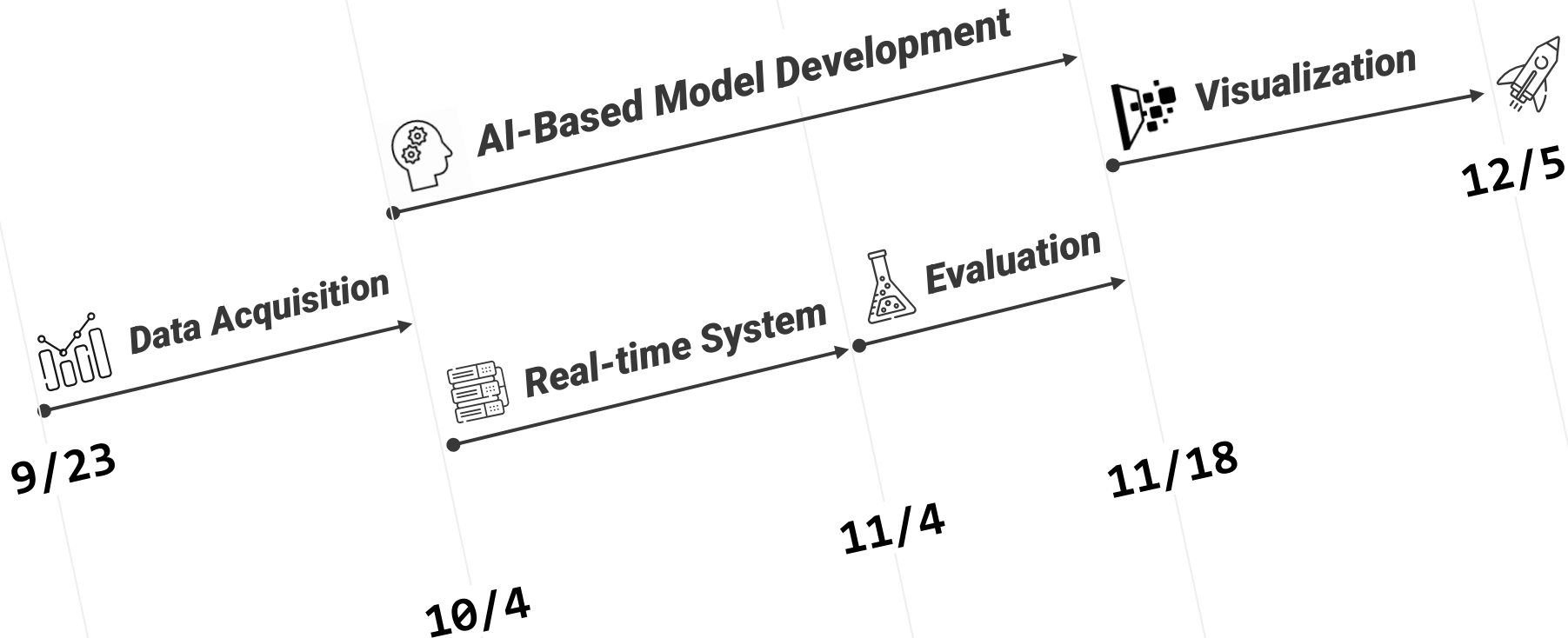




# Timeline

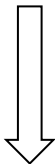




# Visualization

❑ Two ways of Visualization

1. Grad CAM
2. Attention of Transformer



We can not use the both method 😞

Why?

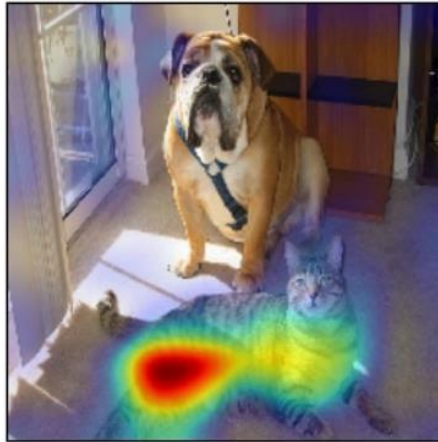


# Visualization

## □ Grad CAM

Original Paper : Grad-CAM: Visual Explanations from Deep Networks via Gradient-based Localization

Grad-CAM was originally invented for 2D-Data which must be propagated through 2D-ConvNet.





