STOCK TRADING STRATEGY BASED ON NEURAL NETWORKS

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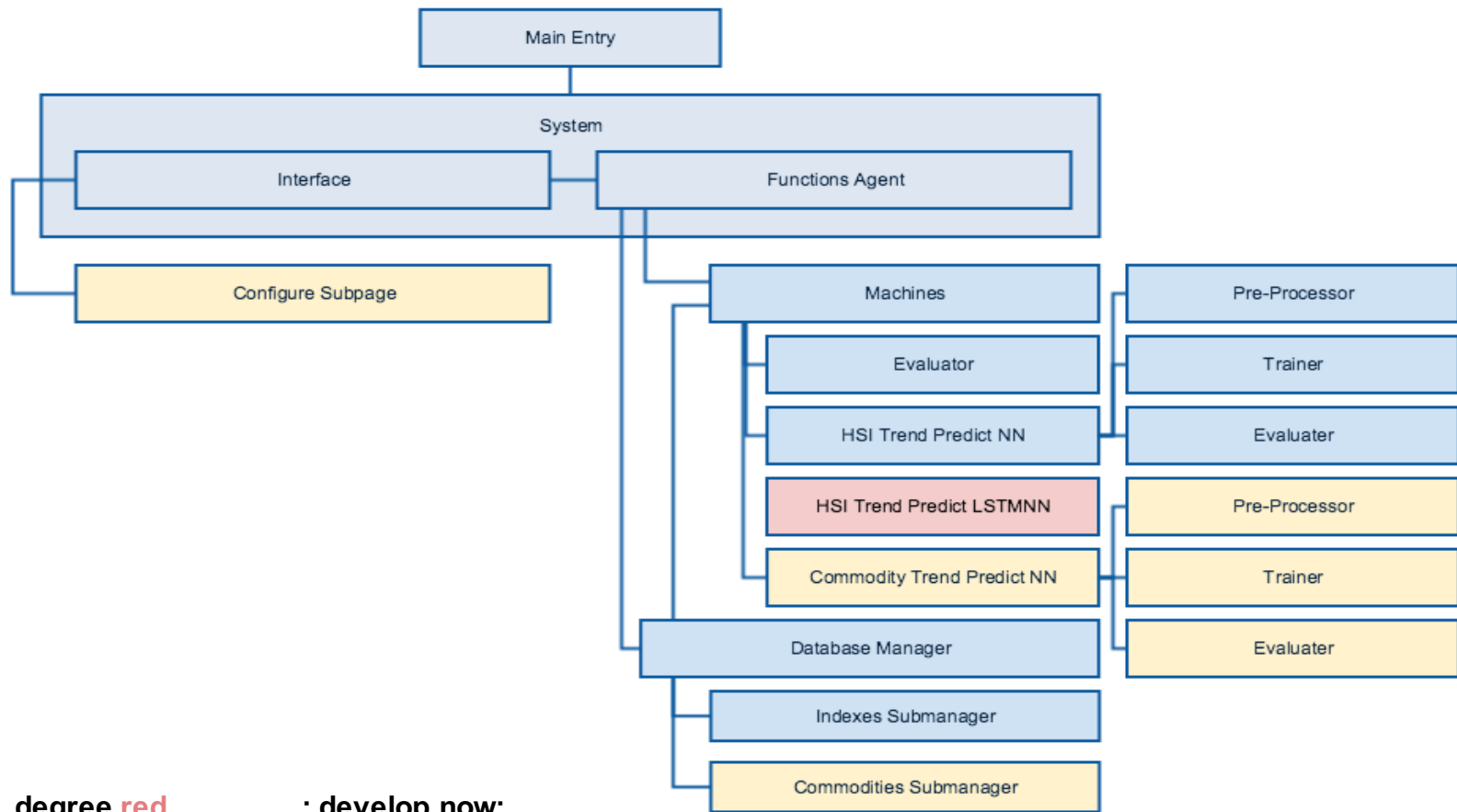
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1. PURPOSE

■ **Learn from historical trading information to recommend trading strategies for a specific market situation:**

■ Input:
  1) real time data: the real time price, volume, time period (divide whole daily trading time in to segments per half-hours);
  2) fundamental data: daily open, high, low, close, adjusted close and volume;
  3) technical values: volume trend, short-term MA and long-term MA;
  4) time information: step follow [9] to initially generate new features contain time information;
  5) environment data: HSBC index, foreign exchange rates (HKD-USD, HKD-CNY exchange rates) and their trends, commodities price (gold, oil, coal) and their trends.

