人工智慧投資分析於金融服務商業應用趨勢
(AI Investment Analysis for Finance Services and Business Applications Trends)

時間：2018年12月14日(五) 下午2:00 至 4:00
地點：元大投信 (台北市中山區南京東路三段225號6樓)
主辦單位：證基會/人才培訓中心

Min-Yuh Day
戴敏育
Assistant Professor
Dept. of Information Management, Tamkang University

http://mail.tku.edu.tw/myday/
2018-12-14
Min-Yuh Day, Ph.D.

Publications Co-Chairs, IEEE/ACM International Conference on Advances in Social Networks Analysis and Mining (ASONAM 2013- )

Program Co-Chair, IEEE International Workshop on Empirical Methods for Recognizing Inference in TExt (IEEE EM-RITE 2012- )

Workshop Chair, The IEEE International Conference on Information Reuse and Integration (IEEE IRI)
Outline

1. 前言
2. AI於金融業之商業運用
   – 資料科學
   – 人工智慧投資分析
   – 財務大數據分析
3. 現行人工智慧投資分析探究
4. 個案分析-國內外AI發展現況
5. QA
AI and Big Data Analytics in Finance

• 金融科技 (Spring 2017) (EMBA IMTKU)  
  – (Financial Technology, FinTech)

• 財務金融大數據分析 (Fall 2017) (EMBA IMTKU)  
  – Big Data Analytics in Finance

• 人工智慧投資分析 (Fall 2018) (EMBA IMTKU)  
  – Artificial Intelligence for Investment Analysis

• 智慧金融大數據分析  
  – AI in Finance Big Data Analytics

• 人工智慧與財務應用  
  – Artificial Intelligence and Financial Application
# 人工智慧投資分析 (AIIA) 課程大綱

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<thead>
<tr>
<th>週次 (Week)</th>
<th>日期 (Date)</th>
<th>內容 (Subject/Topics)</th>
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<tbody>
<tr>
<td>1</td>
<td>2018/09/13</td>
<td>人工智慧投資分析課程介紹 (Course Orientation on Artificial Intelligence for Investment Analysis)</td>
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<tr>
<td>2</td>
<td>2018/09/20</td>
<td>AI 金融科技: 金融服務創新應用 (AI in FinTech: Financial Services Innovation and Application)</td>
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<td>3</td>
<td>2018/09/27</td>
<td>機器人理財顧問與AI交談機器人 (Robo-Advisors and AI Chatbots)</td>
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<td>2018/10/04</td>
<td>投資心理學與行為財務學 (Investing Psychology and Behavioral Finance)</td>
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<td>2018/10/11</td>
<td>財務金融事件研究法 (Event Studies in Finance)</td>
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<td>6</td>
<td>2018/10/18</td>
<td>人工智慧投資分析個案研究 I (Case Study on Artificial Intelligence for Investment Analysis I)</td>
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<td>週次 (Week)</td>
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<td>2018/10/25</td>
<td>Python AI投資分析基礎</td>
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<td>(Foundations of AI Investment Analysis in Python)</td>
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<td>2018/11/01</td>
<td>Python Pandas量化投資分析</td>
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<td>(Quantitative Investing with Pandas in Python)</td>
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<td>2018/11/08</td>
<td>Python Scikit-Learn 機器學習</td>
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<td>(Machine Learning with Scikit-Learn In Python)</td>
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<td>期中報告 (Midterm Project Report)</td>
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<td>TensorFlow 深度學習財務時間序列預測 I</td>
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<td>(Deep Learning for Financial Time Series Forecasting with TensorFlow I)</td>
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<td>12</td>
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<td>TensorFlow 深度學習財務時間序列預測 II</td>
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<td>13</td>
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<td>人工智慧投資分析個案研究 II (Case Study on Artificial Intelligence for Investment Analysis II)</td>
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<td>投資組合最佳化與程式交易 (Portfolio Optimization and Algorithmic Trading)</td>
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<td>16</td>
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<td>自然語言處理 (Natural Language Processing)</td>
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<td>2019/01/03</td>
<td>期末報告 I (Final Project Presentation I)</td>
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<td>18</td>
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<td>期末報告 II (Final Project Presentation II)</td>
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Selected Research Publications

• Journal Publications


Selected Research Publications

• Conference Publications


Selected Research Publications

• Conference Publications


Selected Research Publications

• Conference Publications

7. 林建廷、陳元致、王慶宇、鄧旭廷、邱少文、戴敏育，發展人工智慧對話式理財機器人, 第29屆國際資訊管理學術研討會 The 29th International Conference of Information Management (ICIM2018), Taichung, Taiwan, June 3, 2018.

8. 蔡宗霖、劉鈞霖、李家慶、陳品仔、林建廷、戴敏育，人工智慧保險業智能客服, 第29屆國際資訊管理學術研討會 The 29th International Conference of Information Management (ICIM2018), Taichung, Taiwan, June 3, 2018.

9. 陳昭妤、戴敏育，人工智慧自動文本文摘研究, 第29屆國際資訊管理學術研討會 The 29th International Conference of Information Management (ICIM2018), Taichung, Taiwan, June 3, 2018.
人工智能對話式理財機器人

• 榮獲 2018 全國大專校院資訊應用服務創新競賽 資訊應用組 (IP1) 第一名 獎金2萬元
• 榮獲 2018 全國大專校院資訊應用服務創新競賽 玉山銀行金融科技趨勢應用組 第一名，獎金5萬元
• 榮獲 2018 日盛黑客松證券組 第三名，獎金5萬元
• 榮獲 2018 淡江資管畢業專題競賽 第一名，獎金1萬元
AIWISFIN

人工智慧對話式理財機器人

https://www.youtube.com/watch?v=sEhmyoTXmGk
2018第23届大专校院资讯应用服务创新竞赛

荣誉榜

届别 23

第23届

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<td>陳元致、鄧旭廷、王慶宇、邱少文</td>
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</tr>
</tbody>
</table>

https://innoserve.tca.org.tw/award.aspx
AI for Business Applications in Financial Industry
Business Intelligence, Analytics, and Data Science

Source: https://www.amazon.com/Business-Intelligence-Analytics-Data-Science(dp/0134633288
Artificial Intelligence (AI)
Evolution of Computerized Decision Support to Analytics/Data Science

The timeline in Figure 1.8 shows the terminology used to describe analytics since the 1970s. During the 1970s, the primary focus of information systems support for decision making focused on providing structured, periodic reports that a manager could use for decision making (or ignore them). Businesses began to create routine reports to inform decision makers (managers) about what had happened in the previous period (e.g., day, week, month, quarter). Although it was useful to know what had happened in the past, managers needed more than this: They needed a variety of reports at different levels of granularity to better understand and address changing needs and challenges of the business. These were usually called management information systems (MIS). In the early 1970s, Scott-Morton first articulated the major concepts of DSS. He defined DSSs as "interactive computer-based systems, which help decision makers utilize data and models to solve unstructured problems" (Gorry and Scott-Morton, 1971). The following is another classic DSS definition, provided by Keen and Scott-Morton (1978):

Decision support systems couple the intellectual resources of individuals with the capabilities of the computer to improve the quality of decisions. It is a computer-based support system for management decision makers who deal with semistructured problems.