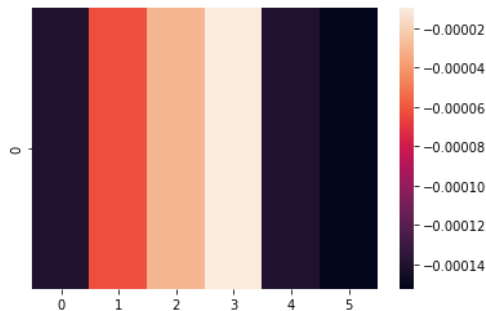
# Visualization

## □ Grad CAM

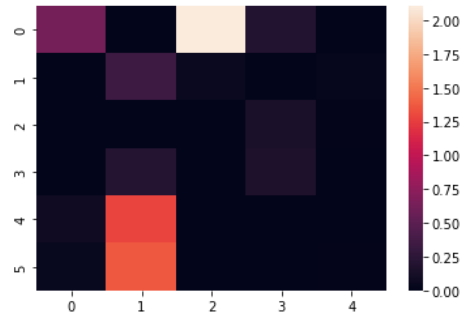
Our Data Shape :  $N \times 6 \times 8$

$N$  : data number,  $6$  : time,  $8$  : features

- We use 1D-CNN, so our grad-CAM result is also 1-dimensional.



- What we actually get (1D Heatmap)



- What we want to get (2D Heatmap)



# Visualization

## □ Grad CAM

Then, should we use 2D-ConvNet?

1. The model lose its accuracy for prediction because we treat each features with filter, not treating them as independents channels.
1. Since we use too small 2D dataset (6X8), we can not resolve the problem of low resolution.
  - Low resolution problem arises because 2D-ConvNet continually shrinks its feature map size.

(e.g) Input data size: 224X224X3 >>> At the end of 2D-ConvNet 14X14X1024)

$$\alpha_k^c = \overbrace{\frac{1}{Z} \sum_i \sum_j}^{\text{global average pooling}} \underbrace{\frac{\partial y^c}{\partial A_{ij}^k}}_{\text{gradients via backprop}}$$

$$L_{\text{Grad-CAM}}^c = ReLU \left( \underbrace{\sum_k \alpha_k^c A^k}_{\text{linear combination}} \right)$$

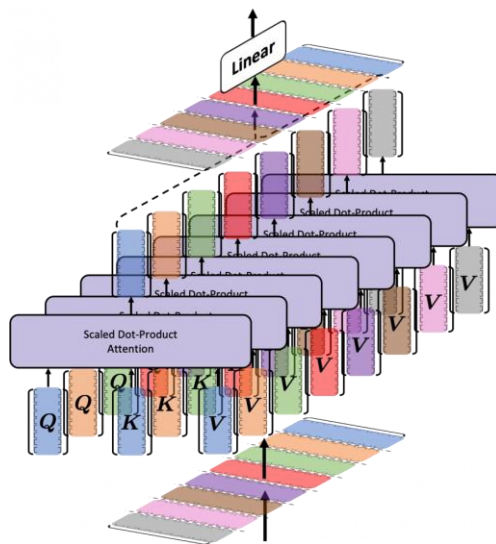


# Visualization

## □ Attention

Same problem with 2D-grad-CAM.

- Since attention aggregates feature dimension, we can not get 2-dimensional important weights.





