

# 산업공학 특론

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연구주제 발표

2015-21142 □ □ □

# 관심 주제

## Motivation

*Deep learning*으로

Vision, Speech 이외에

*Business Application*은 없을까?

# 관심 주제

“

Recurrent Neural Network  
(RNN)  
Long short term memory  
(LSTM)  
을 이용한 classification 문제”

Signature Verification

Mobile gesture classification

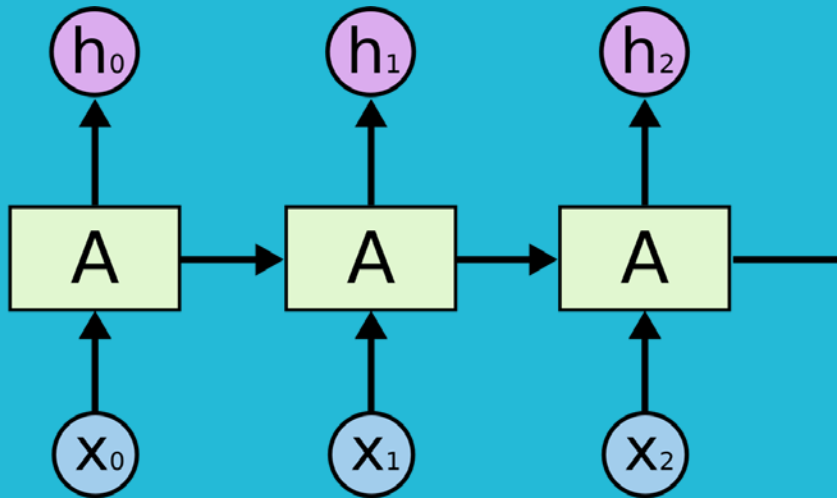
Unsupervised Feature  
Learning

Non-time series

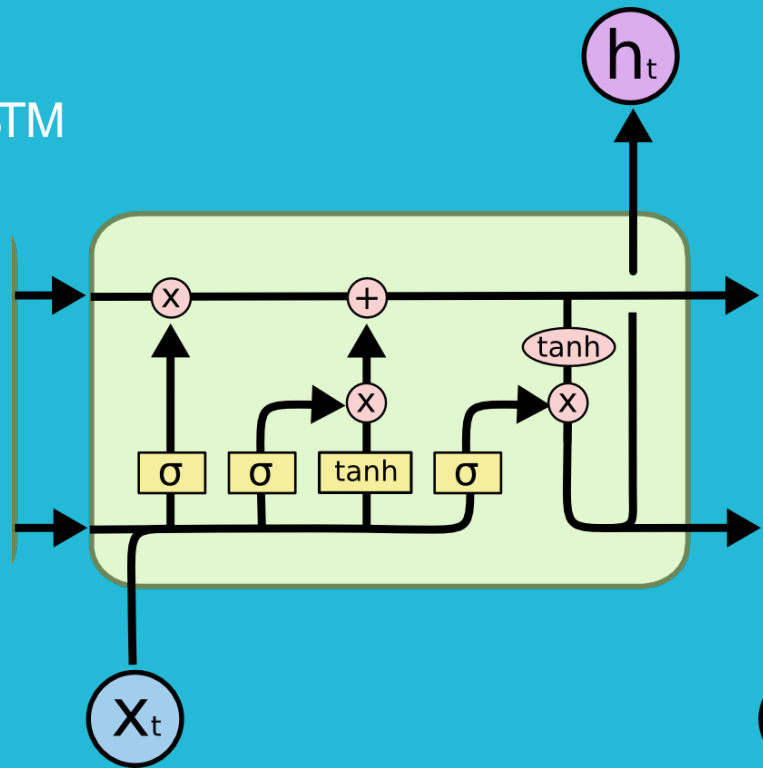
Time series

# Recurrent neural network을 이용한 classification

RNN



LSTM



# Recurrent neural network을 이용한 classification

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Idea1) signature 인식



Idea2) 모바일 sensor data를 통한 동작 인식



Idea3) 1) & 2) 를 조합한 mobile (2d/3d) gesture 인식 (Authentication)