Note that the term decision support system, like management information system and several other terms in the field of IT, is a content-free expression (i.e., it means different things to different people). Therefore, there is no universally accepted definition of DSS.

During the early days of analytics, data was often obtained from the domain experts using manual processes (i.e., interviews and surveys) to build mathematical or knowledge-based models to solve constrained optimization problems. The idea was to do the best with limited resources. Such decision support models were typically called operations research (OR). The problems that were too complex to solve optimally (using linear or nonlinear mathematical programming techniques) were tackled using heuristic methods such as simulation models. (We will introduce these as prescriptive analytics later in this chapter and in a bit more detail in Chapter 6.)

In the late 1970s and early 1980s, in addition to the mature OR models that were being used in many industries and government systems, a new and exciting line of models had emerged: rule-based expert systems. These systems promised to capture experts’ knowledge in a format that computers could process (via a collection of if–then–else rules or heuristics) so that these could be used for consultation much the same way that one...
Business Analytics

Descriptive
- What happened?
- What is happening?
- Enablers: Business reporting, Dashboards, Scorecards, Data warehousing
- Outcomes: Well-defined business problems and opportunities

Predictive
- What will happen?
- Why will it happen?
- Enablers: Data mining, Text mining, Web/media mining, Forecasting
- Outcomes: Accurate projections of future events and outcomes

Prescriptive
- What should I do?
- Why should I do it?
- Enablers: Optimization, Simulation, Decision modeling, Expert systems
- Outcomes: Best possible business decisions and actions

Definition of Artificial Intelligence (A.I.)
Artificial Intelligence

“... the science and engineering of making intelligent machines”

(John McCarthy, 1955)
Artificial Intelligence

“... technology that thinks and acts like humans”
Artificial Intelligence

“... intelligence exhibited by machines or software”
### 4 Approaches of AI

<table>
<thead>
<tr>
<th>Thinking Humanly</th>
<th>Thinking Rationally</th>
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<tbody>
<tr>
<td>Acting Humanly</td>
<td>Acting Rationally</td>
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### 4 Approaches of AI

<table>
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<tr>
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<th>Approaches of AI</th>
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<tbody>
<tr>
<td>1.</td>
<td>Acting Humanly: The Turing Test Approach (1950)</td>
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<td>2.</td>
<td>Thinking Humanly: The Cognitive Modeling Approach</td>
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<td>3.</td>
<td>Thinking Rationally: The “Laws of Thought” Approach</td>
</tr>
<tr>
<td>4.</td>
<td>Acting Rationally: The Rational Agent Approach</td>
</tr>
</tbody>
</table>

AI Acting Humanly: The Turing Test Approach
(Alan Turing, 1950)

- Natural Language Processing (NLP)
- Knowledge Representation
- Automated Reasoning
- Machine Learning (ML)
- Computer Vision
- Robotics

Artificial Intelligence (A.I.) Timeline

1950
TURING TEST
Computer scientist Alan Turing proposes a test for machine intelligence, if a machine can trick humans into thinking it is human, then it has intelligence.

1955
A.I. BORN
Term 'artificial intelligence' is coined by computer scientist, John McCarthy to describe “the science and engineering of making intelligent machines”

1961
UNIMATE
First industrial robot, Unimate, goes to work at GM replacing humans on the assembly line

1964
ELIZA
Pioneering chatbot developed by Joseph Weizenbaum at MIT holds conversations with humans

1966
SHAKEY
The ‘first electronic person’ from Stanford, Shakey is a general-purpose mobile robot that reasons about its own actions

A.I. WINTER
Many false starts and dead-ends leave A.I. out in the cold

1997
DEEP BLUE
Deep Blue, a chess-playing computer from IBM defeats world chess champion Garry Kasparov

1998
KISMET
Cynthia Breazeal at MIT introduces Kismet, an emotionally intelligent robot insofar as it detects and responds to people’s feelings

1999
AIBO
Sony launches first consumer robot pet dog AIBO (Al robot) with skills and personality that develop over time

2002
ROOMBA
First mass produced autonomous robotic vacuum cleaner from iRobot learns to navigate and clean homes

2011
SIRI
Apple integrates Siri, an intelligent virtual assistant with a voice interface, into the iPhone 4S

2011
WATSON
IBM’s question answering computer Watson wins first place on popular $1M prize television quiz show Jeopardy

2014
EUGENE
Eugene Goostman, a chatbot passes the Turing Test with a third of judges believing Eugene is human

2014
ALEXA
Amazon launches Alexa, an intelligent virtual assistant with a voice interface that completes shopping tasks

2016
TAY
Microsoft’s chatbot Tay goes rogue on social media making inflammatory and offensive racist comments

2017
ALPHAGO
Google’s A.I. AlphaGo beats world champion Ke Jie in the complex board game of Go, notable for its vast number of possible positions

Since an early flush of optimism in the 1950s, smaller subsets of artificial intelligence – first machine learning, then deep learning, a subset of machine learning – have created ever larger disruptions.

Artificial Intelligence (AI)

Machine Learning (ML)

Supervised Learning

Unsupervised Learning

Deep Learning (DL)

CNN
RNN LSTM GRU
GAN

Semi-supervised Learning

Reinforcement Learning

Source: https://leonardoaraujosantos.gitbooks.io/artificial-intelligence/content/deep_learning.html
3 Machine Learning Algorithms

Machine Learning (ML) / Deep Learning (DL)

- **Supervised Learning**
  - Decision Tree Classifiers
  - Linear Classifiers
  - Rule-based Classifiers
  - Probabilistic Classifiers
- **Unsupervised Learning**
- **Reinforcement Learning**
- **Deep Learning (DL)**
  - Support Vector Machine (SVM)
  - Neural Network (NN)
  - Deep Learning (DL)
  - Naïve Bayes (NB)
  - Bayesian Network (BN)
  - Maximum Entropy (ME)

Deep Learning and Neural Networks

Input Layer (X)  Hidden Layer (H)  Output Layer (Y)
Deep Learning and Neural Networks

Input Layer (X)