# Visualization

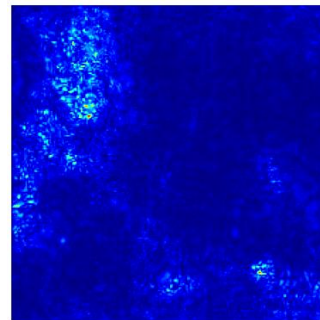
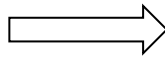
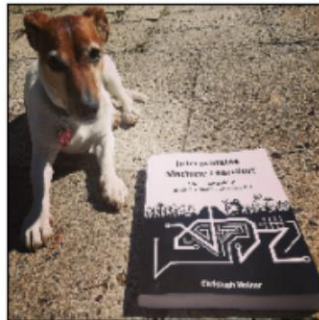
## ❑ Alternative visualization (Traditional Pixel Attribution)

We can get what we want more simpler way. Just get gradient saliency map !

- Many visualization methods have been designed for 2D-data, ConvNet. However, we use very simple and low dimensional time-series data.

### ❑ Method

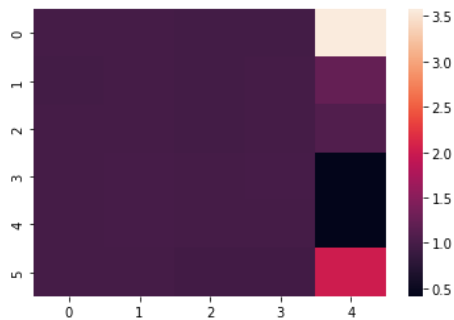
1. Feedforward data with pre-trained model
2. Backpropagate its gradient with maximum  $Y^c$  score over each data.
3. Regard the gradients as important weights



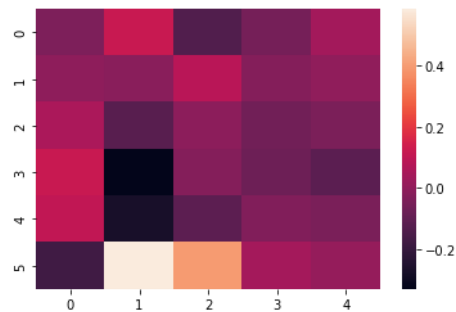


# Visualization

## Result



➤ Input data



➤ Its gradient

Succeed to easily retrieve 2D-gradient for each data. 😊





# Real-time System

- AI model 서버에서 client로 Decision Confidence 송신
  - [0, 1, 2]의 출력 (하향 예측, 횡보 예측, 상향 예측)을 가지며 결과가 2일 경우 해당 종목 코드를 기록
  - 각 class에 대한 confidence를 기록
- 기록된 종목코드를 'buy' tag와 같이 GUI client로 송신
- 기록된 confidence를 'confidence' tag와 같이 GUI client로 송신

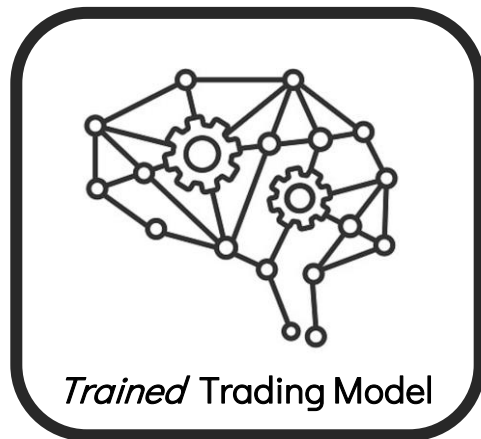


GUI Client

['buy', '001230', '002852', ...]



['confidence', [[0.20, 0.33, 0.47],  
[0.81, 0.09, 0.10], ... ]]