■ **Meanwhile training out well performance NN and using it to predict price trend.**
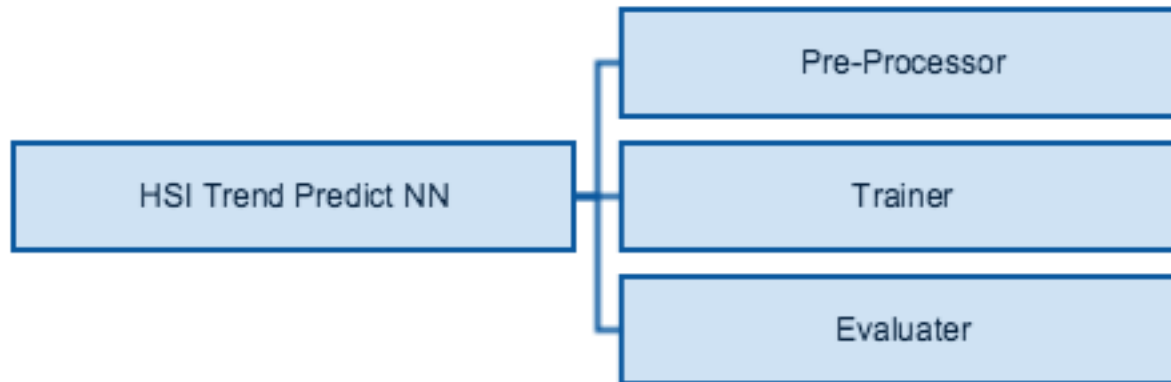
2. SYSTEM STRUCTURE

- **degree red**   : **develop now;**
- **degree yellow** : **planned to develop next step;**
- **degree blue**   : **developed.**
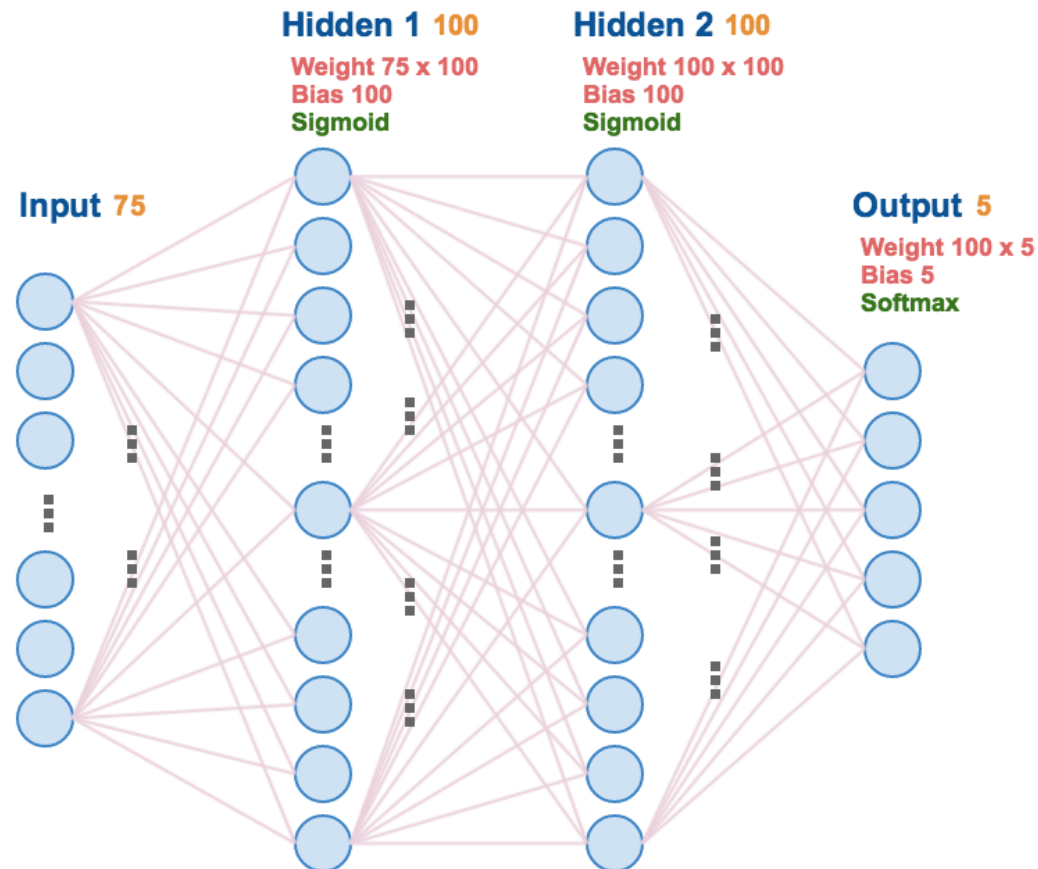
3. CONVERT TO TRADABLE STRATEGIES

