



# 수신호 인식과 표정 인식을 이용한 위기 상황 인지

발표자 : 황준하

고려대학교 실전문제연구단

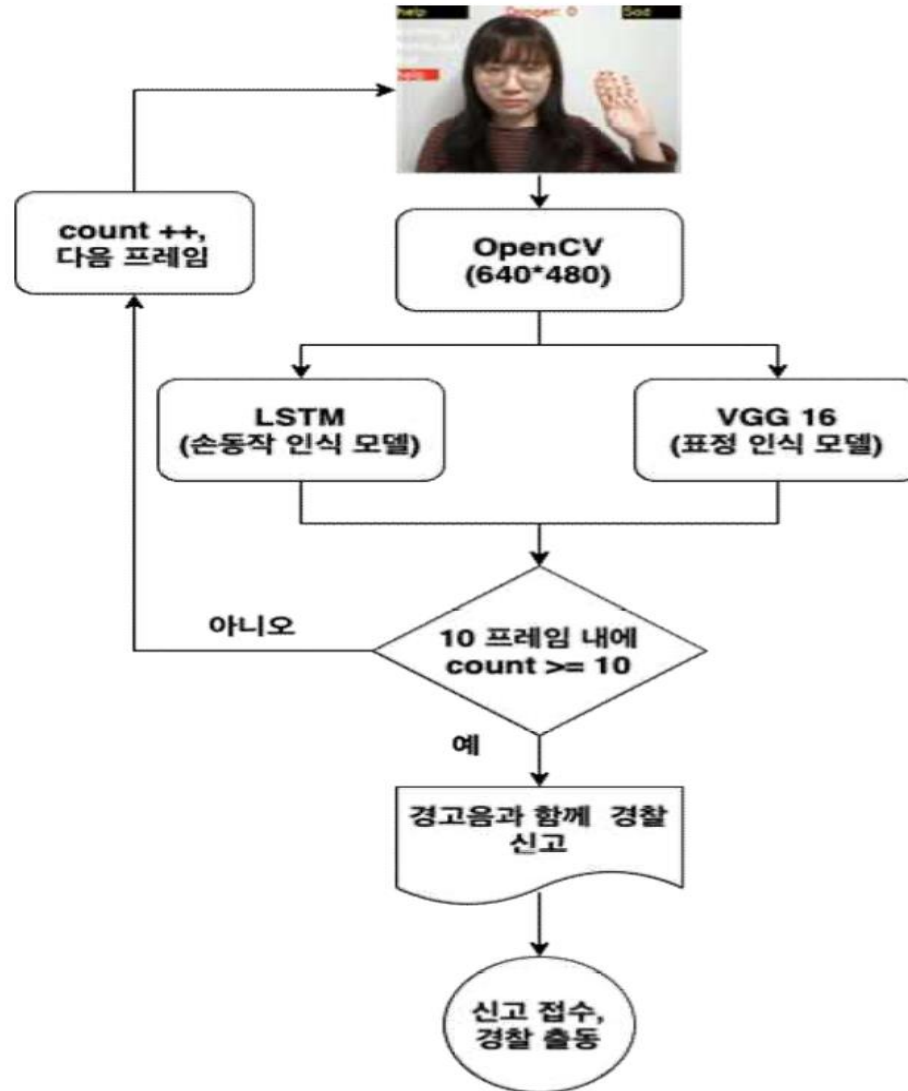
# Background

- 코로나 이전부터 꾸준히 증가하던 가정폭력 현황.
  - 코로나 이후, 가정폭력 신고 건수 감소.
- => '피해자 신고 불가능 상황 지속' 예상

