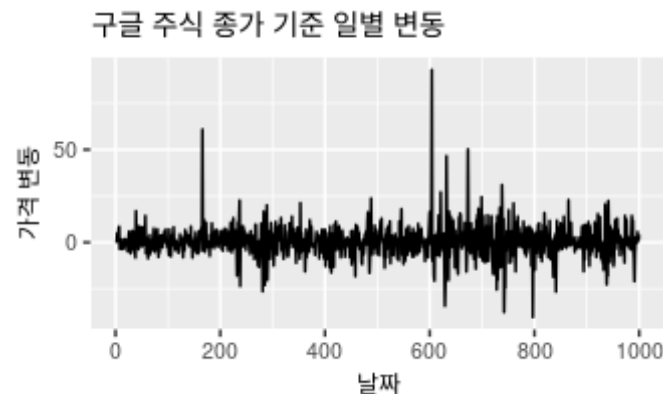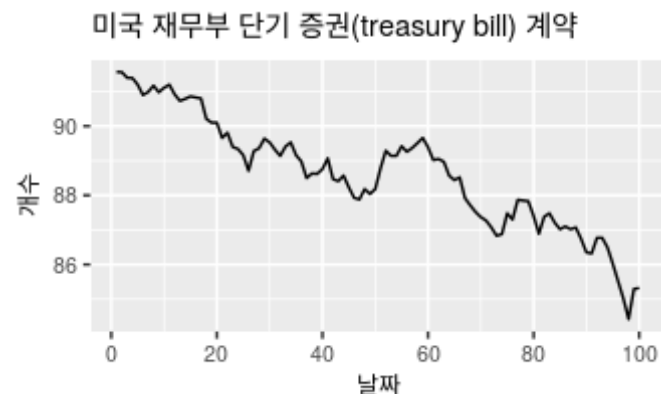**Chapter   09. 시계열을 활용한 딥러닝 (Time Sequence Processing)**

Time Series
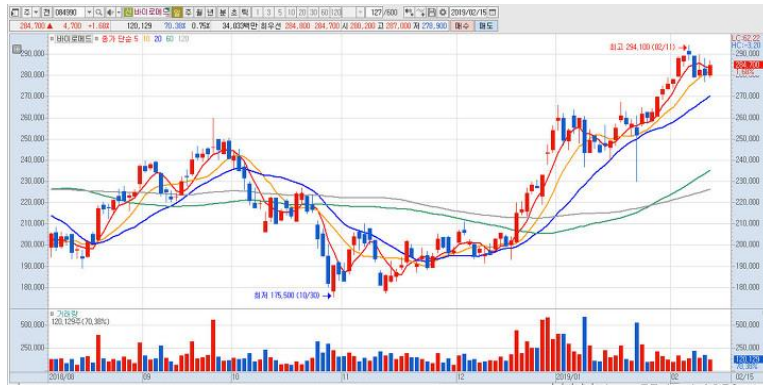# Deep Learning 개요

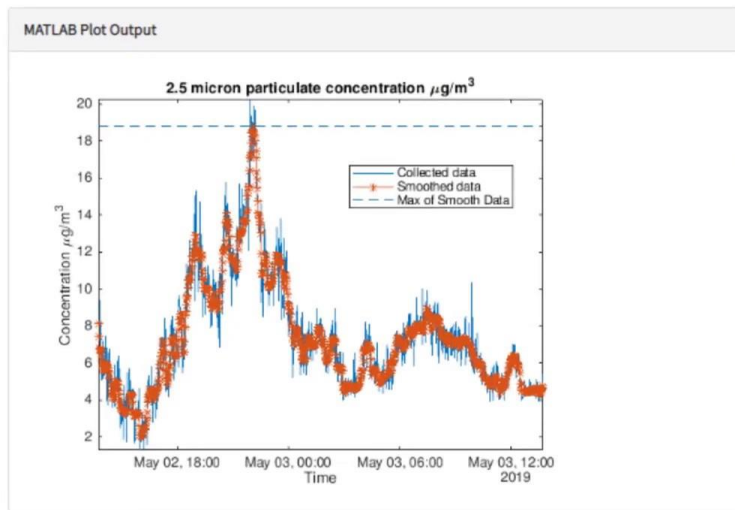# Time Series ?