Hidden Layer (H)

Output Layer (Y)
Deep Learning and Neural Networks

Input Layer (X)

Hidden Layers (H)

Output Layer (Y)

Deep Neural Networks
Deep Learning
Time Series Data

\[ [100, 110, 120, 130, 140, 150] \]
Long Short Term Memory (LSTM) for Time Series Forecasting

\[ X_t, X_{t+1}, X_{t+2}, h_{t-2}, h_{t-1}, h_t, h_{t+1}, h_{t+2} \]
## Time Series Data

\[ [10, 20, 30, 40, 50, 60, 70, 80, 90] \]

<table>
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<th>X</th>
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<tr>
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<tr>
<td>[60 70 80]</td>
<td>90</td>
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</table>
Recurrent Neural Networks (RNN)
Recurrent Neural Networks (RNN)

\[ y_t = f(h_t, x_t) \]
\[ h_t = g(h_{t-1}, y_{t-1}) \]
Recurrent Neural Networks (RNN)  
Time Series Forecasting
Recurrent Neural Networks (RNN)

\[ X_t \xrightarrow{h_{t-1}} X_{t-1} \xrightarrow{h_t} X_t \xrightarrow{h_{t+1}} X_{t+1} \xrightarrow{h_{t+2}} X_{t+2} \]

output

hidden

Input

\[ h_{t-2} \xrightarrow{h_{t-1}} h_t \xrightarrow{h_{t+1}} h_{t+2} \]

\[ y \]
Recurrent Neural Networks (RNN)
Time Series Forecasting

\[x_t - 1\]
\[x_t - 2\]
\[y\]

\[h_t - 2\]
\[h_t - 1\]
\[h_t\]
\[h_{t+1}\]
\[h_{t+2}\]
Recurrent Neural Networks (RNN)  
Sentiment Analysis

\[ X_t, X_{t-1}, X_{t-2}, y \]

output

hidden

Input

This movie is very good
Recurrent Neural Networks (RNN) Sentiment Analysis
The Quant Finance PyData Stack

PyThalesians
Zipline
DX Analytics
PyAlgoTrade
QuantLib

StatsModels
Statistics in Python

scikit-learn

matplotlib

pandas

$y_{it} = \beta x_{it} + \mu_t + \epsilon_{it}$

SciPy

NumPy

SymPy

IPython

Python

Jupyter

Source: http://nbviewer.jupyter.org/format/slides/github/quantopian/pyfolio/blob/master/pyfolio/examples/overview_slides.ipynb#5
Python
Scikit-Learn

Machine Learning in Python

- Simple and efficient tools for data mining and data analysis
- Accessible to everybody, and reusable in various contexts
- Built on NumPy, SciPy, and matplotlib
- Open source, commercially usable - BSD license

Classification

Identifying to which category an object belongs to.

Applications: Spam detection, Image recognition.

Algorithms: SVM, nearest neighbors, random forest, ...

— Examples

Regression

Predicting a continuous-valued attribute associated with an object.

Applications: Drug response, Stock prices.

Algorithms: SVR, ridge regression, Lasso, ...

— Examples

Clustering

Automatic grouping of similar objects into sets.

Applications: Customer segmentation, Grouping experiment outcomes

Algorithms: k-Means, spectral clustering, mean-shift, ...

— Examples

Dimensionality reduction

Reducing the number of random variables to consider.

Applications: Visualization, Increased efficiency

Algorithms: PCA, feature selection, non-negative matrix factorization.

— Examples

Model selection

Comparing, validating and choosing parameters and models.

Goal: Improved accuracy via parameter tuning

Modules: grid search, cross validation, metrics.

— Examples

Preprocessing

Feature extraction and normalization.

Application: Transforming input data such as text for use with machine learning algorithms.

Modules: preprocessing, feature extraction.

— Examples

Source: http://scikit-learn.org/
Google TensorFlow

An open source machine learning framework for everyone

GET STARTED

TensorFlow Dev Summit 2019
The 2019 TensorFlow Dev Summit is back March 6-7! Space is limited - request an invite to stay up to date.

TensorFlow 1.12 is here!
TensorFlow 1.12 is available, see the release notes for the latest updates.

High-level APIs in TensorFlow 2.0
By using Keras as the high-level API for the upcoming TensorFlow 2.0 release, we will make it easier for developers new to machine learning to get started while providing advanced capabilities for researchers.

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https://www.tensorflow.org/
Google Dopamine

Dopamine is a research framework for fast prototyping of reinforcement learning algorithms.

https://github.com/google/dopamine
FROM
RESEARCH TO
PRODUCTION

An open source deep learning platform that provides a seamless path from research prototyping to production deployment.

Get Started

KEY FEATURES & CAPABILITIES

http://pytorch.org/
Iris flower data set

setosa  versicolor  virginica

Source: https://en.wikipedia.org/wiki/Iris_flower_data_set
Iris Classification

 Iris dataset


| 5.1, 3.5, 1.4, 0.2, Iris-setosa | 5.8, 4.0, 1.2, 0.2, Iris-setosa |
| 4.9, 3.0, 1.4, 0.2, Iris-setosa | 5.7, 4.4, 1.5, 0.4, Iris-setosa |
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| 5.1, 3.3, 1.7, 0.5, Iris-setosa | 5.1, 3.3, 1.7, 0.5, Iris-setosa |
| 4.8, 3.4, 1.9, 0.2, Iris-setosa | 4.8, 3.4, 1.9, 0.2, Iris-setosa |
| 5.0, 3.0, 1.6, 0.2, Iris-setosa | 5.0, 3.0, 1.6, 0.2, Iris-setosa |
| 5.0, 3.4, 1.6, 0.4, Iris-setosa | 5.0, 3.4, 1.6, 0.4, Iris-setosa |

Species:
- setosa
- virginica
- versicolor
Iris Data Visualization
Data Visualization in Google Colab

https://colab.research.google.com/drive/1KRqtEUd2Hg4dM2au9bfVQKrxWnWN3O9-

Source: https://seaborn.pydata.org/generated/seaborn.pairplot.html
import seaborn as sns
sns.set(style="ticks", color_codes=True)
iris = sns.load_dataset("iris")
g = sns.pairplot(iris, hue="species")