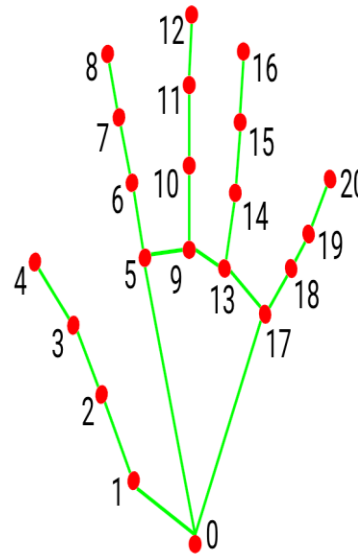
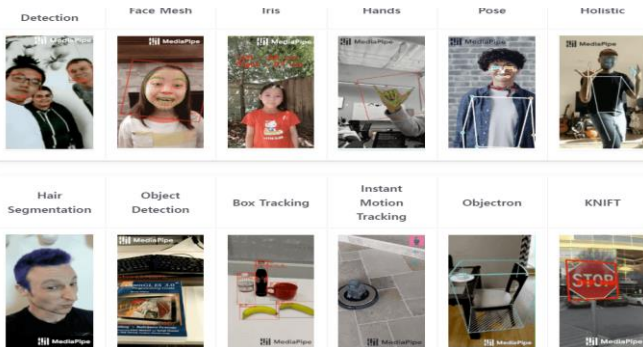


