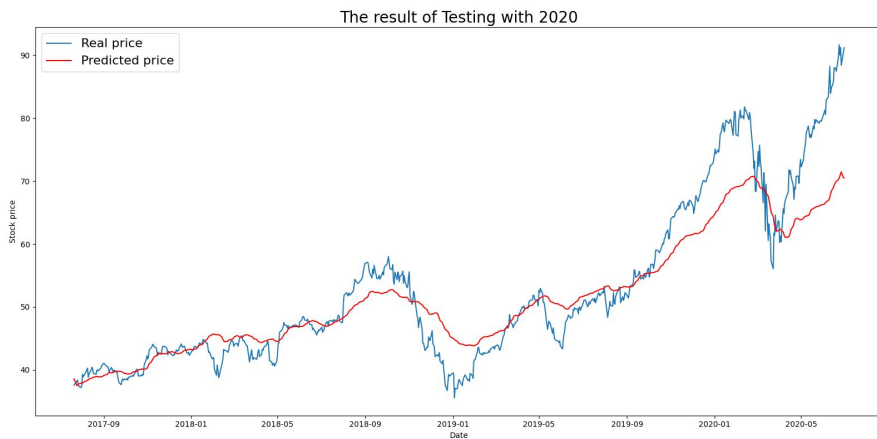
RMSE: 6.60
(include 2020)



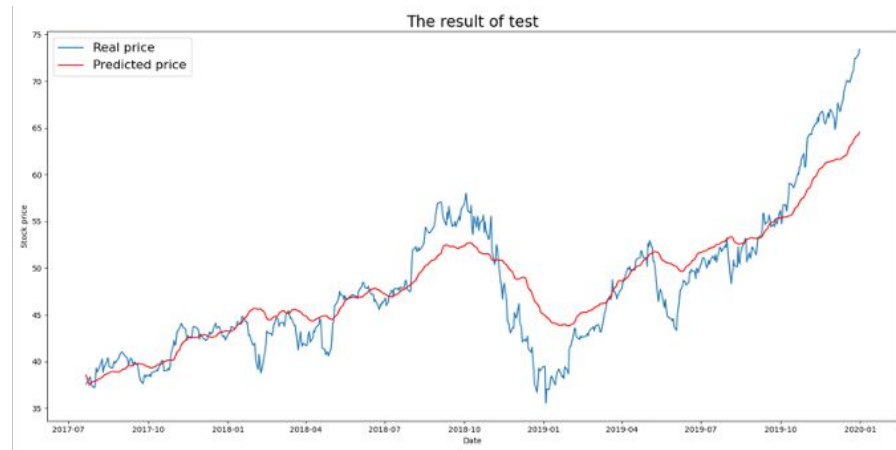
RMSE: 9.47
(remove 2020 data)

Final model (time step 30, output 3)

Basic GAN



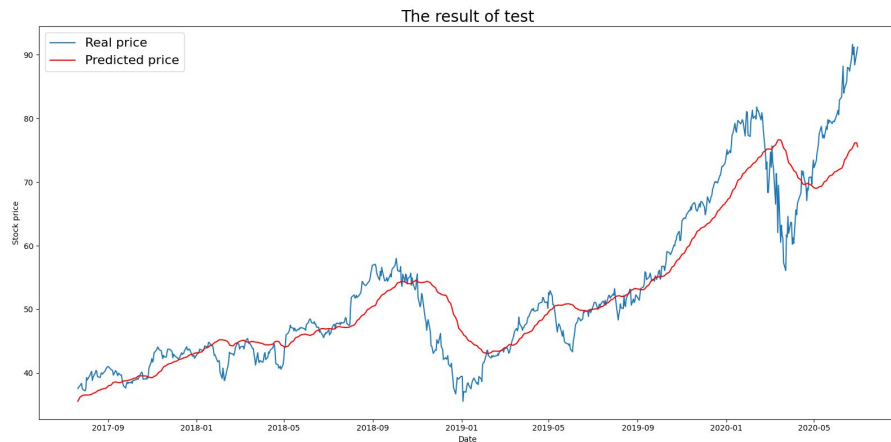
RMSE: 5.36
(include 2020)



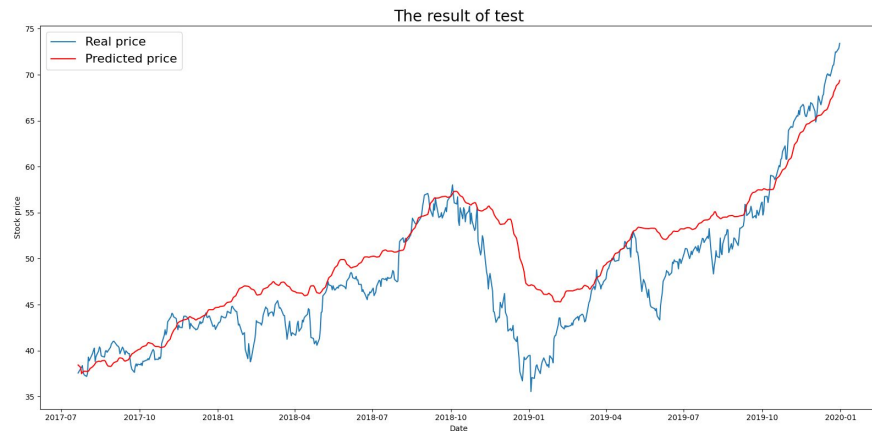
RMSE: 3.09
(remove 2020 data)

Final model (time step 30, output 3)

WGAN-GP



RMSE: 4.77
(include 2020)



RMSE: 3.88
(remove 2020 data)

Model Comparison_(time step 30, output3)

Train dataset

| | Baseline LSTM | Basic GAN | WGAN-GP |
|------|---------------|-----------|---------|
| RMSE | 1.52 | 1.64 | 1.74 |

Test dataset

| | Baseline LSTM | Basic GAN | WGAN-GP |
|------|---------------|-----------|---------|
| RMSE | 6.60 | 5.36 | 4.77 |

Many to many prediction, GAN performance on test data is much better than LSTM.

Test dataset (remove year 2020)

| | Baseline LSTM | Basic GAN | WGAN-GP |
|------|---------------|-----------|---------|
| RMSE | 9.45 | 3.09 | 3.88 |

When stock market operate normally, without unexpected extreme events like Covid-19, GAN performance much better than Baseline model.

Future work

- Report
- Paper Script

Thank you