Source: https://seaborn.pydata.org/generated/seaborn.pairplot.html
Machine Learning
Supervised Learning
Classification
and
Prediction
Data Mining and Machine Learning in Google Colab

```python
# Import libraries
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
from pandas.plotting import scatter_matrix

# Import sklearn
from sklearn import model_selection
from sklearn.metrics import classification_report
from sklearn.metrics import confusion_matrix
from sklearn.metrics import accuracy_score
from sklearn.linear_model import LogisticRegression
from sklearn.tree import DecisionTreeClassifier
from sklearn.neighbors import KNeighborsClassifier
from sklearn.discriminant_analysis import LinearDiscriminantAnalysis
from sklearn.naive_bayes import GaussianNB
from sklearn.svm import SVC
from sklearn.neural_network import MLPClassifier

print("Imported")

# Load dataset
names = ['sepal-length', 'sepal-width', 'petal-length', 'petal-width', 'class']
df = pd.read_csv(url, names=names)

df.head(10)
df.tail(10)
df.describe()
df.info()
df.shape
df.groupby('class').size()
plt.rcParams["figure.figsize"] = (10, 8)
df.plot(kind='box', subplots=True, layout=(2,2), sharex=False, sharey=False)
plt.show()
df.hist()
plt.show()
```
# Make predictions on validation dataset
model = SVC()
model.fit(X_train, Y_train)
predictions = model.predict(X_validation)
print("%.4f" % accuracy_score(Y_validation, predictions))
print(confusion_matrix(Y_validation, predictions))
print(classification_report(Y_validation, predictions))
print(model)
model = SVC()
model.fit(X_train, Y_train)
predictions = model.predict(X_validation)

# Make predictions on validation dataset
model = SVC()
model.fit(X_train, Y_train)
predictions = model.predict(X_validation)
print("%.4f" % accuracy_score(Y_validation, predictions))
print(confusion_matrix(Y_validation, predictions))
print(classification_report(Y_validation, predictions))
print(model)

0.9333
[[ 7  0  0]
 [ 0 10  2]
 [ 0  0 11]]

<table>
<thead>
<tr>
<th></th>
<th>precision</th>
<th>recall</th>
<th>f1-score</th>
<th>support</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iris-setosa</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>7</td>
</tr>
<tr>
<td>Iris-versicolor</td>
<td>1.00</td>
<td>0.83</td>
<td>0.91</td>
<td>12</td>
</tr>
<tr>
<td>Iris-virginica</td>
<td>0.85</td>
<td>1.00</td>
<td>0.92</td>
<td>11</td>
</tr>
</tbody>
</table>

avg / total 0.94 0.93 0.93 30

SVC(C=1.0, cache_size=200, class_weight=None, coef0=0.0,  
decision_function_shape='ovr', degree=3, gamma='auto', kernel='rbf',  
max_iter=-1, probability=False, random_state=None, shrinking=True,  
tol=0.001, verbose=False)
Deep Learning for Financial Time Series Forecasting

https://colab.research.google.com/drive/1aEK0eSev8Q-Y0nNY32geFk7CB8pVgSQM

```python
# univariate data preparation
from numpy import array
# split a univariate sequence into samples
def split_sequence(sequence, n_steps):
    X, y = list(), list()
    for i in range(len(sequence)):
        # find the end of this pattern
        end_ix = i + n_steps
        # check if we are beyond the sequence
        if end_ix > len(sequence)-1:
            break
        # gather input and output parts of the pattern
        seq_x, seq_y = sequence[i:end_ix], sequence[end_ix]
        X.append(seq_x)
        y.append(seq_y)
    return array(X), array(y)

# define input sequence
raw_seq = [10, 20, 30, 40, 50, 60, 70, 80, 90]
# choose a number of time steps
n_steps = 3
# split into samples
X, y = split_sequence(raw_seq, n_steps)
# summarize the data
for i in range(len(X)):
    print(X[i], y[i])
```

Source: https://machinelearningmastery.com/how-to-develop-lstm-models-for-time-series-forecasting/
Deep Learning for Financial Time Series Forecasting

https://colab.research.google.com/drive/1aEK0eSev8Q-Y0nNY32geFk7CB8pVgSQM

```python
# univariate lstm example
from numpy import array
from keras.models import Sequential
from keras.layers import LSTM
from keras.layers import Dense
import matplotlib.pyplot as plt

# define dataset
X = array([[100, 110, 120], [110, 120, 130], [120, 130, 140], [130, 140, 150], [140, 150, 160]])
y = array([130, 140, 150, 160, 170])

# reshape from [samples, timesteps] into [samples, timesteps, features]
X = X.reshape((X.shape[0], X.shape[1], 1))

# define model
model = Sequential()
model.add(LSTM(50, activation='relu', input_shape=(3, 1)))
model.add(Dense(1))
model.compile(optimizer='adam', loss='mse')

# fit model
history = model.fit(X, y, epochs=2000, verbose=0)

# demonstrate prediction
x_input = array([[150, 160, 170]])
x_input = x_input.reshape((1, 3, 1))
yhat = model.predict(x_input, verbose=0)

print('yhat', yhat)

print(model.summary())

# list all data in history
print(history.history.keys())

# summarize history for loss
print('loss:', history.history['loss'][-1])

plt.plot(history.history['loss'])
plt.title('model loss')
plt.ylabel('loss')
plt.xlabel('epoch')
plt.show()

yhat [[181.34615]]
```

Source: https://machinelearningmastery.com/how-to-develop-lstm-models-for-time-series-forecasting/
Deep Learning for Financial Time Series Forecasting

https://colab.research.google.com/drive/1aEK0eSev8Q-Y0nNY32geFk7CB8pVgSQM

Source: https://github.com/yash-1337/AAPL_LSTM_Stock_Predictor/blob/master/AAPL_daily_LSTM_stock_predictor.ipynb
AI in FinTech
Robo-Advisors
FinTech high-level classification

Lending  Payments  **Robo Advisors**  Analytics  Others

Profile  Advice  Re-Balance  Indexing

From Algorithmic Trading to Personal Finance Bots: 41 Startups Bringing AI to Fintech

Source: https://www.cbinsights.com/blog/artificial-intelligence-fintech-market-map-company-list/
From Algorithmic Trading To Personal Finance Bots: 41 Startups Bringing AI To Fintech

AI in Fintech

Source: https://www.cbinsights.com/blog/artificial-intelligence-fintech-market-map-company-list/
Artificial Intelligence (AI) in Fintech

General Purpose/ Predictive Analytics
- AYASDI
- Digital Reasoning
- context relevant
- H2O
- Kensho
- Cortical.io
- Numenta
- DataRobot
- Nervana Systems

Market Research & Sentiment Analysis
- Indico
- Acuity Trading
- Lucena Quantitative Analytics
- Numerai
- Dataminr

Search Engine
- Alphasense

Source: https://www.cbinsights.com/blog/artificial-intelligence-fintech-market-map-company-list/
Artificial Intelligence (AI) in Fintech

Quantitative Trading
- sentient technologies
- CLONE ALGO
- Alpaca
- WALNUT ALGORITHMS

AI Assistants/Bots
- KASIST
- TRIM
- Penny
- INSURIFY
- SURE.