=> 문제 인식 후, 해당 문제 해결을 위한 알고리즘 구현

# Algorithm Flow



# Gesture Model *(Data Collection)*

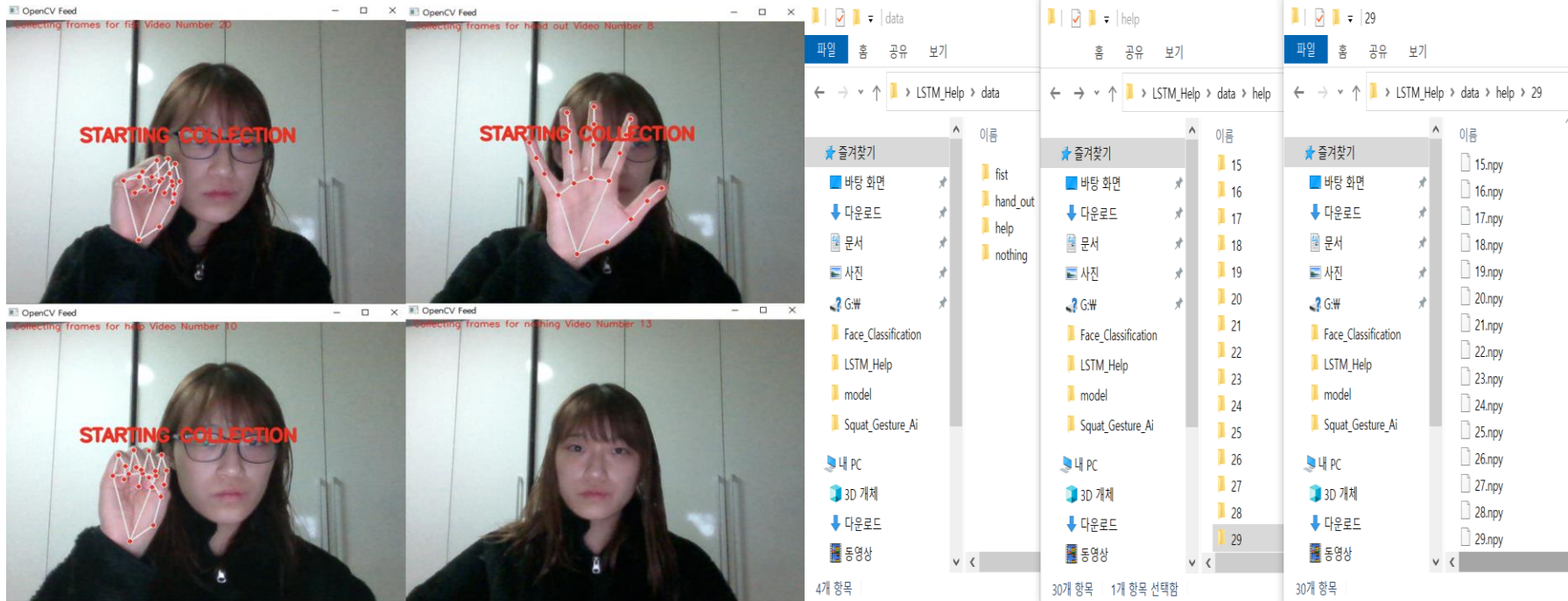


- |                       |                       |
|-----------------------|-----------------------|
| 0. WRIST              | 11. MIDDLE_FINGER_DIP |
| 1. THUMB_CMC          | 12. MIDDLE_FINGER_TIP |
| 2. THUMB_MCP          | 13. RING_FINGER_MCP   |
| 3. THUMB_IP           | 14. RING_FINGER_PIP   |
| 4. THUMB_TIP          | 15. RING_FINGER_DIP   |
| 5. INDEX_FINGER_MCP   | 16. RING_FINGER_TIP   |
| 6. INDEX_FINGER_PIP   | 17. PINKY_MCP         |
| 7. INDEX_FINGER_DIP   | 18. PINKY_PIP         |
| 8. INDEX_FINGER_TIP   | 19. PINKY_DIP         |
| 9. MIDDLE_FINGER_MCP  | 20. PINKY_TIP         |
| 10. MIDDLE_FINGER_PIP |                       |

- Module에 내장된 고속 ML를 이용하여 빠르게 원하는 결과 도출 가능.
- ios, desktop, cloud등 다양한 환경에서 제공.
- 이미 입증된 프레임 워크.



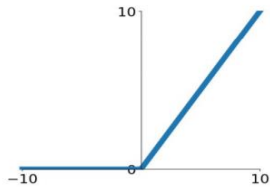
# Gesture Model *(Data Collection)*



- 4개의 Class (Fist, Hand\_out, Help, Nothing)에 각각 30개의 좌표 데이터를 30 frame씩 Numpy로 저장.

# Gesture Model (Model Exp.)

## Activation Functions



**ReLU**  
(Rectified Linear Unit)

- Computes  $f(x) = \max(0, x)$
- Does not saturate (in +region)
- Very computationally efficient
- Converges much faster than sigmoid/tanh in practice (e.g. 6x)
- Actually more biologically plausible than sigmoid

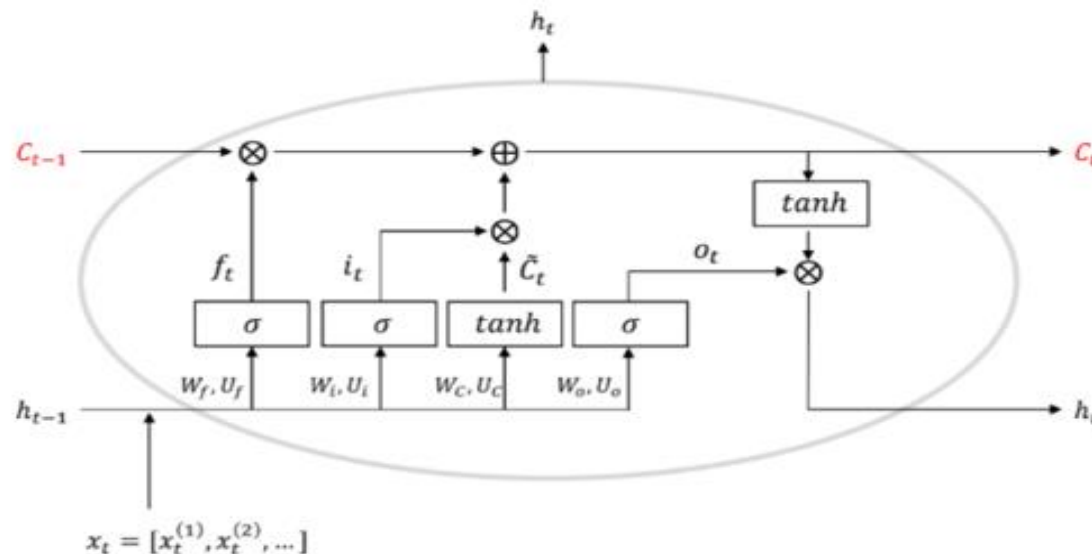
- Not zero-centered output
- An annoyance:

hint: what is the gradient when  $x < 0$ ?