AI model Server



# Real-time System

- Client는 confidence 수신 후 class 2 [buy]의 confidence에 따라 배경색 변경

Coturnix

계좌번호: 8012504311 주문가능금액: 94342540

	종목코드	종목명	시가	고가	저가	현재가	거래량
10	149480	오픈베이스	3220	3455	3155	3415	2401126
11	154920	한컴위드	9140	9990	9050	9650	1278364
12	160480	국일신동	3970	4150	3870	3895	403588
13	162970	피파아이	3615	4360	3615	3980	1171233
14	171280	로체시스템즈	5500	6170	5490	5740	2657296
15	178130	국일제지	4080	4300	4080	4160	783661
16	190470	제이스텍	7740	8300	6920	6930	2089689
17	191990	셀트리온헬스케...	86700	86900	82900	84000	766781
18	195500	미래나노텍	4140	4535	4125	4510	1157349
19	36510	에디슨EV	33100	35500	32400	32750	1053399
20	89860	서전기전	8100	8490	7800	7840	485290
21	108710	바이오로그디바...	3890	4100	3575	3605	14270901
22	22980	한국맥날티	7530	7900	7420	7610	641873
23	37750	피앤씨테크	6980	8240	6950	7910	593692
24	63800	데이터솔루션	6380	7450	6030	7200	3890628
25	103530	이노맵	33100	33850	31350	32350	1788903
26	106620	네온테크	4900	5280	4415	4600	2587722
27	111320	지오엘리먼트	29100	36800	28200	34350	705727
28	167000	플래티어	26650	31150	26650	28900	2502323

[10:28:37] [Update] 누리플렉스 040160

[10:28:37] [Update] 미래나노텍 095500

[10:28:37] [Update] 에스엠코어 007820

[10:28:37] [Update] 누리플렉스 040160

[10:28:37] [Update] 드래곤플라이 030350

[10:28:37] [Update] 서전기전 189860

[10:28:37] [Update] 누리플렉스 040160

[10:28:37] [Update] 드래곤플라이 030350

[10:28:37] [Update] 네온테크 306620

[10:28:37] [Update] 바이오로그디바이스 208710

[10:28:37] [Update] 누리플렉스 040160

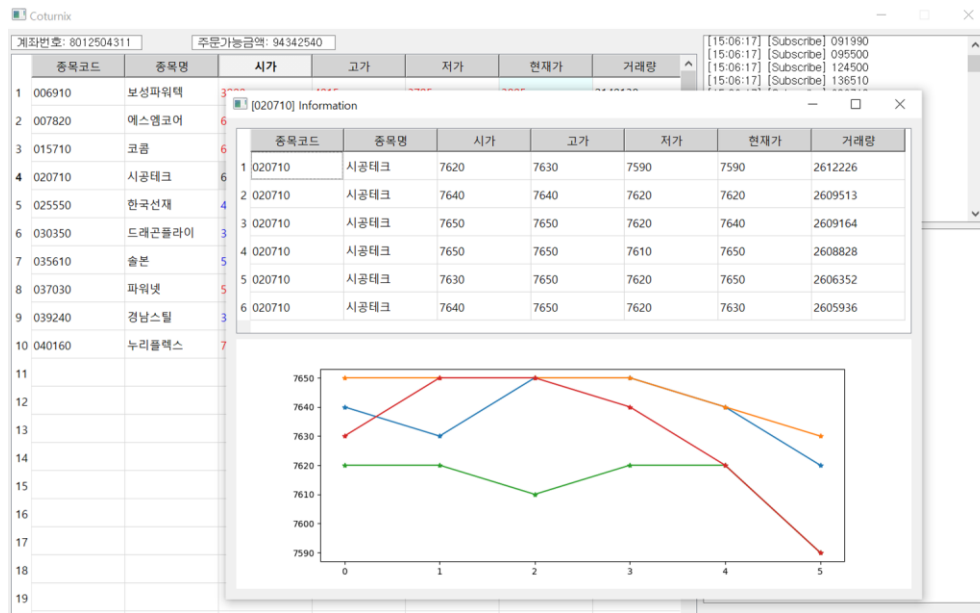
[10:28:37] [Update] 에스엠코어 007820

[10:28:37] [Update] 오픈베이스 049480



# Real-time System

- ❑ 종목 더블 클릭시 상세 정보 및 그래프 출력
- ❑ (예정사항) 이후 input에 대한 heatmap 수신시 Thread 를 통한 실시간 갱신





# Real-time System

 Demo Video