Credit Scoring
- TypeScore
- aire
- creditvidya
- zest finance
- ADF
- APPLIED DATA FINANCE

Blockchain
- © Skry
- EUKLID

Debt Collection
- TrueAccord

Personal Banking
- personetics
- SBDA group

Fraud Detection
- feedzai
- BIOCATCH

Source: https://www.cbinsights.com/blog/artificial-intelligence-fintech-market-map-company-list/
Financial Technology
FinTech

“providing financial services by making use of software and modern technology”

Source: https://www.fintechweekly.com/fintech-definition
Financial Services
Financial Services

Source: http://www.crackitt.com/7-reasons-why-your-fintech-startup-needs-visual-marketing/
FinTech:
Financial Services Innovation

1. Payments
2. Insurance
3. Deposits & Lending
4. Capital Raising
5. Investment Management
6. Market Provisioning

Source: http://www3.weforum.org/docs/WEF_The_future__of_financial_services.pdf
FinTech: Investment Management
FinTech: Investment Management
Empowered Investors
Process Externalization
FinTech: Market Provisioning

Source: http://www3.weforum.org/docs/WEF_The_future__of_financial_services.pdf
FinTech: Market Provisioning
Smarter, Faster Machines
New Market Platforms
The New Alpha: 30+ Startups Providing Alternative Data For Sophisticated Investors

New sources of data mined by startups like Foursquare, Premise, and Orbital Insight are letting investors understand trends before they happen.

Source: https://www.cbinsights.com/blog/alternative-data-startups-market-map-company-list/
The New Alpha: 30+ Startups Providing Alternative Data For Sophisticated Investors

Alternative Data Sources

Source: https://www.cbinsights.com/blog/alternative-data-startups-market-map-company-list/
Artificial Intelligence for Conversational Robo-Advisor
AI Conversational Robo-Advisor

AI Portfolio
Asset Allocation

AI Conversation
Dialog System

Multichannel Platforms
## Portfolio Performance in 2016
### Annual Portfolio Statistics

<table>
<thead>
<tr>
<th></th>
<th>Black-Litterman Portfolio - the LSTM Investor Views</th>
<th>Markowitz Portfolio</th>
<th>Equally Weighted Portfolio</th>
<th>S&amp;P 500 Index</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Annual return</strong></td>
<td>16.151%</td>
<td>15.172%</td>
<td>12.428%</td>
<td>9.643%</td>
</tr>
<tr>
<td><strong>Annual volatility</strong></td>
<td>13.897%</td>
<td>14.365%</td>
<td>15.870%</td>
<td>13.169%</td>
</tr>
<tr>
<td><strong>Sharpe ratio</strong></td>
<td>1.14697</td>
<td>1.05534</td>
<td>0.81762</td>
<td>0.76492</td>
</tr>
<tr>
<td><strong>Stability</strong></td>
<td>0.82500</td>
<td>0.82515</td>
<td>0.82514</td>
<td>0.78754</td>
</tr>
<tr>
<td><strong>Max drawdown</strong></td>
<td>-10.105%</td>
<td>-10.465%</td>
<td>-12.529%</td>
<td>-10.306%</td>
</tr>
<tr>
<td><strong>Skew</strong></td>
<td>-0.35652</td>
<td>-0.52985</td>
<td>-0.56976</td>
<td>-0.36795</td>
</tr>
<tr>
<td><strong>Kurtosis</strong></td>
<td>2.49845</td>
<td>3.00613</td>
<td>2.41894</td>
<td>2.21958</td>
</tr>
<tr>
<td><strong>Daily value at risk</strong></td>
<td>-1.688%</td>
<td>-1.750%</td>
<td>-1.948%</td>
<td>-1.619%</td>
</tr>
<tr>
<td><strong>Alpha</strong></td>
<td>0.06445</td>
<td>0.05354</td>
<td>0.02158</td>
<td>0.00000</td>
</tr>
<tr>
<td><strong>Beta</strong></td>
<td>1.01485</td>
<td>1.04816</td>
<td>1.15631</td>
<td>1.00000</td>
</tr>
<tr>
<td><strong>Information ratio</strong></td>
<td>0.10935</td>
<td>0.09129</td>
<td>0.04655</td>
<td>-</td>
</tr>
</tbody>
</table>

Portfolio Cumulative Returns

System Architecture of AI Conversational Robo-Advisor

Cumulative Returns
Markowitz v.s. Black-litterment

Source: Min-Yuh Day, Jian-Ting Lin and Yuan-Chih Chen (2018), "Artificial Intelligence for Conversational Robo-Advisor", in Proceedings of the 2018 IEEE/ACM International Conference on Advances in Social Networks Analysis and Mining (ASONAM 2018), Barcelona, Spain, August 28-31, 2018
Conversational Model
(LINE, FB Messenger)

Conversational Robo-Advisor
Multichannel UI/UX
Robots

ALPHA 2

ZENBO
AI Chatbot for Conversational Commerce
Chatbots: Evolution of UI/UX

<table>
<thead>
<tr>
<th>Paradigm</th>
<th>mid - 80s</th>
<th>mid - 90s</th>
<th>mid - 00s</th>
<th>mid - 10s</th>
</tr>
</thead>
<tbody>
<tr>
<td>Platform</td>
<td>PC</td>
<td>Web</td>
<td>Smartphone</td>
<td>Messaging</td>
</tr>
<tr>
<td>Examples</td>
<td>Desktop</td>
<td>Browser</td>
<td>Mobile OS</td>
<td>Messaging Apps</td>
</tr>
<tr>
<td>DOS, Windows, Mac OS</td>
<td>Mosaic, Explorer, Chrome</td>
<td>iOS, Android</td>
<td>WhatsApp, Messenger, Slack</td>
<td></td>
</tr>
<tr>
<td>Applications</td>
<td>Clients</td>
<td>Website</td>
<td>Apps</td>
<td>Bots</td>
</tr>
<tr>
<td>Excel, PPT, Lotus</td>
<td>Yahoo, Amazon</td>
<td>Angry Birds, Instagram</td>
<td>Weather, Travel</td>
<td></td>
</tr>
<tr>
<td>UI/UX</td>
<td>Native Screens</td>
<td>Web Pages</td>
<td>Native Mobile Screens</td>
<td>Message</td>
</tr>
<tr>
<td>S/w Dev</td>
<td>Client-side</td>
<td>Server-side</td>
<td>Client-side</td>
<td>Server-side</td>
</tr>
</tbody>
</table>

Source: https://bbvaopen4u.com/en/actualidad/want-know-how-build-conversational-chatbot-here-are-some-tools
Chatbot
Dialogue System
Intelligent Agent
Can machines think?