# Example 1) Signature authentication

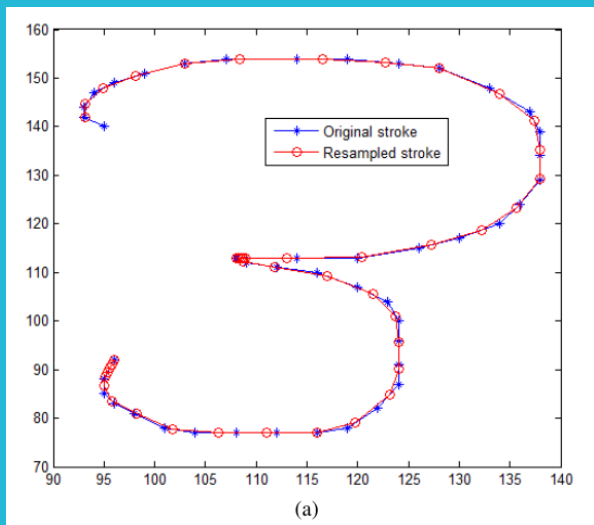
<관련 □ □ >

- Conrad Tiflin, LSTM Recurrent Neural Networks for Signature Verification, SATNAC, 2003
- Napa Sae-Bae, Online Signature Verification on Mobile Devices, IEEE, 2014

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- MCYT(2003), SUSIG(2009) dataset

X, y position at t, pressure at t, angle at t, acquired FROM Tablet



## Example 2) 모바일 sensor data를 통한 동작 인식

### <관련 연구>

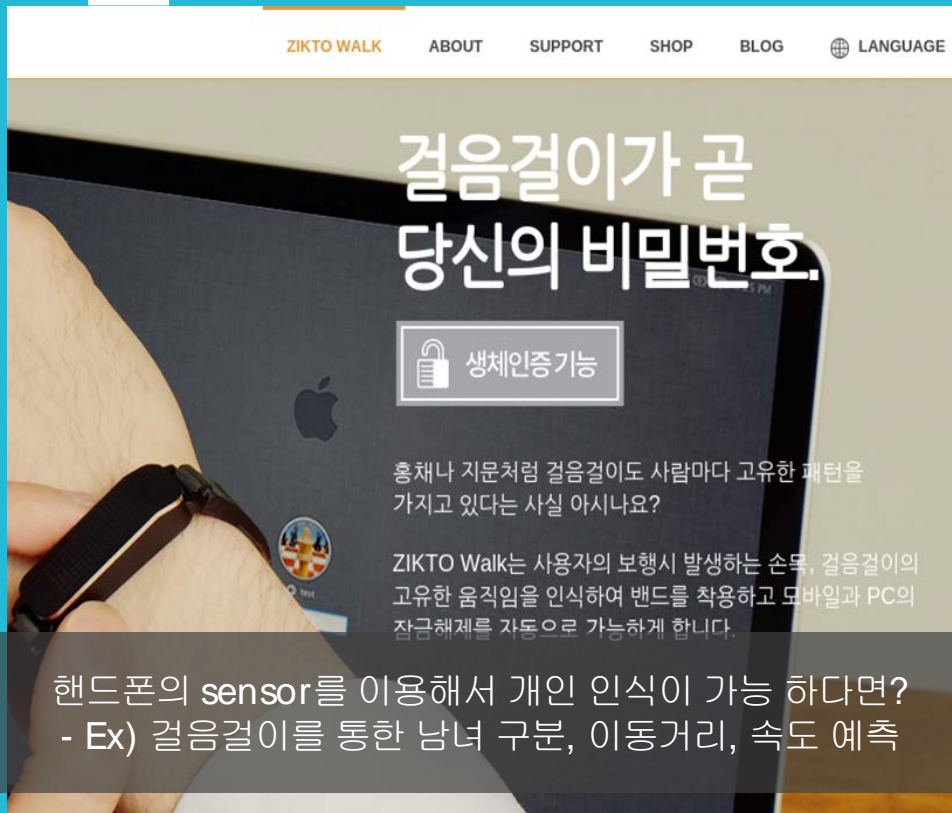
- Grégoire Lefebvre, BLSTM-RNN based 3D gesture classification, ICANN, 2013