- 수집 데이터들과 사전에 Labeling된 Target값을 LSTM 모델에 Supervised Learning을 진행.

- Activation Function은 'Relu'사용.

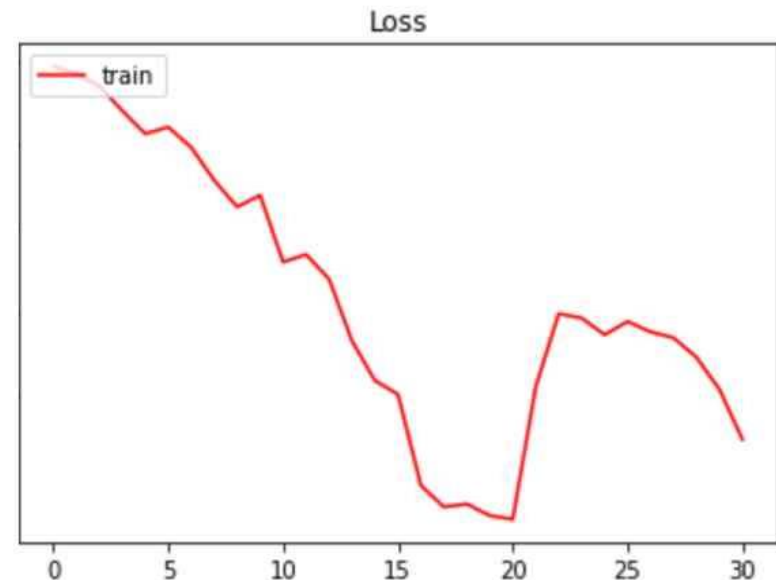
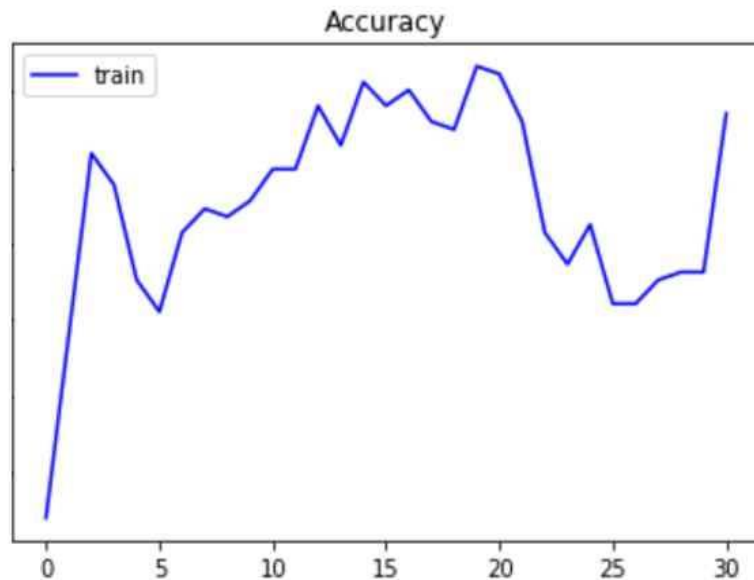
=>  $z < 0$  경우, 좌표 제거.



- (1)  $f_t = \sigma(W_f \cdot x_t + U_f \cdot h_{t-1} + b_f)$
- (2)  $i_t = \sigma(W_i \cdot x_t + U_i \cdot h_{t-1} + b_i)$
- (3)  $\tilde{C}_t = \tanh(W_C \cdot x_t + U_C \cdot h_{t-1} + b_C)$
- (4)  $C_t = f_t \otimes C_{t-1} \oplus i_t \otimes \tilde{C}_t$
- (5)  $o_t = \sigma(W_o \cdot x_t + U_o \cdot h_{t-1} + b_o)$
- (6)  $h_t = o_t \otimes \tanh(C_t)$