(Alan Turing, 1950)

Chatbot

“online human-computer dialog system with natural language.”

Chatbot Conversation Framework

- **Open Domain**
  - Impossible
  - General AI
    - Hardest
- **Closed Domain**
  - Rules-Based
    - Easiest
  - Smart Machine
    - Hard

- **Retrieval-Based**
  - Impossible
- **Generative-Based**
  - General AI

Source: https://chatbotslife.com/ultimate-guide-to-leveraging-nlp-machine-learning-for-you-chatbot-531ff2dd870c
From E-Commerce to Conversational Commerce: Chatbots and Virtual Assistants

Source: http://www.guided-selling.org/from-e-commerce-to-conversational-commerce/
Conversational Commerce: eBay AI Chatbots

Hotel Chatbot

**BookHotel**

I'd like to book a hotel

Sure, which city?

*New York City*

What date are you leaving?

November 30th, 2016

Are you sure you want to book the hotel in NYC?

Yes

Thank you. The reservation went through successfully.

**Intents**
An intent performs an action in response to natural language user input.

**Utterances**
Spoken or typed phrases that invoke your intent.

**Slots**
Slots are input data required to fulfill the intent.

**Fulfillment**
Fulfillment mechanism for your intent.

Source: https://sdtimes.com/amazon/guest-view-capitalize-amazon-lex-available-general-public/
H&M’s Chatbot on Kik

Source: http://www.guided-selling.org/from-e-commerce-to-conversational-commerce/
Uber’s Chatbot on Facebook’s Messenger

- one main benefit: it loads much faster than the Uber app

Source: http://www.guided-selling.org/from-e-commerce-to-conversational-commerce/
Savings Bot

Mastercard Makes Commerce More Conversational

Bot
Platform
Ecosystem
The bot platform ecosystem
and the emerging giants

Nearly every large software company has announced some sort of bot strategy in the last year. Here’s a look at a handful of leading platforms that developers might use to send messages, interpret natural language, and deploy bots, with the emerging bot-ecosystem giants highlighted.

General AI agents with platforms
Developer access available now or announced

Source: https://www.oreilly.com/ideas/infographic-the-bot-platform-ecosystem
Bot frameworks and deployment platforms

- Wit.ai (Facebook)
- BotKit (Howdy)
- Chatfuel
- Automat (Bot Framework, Microsoft)
- Api.ai (Google)
- Pandorabots
- MindMeld
- Gupshup
- Sequel

Source: https://www.oreilly.com/ideas/infographic-the-bot-platform-ecosystem
Bots Landscape

Bots with traction

Connectors/Shared Services

AI Tools: Natural Language Processing, Machine Learning, Speech & Voice Recognition

Bot Discovery

Bot developer frameworks and tools

Analytics

Messaging

Chatbots

Bot Maturity Model

Customers want to have simpler means to interact with businesses and get faster response to a question or complaint.

Question Answering (QA)
IMTKU Question Answering System for World History Exams at NTCIR-13 QALab-3
IMTKU Textual Entailment System for Recognizing Inference in Text at NTCIR-9 RITE

Department of Information Management
Tamkang University, Taiwan

Min-Yuh Day
myday@mail.tku.edu.tw

Chun Tu
IMTKU Textual Entailment System for Recognizing Inference in Text at NTCIR-10 RITE-2

Department of Information Management
Tamkang University, Taiwan

Min-Yuh Day
Chun Tu
Hou-Cheng Vong
Shih-Wei Wu
Shih-Jhen Huang
IMTKU Textual Entailment System for Recognizing Inference in Text at NTCIR-11 RITE-VAL

Tamkang University

2014

Yu-Hsuan Tai

Yu-An Lin

Shang-Yu Wu

Yu-Hsuan Tai

Cheng-Chia Tsai

Huai-Wen Hsu

Min-Yuh Day

Ya-Jung Wang

Che-Wei Hsu

En-Chun Tu

NTCIR-11 Conference, December 8-12, 2014, Tokyo, Japan
2016
IMTKU Question Answering System for
World History Exams at NTCIR-12 QA Lab2

Department of Information Management
Tamkang University, Taiwan

Min-Yuh Day
Cheng-Chia Tsai
Wei-Chun Chung
Hsiu-Yuan Chang
Tzu-Jui Sun
Yuan-Jie Tsai
Jin-Kun Lin
Cheng-Hung Lee
Yu-Ming Guo
Yue-Da Lin
Wei-Ming Chen
Yun-Da Tsai
Cheng-Jhih Han
Yi-Jing Lin
Yi-Heng Chiang
Ching-Yuan Chien

myday@mail.tku.edu.tw

NTCIR-12 Conference, June 7-10, 2016, Tokyo, Japan
2017

IMTKU Question Answering System for World History Exams at NTCIR-13 QALab-3

Department of Information Management
Tamkang University, Taiwan

myday@mail.tku.edu.tw

NTCIR-13 Conference, December 5-8, 2017, Tokyo, Japan
IMTKU System Architecture for NTCIR-13 QALab-3

Question (XML)

- Complex Essay
- Simple Essay
- True-or-False
- Factoid
- Slot-Filling
- Unique

Question Analysis

- JA&EN Translator
- Stanford CoreNLP
- Wikipedia

Document Retrieval

Answer Extraction

Answer Generation

Answer (XML)

Wikipedia

Word Embedding

Wiki Word2Vec

NTCIR-13 Conference, December 5-8, 2017, Tokyo, Japan
System Architecture of Intelligent Dialogue and Question Answering System

User Question Input

Dialogue Intention Detection

RNN LSTM GRU

AIML Dialogue Engine

AIML KB

Real Time Dialogue API

Cloud Resource

System Response Generator

Answer Generation

Answer Validation

Answer

Document Retrieval

Question Analysis

Deep Learning

TensorFlow

Python NLTK

Dialogue KB

IR

Deep Learning

Cloud Resource

Real Time Dialogue API

System Response Generator

Answer Generation

Answer Validation

Answer

Dialogue Intention Detection

Question Analysis

Document Retrieval

Answer Extraction

Deep Learning

TensorFlow

Python NLTK

Dialogue KB

IR

Deep Learning

Cloud Resource

Real Time Dialogue API

System Response Generator

Answer Generation

Answer Validation

Answer
AI
Dialogue
System
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  - **Smart Machine [Hard]**