### <□ □ >

- public dataset □□, □□□ □□□□ □ (□□□ ?)
- □□ □, □□, □ □□□ □□□ □□□ □□□ -> □□□□□, □□ □□
- Applications? □□□ □, □□□ □ □□□□ □□□□□□, Home appliance □ □□□ □




## Example 3) 모바일 센서를 이용한 개인 인식



ZIKTO WALK ABOUT SUPPORT SHOP BLOG LANGUAGE

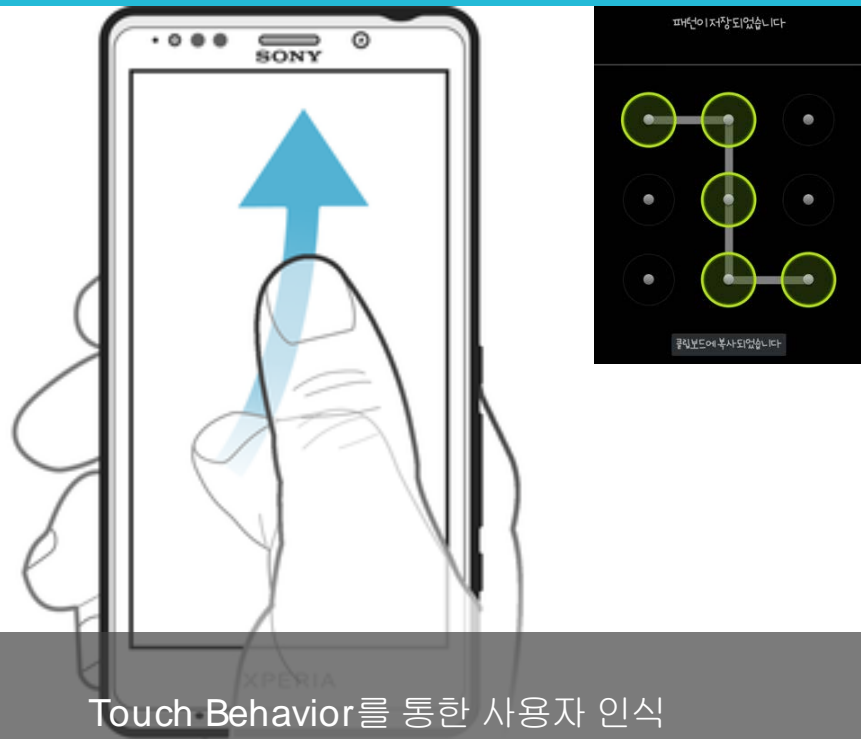
# 걸음걸이가 곧 당신의 비밀번호.

 생체인증기능

홍채나 지문처럼 걸음걸이도 사람마다 고유한 패턴을 가지고 있다는 사실 아시나요?

ZIKTO Walk는 사용자의 보행시 발생하는 손목, 걸음걸이의 고유한 움직임을 인식하여 밴드를 착용하고 모바일과 PC의 잠금해제를 자동으로 가능하게 합니다.

핸드폰의 **sensor**를 이용해서 개인 인식이 가능 하다면?  
- Ex) 걸음걸이를 통한 남녀 구분, 이동거리, 속도 예측





# Unsupervised Feature Learning (for non-time series)

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<관련 □ □ >

An Analysis of Single-Layer Networks in Unsupervised Feature Learning

1. Feature Extraction are critical to achieving high performance
2. Using only single-layer network, it achieved state-of-the-art performance

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- Auto-encoder
- Sparse Coding
- ICA(Independent component analysis)
- RICA



# Unsupervised feature learning for time-series

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A review of unsupervised feature learning and deep learning for time-series modeling

1. restricted boltzmann machine(RBM)
2. Gated RBM, conditional RBM(cRBM)
3. Auto-encoder, Temporal Auto-Encoder

<관련 □ □ >

- Sleep Stage Classification using Unsupervised Feature Learning(Martin Längkvist, 2012)
- Malware Classification with Recurrent Networks(Razvan Pascanu, ICASSP, 2015)

Unsupervised □ □ □ □ feature □ □ □ □ MLP □ classifier □ □ □



- 1), 2), 3) 중 □□ □□□ Idea?  
(□□ □□ □□□□ ..?)

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# QUESTIONS?

