

# Predicting Financial Time Series using Deep Learning

## Module1. Introduction to the course

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# The Future of Asset Management

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“Worldwide, by 2025 we expect AI technologies to reduce employees in the capital markets by 230,000 people. **The asset management industry will shrink most, with around 90,000 people being replaced by machines.**” (Optimas, 2018)

## LEVERAGING MACHINE LEARNING STRATEGIES FOR HEDGE FUND GAINS

Bloomberg

LATEST NEWS MACHINE

by Kamalika Some / Oct

### The Massive Hedge Fund Betting on AI

Initially wary  
Group was so  
from algorithm

### Artificial Intelligence in Capital Markets: The Next Operational Revolution

author: Axel Pierron | date: 2017-03-01

# The Future of Asset Management

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Change is Coming!



# Deep Learning: Financial Time Series Prediction

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- Welcome to “Predicting Financial Time Series using Deep Learning”
- This session is designed to learn a framework for predictive trading using deep learning
- We mainly focus on stock / coin price prediction based on deep learning, pursuing the most essential algorithms

# Motivation of This Session

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- Don't have a boss. Be the boss with AI.
- What is the most important thing of systematic trading?
  - Alpha generating capability

“**Alpha** is a measure of the active return on an investment, the performance of that investment compared with a suitable market index. An alpha of 1% means the investment's return on investment over a selected period of time was 1% better than the market during that same period.” (wikipedia)

- Why Deep Learning Approach?
  - Deep Learning performs much better than other traditional methods in predictive analytics

# Goals of This Session

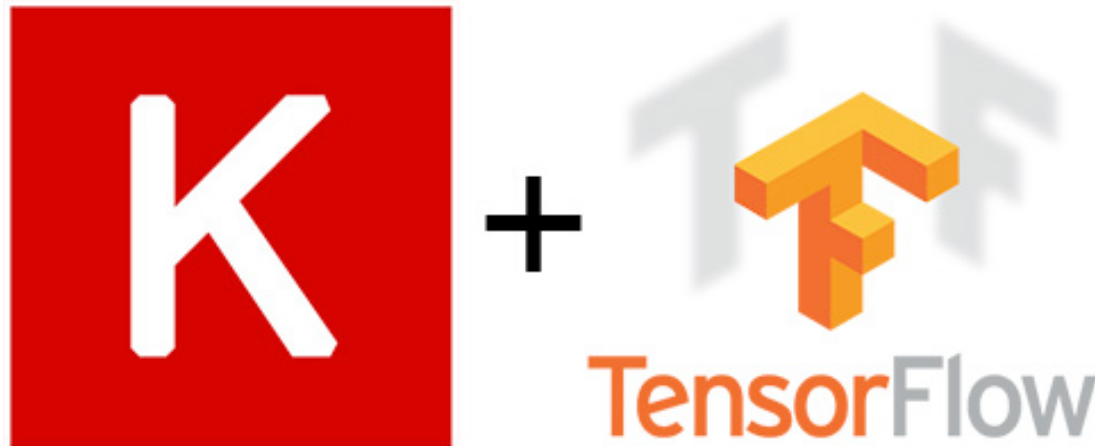
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- Implement three neural network models from the simple model to advanced models with cryptocurrency data
- Understand the problems with financial time series predictions and advantages/disadvantages of machine learning
- Learn how to implement FNN, CNN, RNN models using Tensorflow Keras API on [Google Colaboratory](<https://colab.research.google.com/>)
- Learn which metrics could be important for robustness of time series prediction algorithms

# Why Do We Use Tensorflow Keras API?

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- Keras is a simple, high-level neural networks library
- Proper level of abstraction for this session
- You can probably learn the basics of Keras in 5-10 minute



# Four Modules of This Session

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- Module 1. Deep Learning Revisiting
- Module 2. RNN Model for Price Prediction
- Module 3. CNN Encoder + RNN Model for Price Prediction
- Module 4. Wavelet Denoising + Auto Encoder Model + RNN Prediction Model for Price Prediction