- **Retrieval-Based**
- **Generative-Based**

Source: https://chatbotslife.com/ultimate-guide-to-leveraging-nlp-machine-learning-for-you-chatbot-531ff2dd870c
Dialogue System

Short Text Conversation Task (STC-3)
Chinese Emotional Conversation Generation (CECG) Subtask

Source: http://coai.cs.tsinghua.edu.cn/hml/challenge.html
## NTCIR Short Text Conversation

### STC-1, STC-2, STC-3

<table>
<thead>
<tr>
<th></th>
<th>Japanese</th>
<th>Chinese</th>
<th>English</th>
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</thead>
<tbody>
<tr>
<td><strong>NTCIR-12 STC-1</strong></td>
<td>Twitter, Retrieval</td>
<td>Weibo, Retrieval</td>
<td></td>
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<tr>
<td>22 active</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>participants</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>NTCIR-13 STC-2</strong></td>
<td>Yahoo! News,</td>
<td>Weibo, Retrieval+</td>
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<tr>
<td>27 active</td>
<td>Retrieval+</td>
<td>Generation</td>
<td></td>
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<td>participants</td>
<td>Generation</td>
<td></td>
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<td><strong>NTCIR-14 STC-3</strong></td>
<td></td>
<td>Weibo, Generation</td>
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<tr>
<td></td>
<td></td>
<td>for given emotion</td>
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<td></td>
<td></td>
<td>categories</td>
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<tr>
<td></td>
<td>Chinese Emotional</td>
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<td></td>
<td>Conversation</td>
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<tr>
<td></td>
<td>Generation (CECG)</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>subtask</td>
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</tr>
<tr>
<td></td>
<td>Dialogue Quality</td>
<td>Weibo+English</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(DQ) and Nugget</td>
<td>translations,</td>
<td></td>
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<tr>
<td></td>
<td>Detection (ND)</td>
<td>distribution</td>
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<td></td>
<td>subtasks</td>
<td>estimation for</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>subjective</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>annotations</td>
<td></td>
</tr>
</tbody>
</table>

**Source:** [https://waseda.app.box.com/v/STC3atNTCIR-14](https://waseda.app.box.com/v/STC3atNTCIR-14)
The 14th NTCIR (2018 - 2019)

NTCIR (NII Testbeds and Community for Information access Research) Project

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NTCIR-14

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NTCIR-14

The 14th NTCIR (2018 - 2019)
Evaluation of Information Access Technologies

January 2018 - June 2019

What's New

- February 1, 2018: Call for participation to the NTCIR-14 Kick-Off Event released.
- February 1, 2018: Call for participation to the NTCIR-14 QALab-Polinfo Kick-Off Event released.

December 5, 2017: The NTCIR-14 Task Selection Committee has selected the following six Tasks. Lifelig-3, OpenLiveQ-2, QA Lab-4, STC-3, WWW-2, CENTRE.

August 23, 2017: NTCIR-14 Call for Task Proposals released. (Closed.)

About Proceedings

After the NTCIR-14 conference, a post-proceedings of revised selected papers will be published in the Springer Lecture Notes on Computer Science (LNCS) series.

http://research.nii.ac.jp/ntcir/ntcir-14/index.html
NTCIR-14 STC-3
Short Text Conversation Task (STC-3)
Chinese Emotional Conversation Generation (CECG) Subtask

Call for Participation

In recent years, there has been a rising tendency in AI research to enhance Human-Computer Interaction by humanizing machines. However, to create a robot capable of acting and talking with a user at the human level requires the robot to understand human cognitive behaviors, while one of the most important human behaviors is expressing and understanding emotions and affects. As a vital part of human intelligence, emotional intelligence is defined as the ability to perceive, integrate, understand, and regulate emotions. Though a variety of models have been proposed for conversation generation from large-scale social data, it is still quite challenging (and yet to be addressed) to generate emotional responses.

In this challenge, participants are expected to generate Chinese responses that are not only appropriate in content but also adequate in emotion, which is quite important for building an empathic chatting machine. For instance, if user says “My cat died yesterday”, the most appropriate response may be “It’s so sad, so sorry to hear that” to express sadness, but also could be “Bad things always happen, I hope you will be happy soon” to express comfort.

Previous Evaluation Challenge at NLPCC 2017
Overview of the NLPCC 2017 Shared Task: Emotion Generation Challenge

http://www.aihuang.org/p/challenge.html
Short Text Conversation (NTCIR-13 STC2) Retrieval-based

Given a new post, can a **coherent** and **useful** comment be returned by searching a post-comment repository?

Short Text Conversation (NTCIR-13 STC2) Generation-based method

Given a new post, can a fluent, coherent and useful comment be generated?

post-comment repository

post
comment

comment

post
comment

comment

post
comment

comment

generated comment

generated comment

generated comment

Used to train the generator

Given post:
The man who cooks and loves dogs is very handsome!

<table>
<thead>
<tr>
<th>Response</th>
<th>Chinese / Translated English</th>
<th>Emotion Class</th>
<th>Coherence and Fluency</th>
<th>Emotion Consistency</th>
<th>Label</th>
</tr>
</thead>
<tbody>
<tr>
<td>Response 1</td>
<td>会做饭的男人是很帅的啊。 The man who cooks is handsome.</td>
<td>喜欢 Like</td>
<td>Yes</td>
<td>Yes</td>
<td>2</td>
</tr>
<tr>
<td>Response 2</td>
<td>哈哈，我也觉得。 Haha, I feel the same way.</td>
<td>喜欢 Like</td>
<td>Yes</td>
<td>No</td>
<td>1</td>
</tr>
<tr>
<td>Response 3</td>
<td>这是哪部电影里的？ Which movie is this from?</td>
<td>厌恶 Disgust</td>
<td>No</td>
<td>Yes</td>
<td>0</td>
</tr>
<tr>
<td>Response 4</td>
<td>哈哈,你也是。 Haha, the same to you.</td>
<td>喜欢 Like</td>
<td>No</td>
<td>No</td>
<td>0</td>
</tr>
<tr>
<td>Response 5</td>
<td>我爱你会。 I love you, will you.</td>
<td>厌恶 Disgust</td>
<td>No</td>
<td>Yes</td>
<td>0</td>
</tr>
<tr>
<td>Response 6</td>
<td>这是同主义同的道！ This is the same way of the same doctrine!</td>
<td>厌恶 Disgust</td>
<td>No</td>
<td>No</td>
<td>0</td>
</tr>
</tbody>
</table>

NLPCC
Emotion Classification Challenge
6 classes (64%)

• 0: Other
• 1: Like
• 2: Sadness
• 3: Disgust
• 4: Anger
• 5: Happiness

Source: http://coai.cs.tsinghua.edu.cn/hml/challenge/dataset_description/
### Chinese Emotional Conversation Generation (CECG)