■ **Separate the part of well performance to do trend predict.**
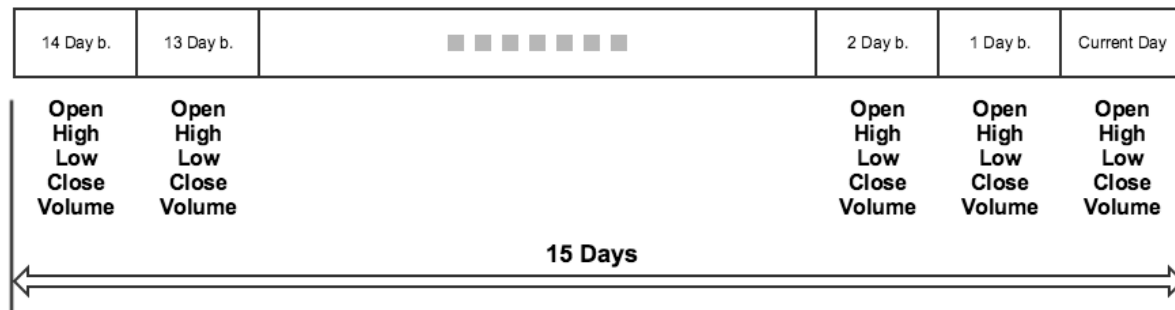
4. INITIAL NN

- **HSI daily trend predict NN.**
- **Structure:**

4. INITIAL NN

- **Input:**

  - 15 days' OHLCV data (1 year).

| 14 Day b.	13 Day b.	■ ■ ■ ■ ■ ■ ■ ■		2 Day b.	1 Day b.	Current Day
Open High Low Close Volume	Open High Low Close Volume			Open High Low Close Volume	Open High Low Close Volume	Open High Low Close Volume

15 Days

  - Preprocess the data, making of data in the range of [-1,1].

```
>>> xtrain
array([[-0.3836776 , -0.39434153, -0.36982896, ..., -0.12170358,
        -0.13706482, -0.65906868],
       [-0.41279747, -0.42167821, -0.36546025, ..., -0.16627372,
        -0.14624921, -0.71619336],
       [-0.37259361, -0.37252426, -0.32068156, ..., -0.16206732,
        -0.18077036, -0.72574207],
       ...,
       [-0.34788089, -0.36336482, -0.29793301, ..., -0.24736041,
        -0.19484121, -0.47514659],
       [-0.38072462, -0.37113169, -0.30929904, ..., -0.15642892,
        -0.16546251, -0.56878069],
       [-0.3818175 , -0.39782995, -0.35630929, ..., -0.16174141,
        -0.168963  , -0.70325722]])
```

4. INITIAL NN

- **Output(labels):**

  - 10 days' close price change rate.
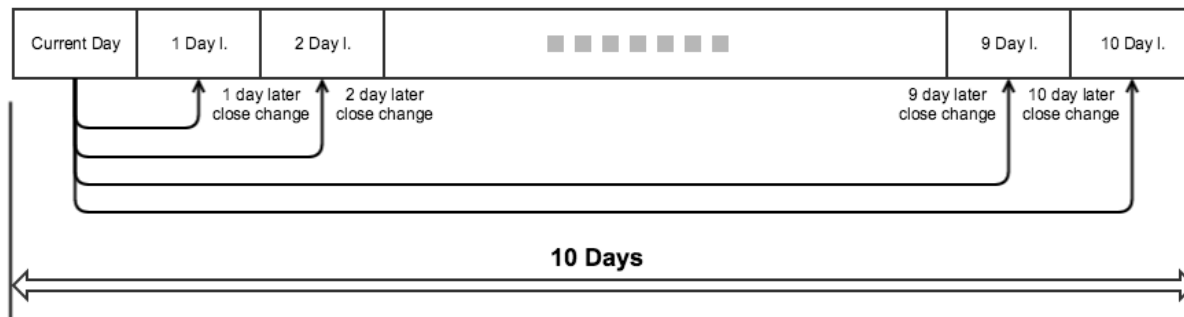
  - Preprocess the data, dividing the change rate into 5 classes, namely DU-dramatic up, U-up, F-fluctuate, D-down and DD-dramatic down.
  - E.g. [1,0,0,0,0] means DU; [0,0,1,0,0] means F.

4. INITIAL NN

- **Result:**

    - Use accuracy, recall and precise to evaluate the NN.

```
>>> accuracy(ypredict, ycorrect)
Accuracy:
0.243333333333
>>> recall(ypredict, ycorrect)
Recall:
DU        U        F        D        DD
0.064    0.166    0.470    0.196    0.117
>>> precise(ypredict, ycorrect)
Precise:
DU        U        F        D        DD
0.133    0.229    0.307    0.168    0.235
```

    - That means the current NN performs bad.