# How to Study by Yourself in This Session

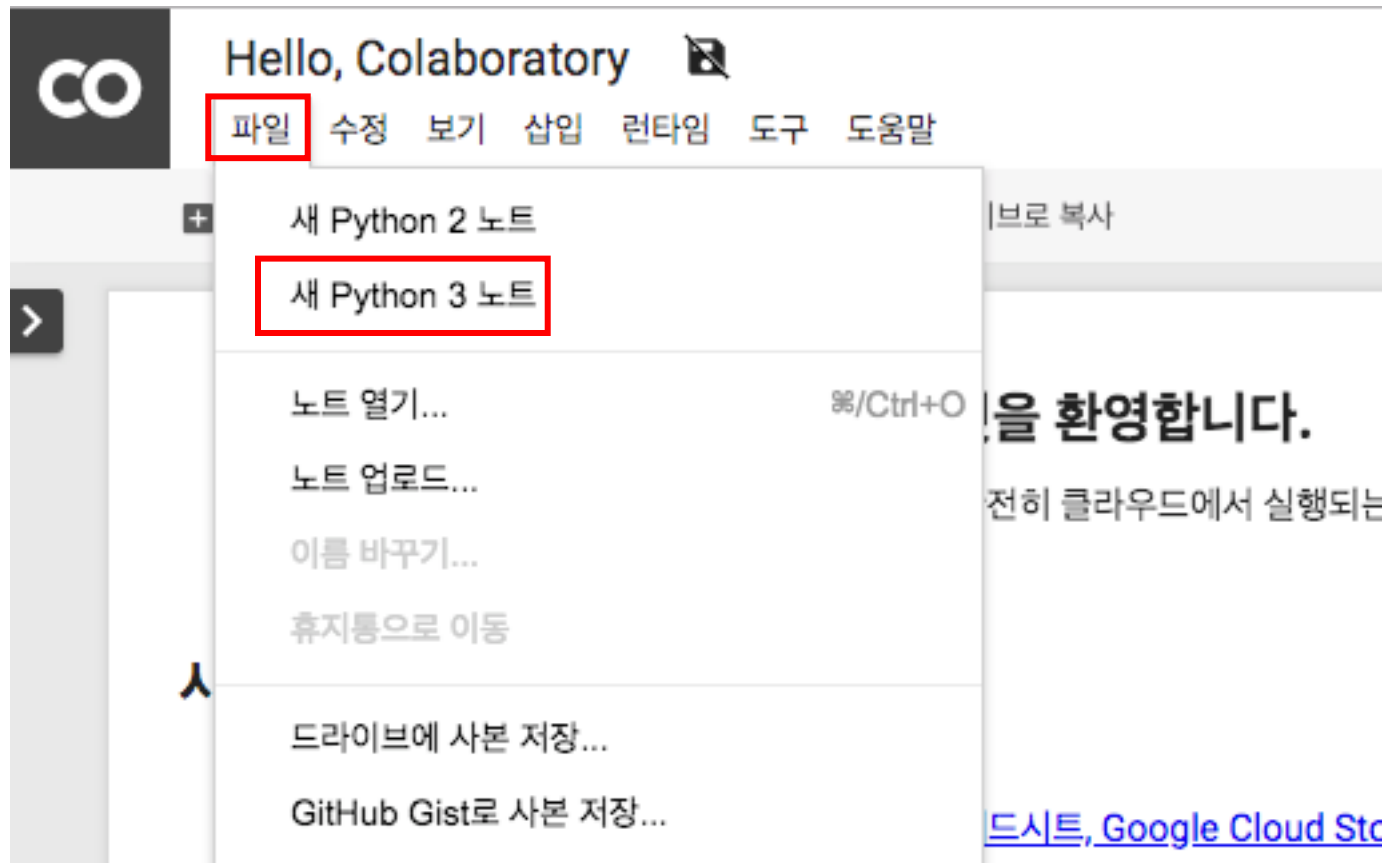
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- Write code
  - There will be suggested exercise with template codes
  - At the end of each module, solutions will be given
  - But I strongly recommend write the code by yourself
- Using the Q&A is a must (I want you to succeed)
- Where to get the code and data (will be updated weekly)
  - <https://github.com/jonghkim/financial-time-series-prediction-v2>
  - git clone url or download zip from page

# Quick Tutorial for Google Colab

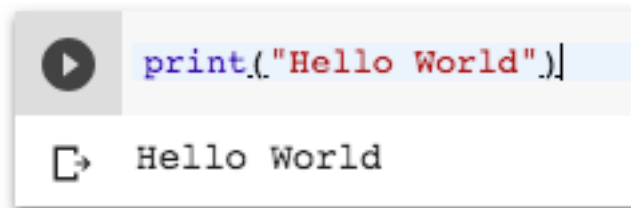
# Hello World on Colab

Access to URL: <https://colab.research.google.com/notebooks/welcome.ipynb#recent=true>