<table>
<thead>
<tr>
<th>Post (Given)</th>
<th>Emotion Category (Given)</th>
<th>Response (to be generated)</th>
</tr>
</thead>
<tbody>
<tr>
<td>爱狗还会做饭的男人，最帅了！</td>
<td>喜欢</td>
<td>会做饭的男人是很帅的啊。</td>
</tr>
<tr>
<td>The man who cooks and loves dogs is very handsome!</td>
<td>Like</td>
<td>The man who cooks is handsome.</td>
</tr>
<tr>
<td>爸爸，明天是六一啦，带我出去玩吧！</td>
<td>喜欢</td>
<td>好，一定带。</td>
</tr>
<tr>
<td>Daddy, tomorrow is June 1th Children’s Day. Please take me out to play!</td>
<td>Like</td>
<td>Yes, of course.</td>
</tr>
<tr>
<td>被特别在乎的人忽略，会很难过，而装做不在乎，会更难过。</td>
<td>悲伤</td>
<td>因为在乎，所以在乎。</td>
</tr>
<tr>
<td>It's sad to be ignored by someone that you really care, and it's harder to pretend that you don't care.</td>
<td>Sadness</td>
<td>I am concerned with it, because I care about it.</td>
</tr>
<tr>
<td>冰天雪地的哈尔滨！你要冻死我咋地？！？！</td>
<td>喜欢</td>
<td>注意保暖，小心别感冒！</td>
</tr>
<tr>
<td>Harbin is in the snow! Are you going to freeze me to death?!?!</td>
<td>Like</td>
<td>Keep warm. Watch out for getting cold!</td>
</tr>
<tr>
<td>本来想学一把沧桑，结果令我更恍伤。</td>
<td>悲伤</td>
<td>这是一个悲伤的故事。</td>
</tr>
<tr>
<td>I wanted to learn the vicissitudes of life, but I became sadder.</td>
<td>Sadness</td>
<td>It a sad story.</td>
</tr>
<tr>
<td>今天一整天都在海边训练。虽然很累，但还是很开心的！</td>
<td>快乐</td>
<td>是的呢，开心！</td>
</tr>
<tr>
<td>I have been training at the seaside all day. Though very tired, I still very happy!</td>
<td>Happiness</td>
<td>Yeah, happy!</td>
</tr>
</tbody>
</table>

Source: [http://coai.cs.tsinghua.edu.cn/hml/challenge/task_definition/]
Sample responses generated by Seq2Seq and ECM (Emotional Chatting Machine)

<table>
<thead>
<tr>
<th>Post</th>
<th>Model</th>
<th>Response (Original)</th>
<th>Response (Translated)</th>
</tr>
</thead>
<tbody>
<tr>
<td>承诺，就是一个骗子说给一个傻子听的。A promise is what a cheater says to a fool.</td>
<td>Seq2Seq</td>
<td>承诺，就是一个骗子说给一个傻子听的。</td>
<td>A promise is what a cheater says to a fool.</td>
</tr>
<tr>
<td>马路</td>
<td>ECM</td>
<td>像一个</td>
<td>Promise is a single-minded fool</td>
</tr>
<tr>
<td>小孩</td>
<td></td>
<td>专一的傻子</td>
<td>I'm just a happy fool</td>
</tr>
<tr>
<td>伤心</td>
<td></td>
<td>悲伤的傻子</td>
<td>I am a sad fool</td>
</tr>
<tr>
<td>恶心</td>
<td></td>
<td>一个骗子说给一个傻子听</td>
<td>A cheater says to a fool</td>
</tr>
<tr>
<td>恼怒</td>
<td></td>
<td>不管你信不信，反正我信了！</td>
<td>Whatever you believe or not, I trust in it!</td>
</tr>
<tr>
<td>知道真相的我眼泪掉下来。Knowing the truth, I burst into tears.</td>
<td>Seq2Seq</td>
<td>知道真相的我眼泪掉下来。</td>
<td>After knowing the truth, I burst into tears.</td>
</tr>
<tr>
<td>喜欢</td>
<td>ECM</td>
<td>太可爱了，太可爱了！</td>
<td>Too lovely, it's too lovely.</td>
</tr>
<tr>
<td>高兴</td>
<td></td>
<td>笑得我眼泪都出来了。</td>
<td>I can't help laugh myself to tears.</td>
</tr>
<tr>
<td>伤心</td>
<td></td>
<td>知道真相的我眼泪掉下来。</td>
<td>After knowing the truth, I burst into tears.</td>
</tr>
<tr>
<td>恶心</td>
<td></td>
<td>这是真的还是假的？</td>
<td>Is this true?</td>
</tr>
<tr>
<td>恼怒</td>
<td></td>
<td>什么意思？没看懂。</td>
<td>What do you mean? I don’t understand.</td>
</tr>
</tbody>
</table>

Sample responses generated by Seq2Seq and ECM (Emotional Chatting Machine)

<table>
<thead>
<tr>
<th>Post</th>
<th>Model</th>
<th>Response(Original)</th>
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<tr>
<td>承诺, 就是一个骗子说给一个傻子听的。 A promise is what a cheater says to a fool.</td>
<td>Seq2Seq</td>
<td>承诺，就是一个骗子说给一个傻子听的。</td>
</tr>
<tr>
<td></td>
<td>ECM</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Like</td>
<td>承诺是一个专一的傻子</td>
</tr>
<tr>
<td></td>
<td>Happy</td>
<td>我就是一个开心的傻子</td>
</tr>
<tr>
<td></td>
<td>Sad</td>
<td>我就是一个悲伤的傻子</td>
</tr>
<tr>
<td></td>
<td>Disgust</td>
<td>一个骗子说给一个傻子听</td>
</tr>
<tr>
<td></td>
<td>Angry</td>
<td>不管你信不信，反正我信了！</td>
</tr>
</tbody>
</table>

Summary

1. 前言

2. AI於金融業之商業運用
   - 資料科學
   - 人工智慧投資分析
   - 財務大數據分析

3. 現行人工智慧投資分析探究

4. 個案分析-國內外AI發展現況

5. QA
人工智慧投資分析於金融服務商業應用趨勢
(AI Investment Analysis for Finance Services and Business Applications Trends)

時間：2018年12月14日(五) 下午2:00 至 4:00
地點：元大投信 (台北市中山區南京東路三段225號6樓)
主辦單位：證基會/人才培訓中心

Min-Yuh Day
戴敏育
Assistant Professor
Dept. of Information Management, Tamkang University

http://mail.tku.edu.tw/myday/
2018-12-14
References