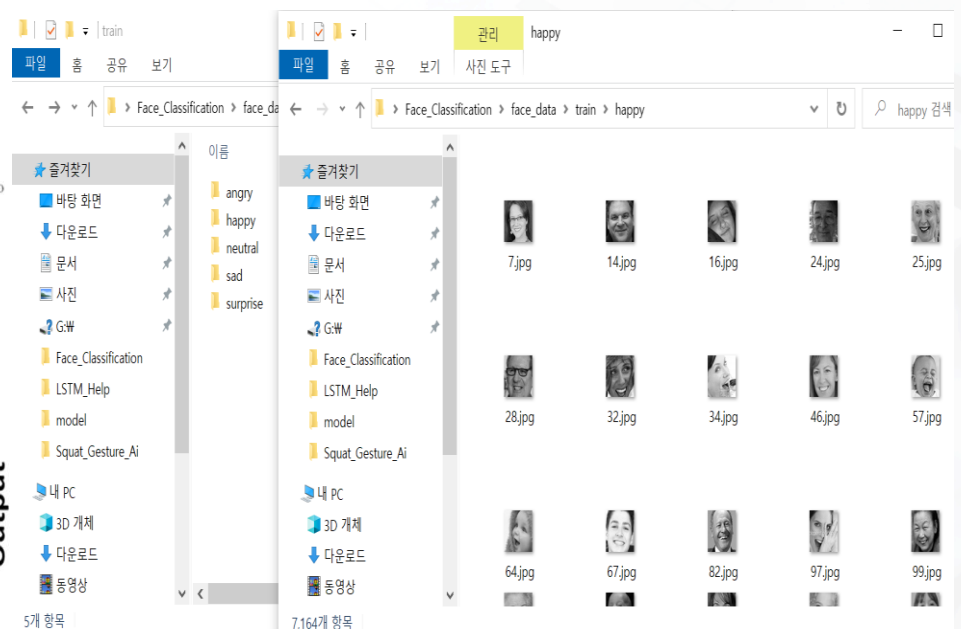
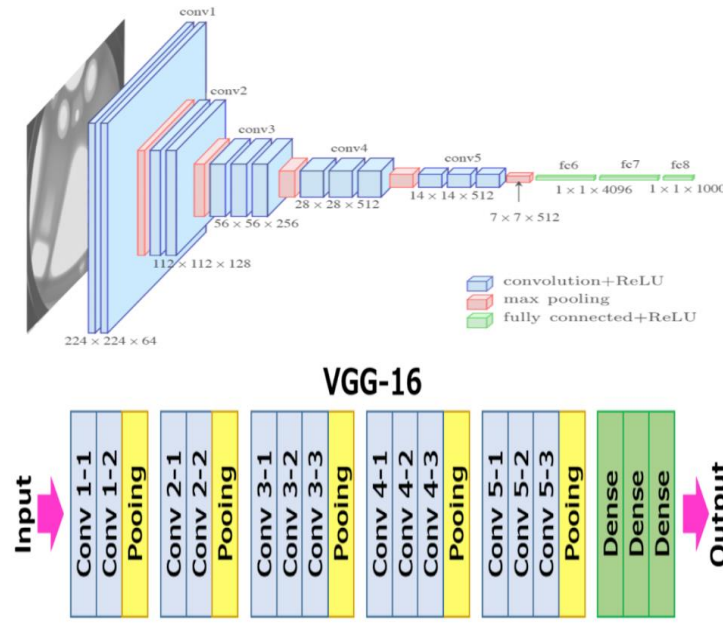
(f: forget i: ignore o: output  $\sigma$ : sigmoid)

# Gesture Model (Model Result)



- Early stopping 조건으로 epoch 20에서 10번 연속 개선 x, 조기 종료.  
=> 학습 데이터 정확도 91.67%

# Emotion Model *(Model Exp. & Data collect)*



- Github 학습 데이터 한계로 인한 task에 맞게 조절.
- 1. 기존 VGG 16 모델 대비 입력 input 데이터 축소.
- 2. Over fitting을 줄이기 위한 Layer 별 dropout 증가.
- 3. Early stopping 조건 추가.

=> 학습 시 정확도 74.13%



# *Model Perform Result*



**Thank you.**