# Hello World on Colab

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A screenshot of a Google Colab code cell. The top part shows a play button icon and the code `print("Hello World")` with syntax highlighting. The bottom part shows a copy icon and the output `Hello World`.

```
print("Hello World")  
Hello World
```

- `print("Hello World")`
- Click button or type “CTRL + ENTER”

# File Upload on Colab

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Access to URL: <https://colab.research.google.com/notebooks/io.ipynb>

```
▶ from google.colab import files  
uploaded = files.upload()  
  
for fn in uploaded.keys():  
    print('User uploaded file "{name}" with length {length} bytes'.format(  
        name=fn, length=len(uploaded[fn])))
```



파일 선택    선택된 파일 없음

Cancel upload

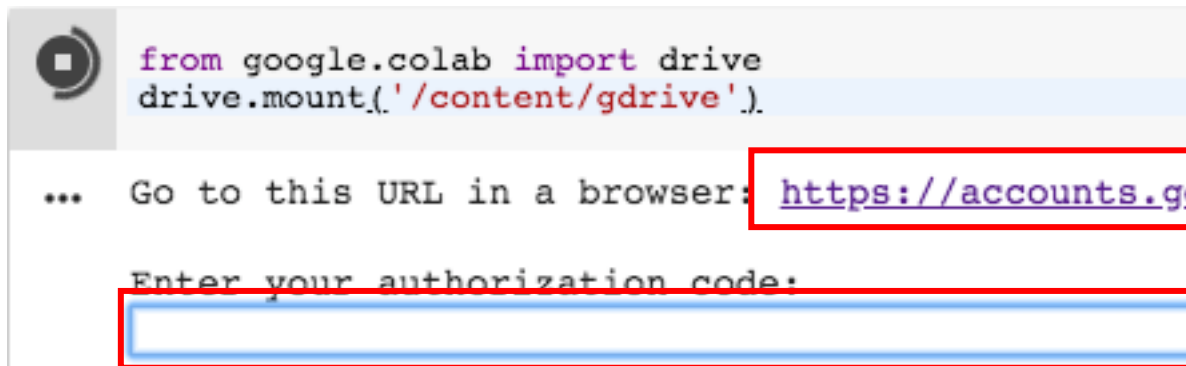
# Google Drive Access on Colab

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- First Step: Upload your data on Google Drive

<http://drive.google.com>

- Second Step: Enter Authentication Code on Google Colab



The screenshot shows the Google Colab interface. At the top, there is a code editor with the following code: 

```
from google.colab import drive
drive.mount('/content/gdrive').
```

 Below the code editor, there is a message: "... Go to this URL in a browser: <https://accounts.google.com/ConnectAuth?continue=https://colab.research.google.com/#c=1234567890>". The URL is highlighted with a red box. Below the URL, there is a prompt: "Enter your authorization code:". Below the prompt, there is a text input field, which is also highlighted with a red box.

• Go to Url

• Type Code

# Check Data Available on Google Drive

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- `!ls "/content/gdrive/My Drive/"`

```
[ ] !ls "/content/gdrive/My Drive/Lecture/StudyPie/Data"
```

```
↳ crypto_data.zip  kagglecatsanddogs_3367a.zip  PetImages.zip
```

# Set GPU on Colab



## 노트 설정

런타임 유형

Python 3

하드웨어 가속기

GPU

☐ 이 노트를 저장할 때 코드 셀 출력 생략

취소

저장



# Google Colaboratoy Useful Shortcuts

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Actions	Colab	Jupyter
show keyboard shortcuts	Ctrl/Cmd M H	H
Insert code cell above	Ctrl/Cmd M A	A
Insert code cell below	Ctrl/Cmd M B	B
Delete cell/selection	Ctrl/Cmd M D	DD
Interrupt execution	Ctrl/Cmd M I	II
Convert to code cell	Ctrl/Cmd M Y	Y
Convert to text cell	Ctrl/Cmd M M	M
Split at cursor	Ctrl/Cmd M -	Ctrl Shift -

Thank you ☺

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# Appendix1. For Machine Learning Beginner

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- Although we will review essential concepts of machine learnings, this session recommends to study below lectures in parallel for beginners

- 모두를 위한 딥러닝 강좌

[https://www.youtube.com/watch?v=BS6O0zOGX4E&list=PLlMkM4tgfjnLSOjrEJN31gZATbcj\\_MpUm](https://www.youtube.com/watch?v=BS6O0zOGX4E&list=PLlMkM4tgfjnLSOjrEJN31gZATbcj_MpUm)

## Appendix2. How to Download Files on Github

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