5. IMPROVEMENT

- **Improvement:**
  - Try to use longer training data (e.g. 3 years); shorter training data (e.g. 5 months);
  - Try to use different label mechanism (e.g. 2/3 classes);
  - Try to use different Input data (e.g. remove OHL price and rest close price and volume only);
  - Try to add some new features (e.g. SMA indicators);
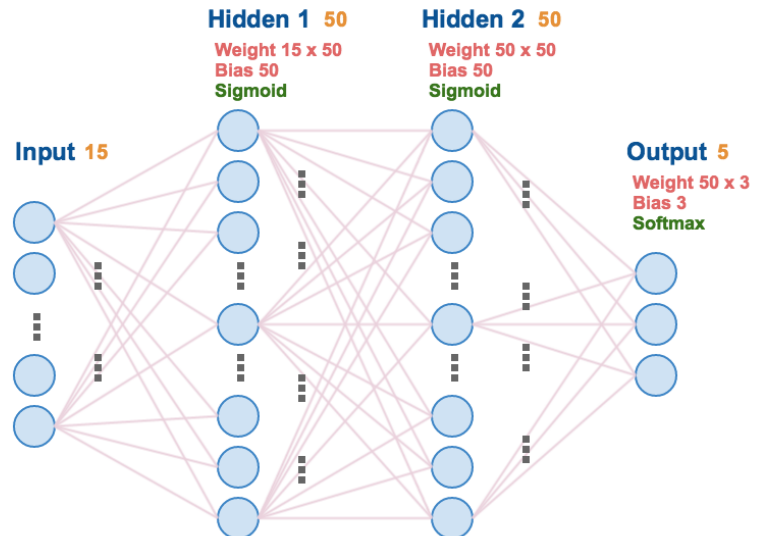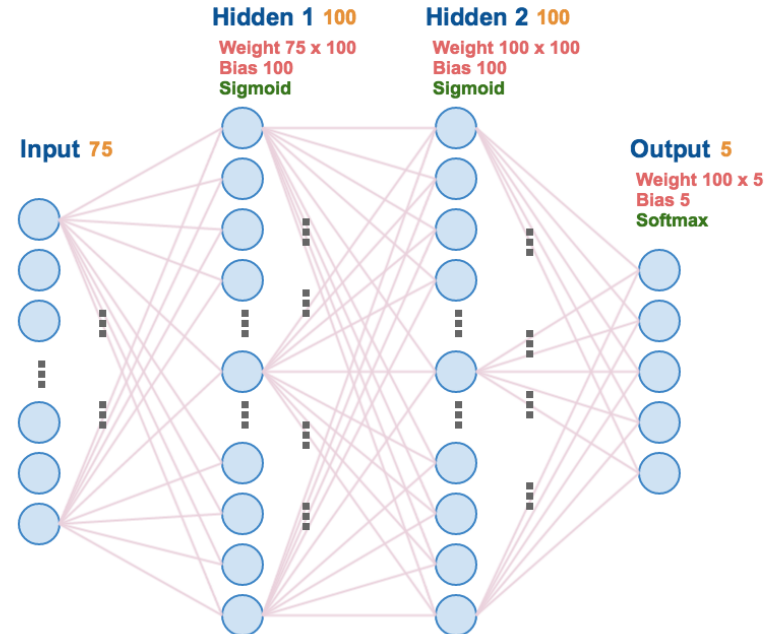 - Try add more hidden layers/neurons.

- **Most Interested:**
  - Try another NN, current NN is a simple forward propagation NN, try implement RNN and CNN.

5. IMPROVEMENT

■ **New structure**

  ■ Cut down hidden neurons
  ■ Cut down inputs
  ■ Use less classes

  ■ It is an overall smaller size NN

5. IMPROVEMENT

■ **New result**

```
Info:   HSI Daily Trend Predict NN, training model
Input: Learning times: 250
Info:   HSI Daily Trend Predict NN, evaluate model
Info:   Evaluate on train data set
Info:   Accuracy:          0.653
Info:   Classes :          U         F         D
Info:   Recall  :          0.618     0.553     0.759
Info:   Precise :          0.739     0.679     0.6
Info:   Counts  :          55        65        79
Info:   Evaluate on test data set
Info:   Accuracy:          0.551
Info:   Classes :          U         F         D
Info:   Recall  :          0.2       0.65      0.785
Info:   Precise :          0.428     0.65      0.5
Info:   Counts  :          15        20        14
```

5. IMPROVEMENT

■ **New result**

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```

6. FUTURE

- **RNN**
- **Online learning machine**

THE END
THANKS