시계열(時系列, 영어: time series)은 일정 시간 간격으로 배치된 데이터들의 수열을 말한다.
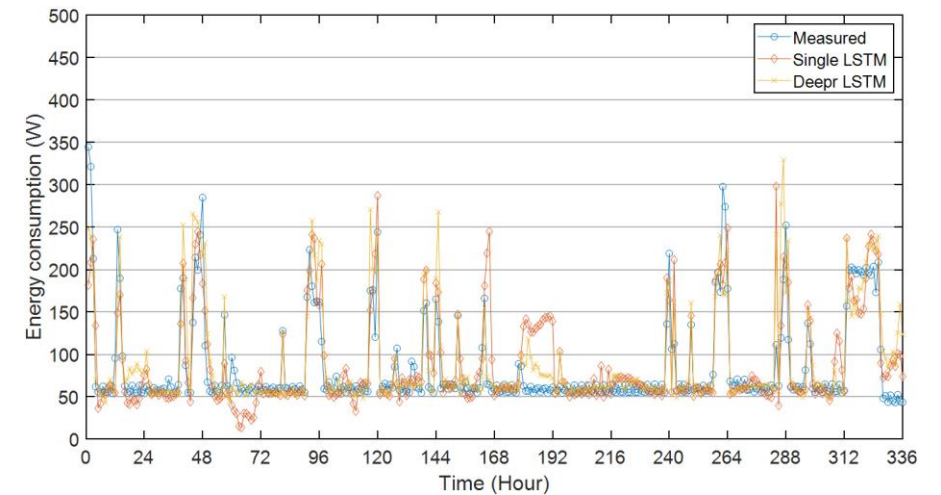
Application
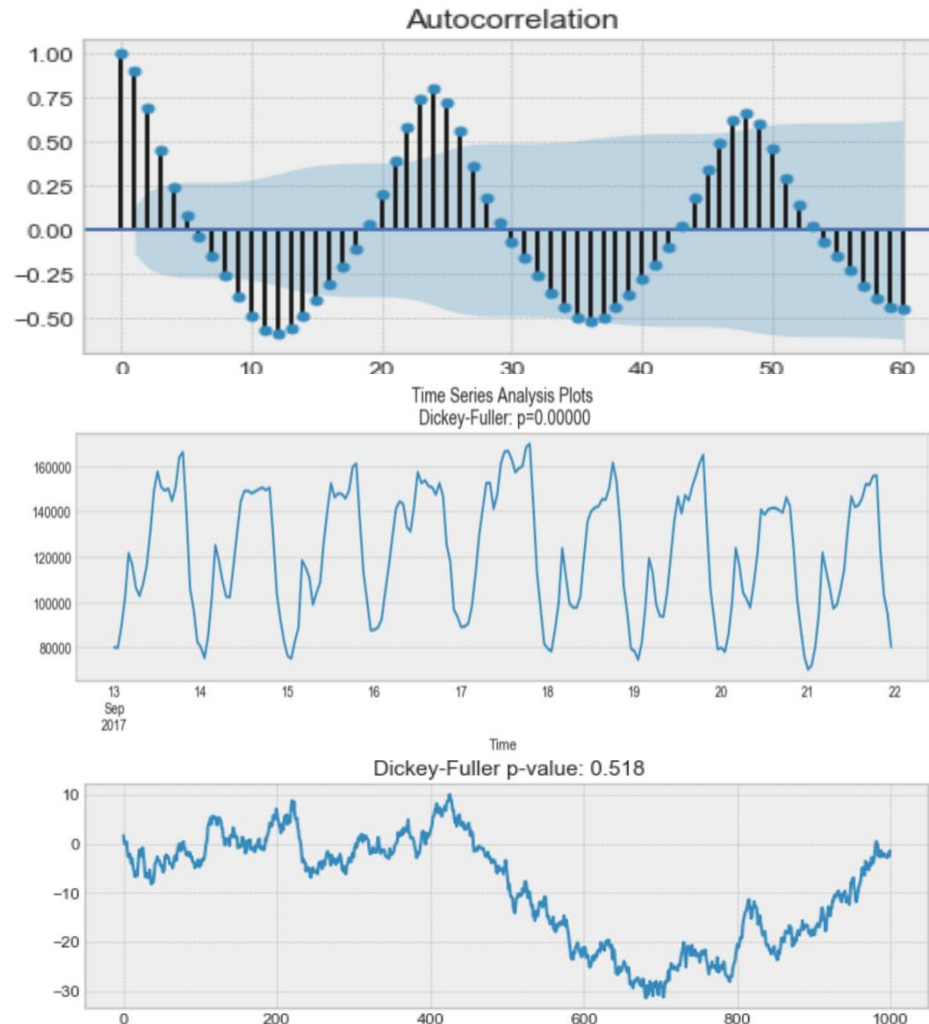

주식 analysis

Audio Analysis

Sensor Data Analysis

Energy Consumption Analysis
(HVAC)

Traditional Method

autocorrelation is the similarity between observations as a function of the time lag between them.
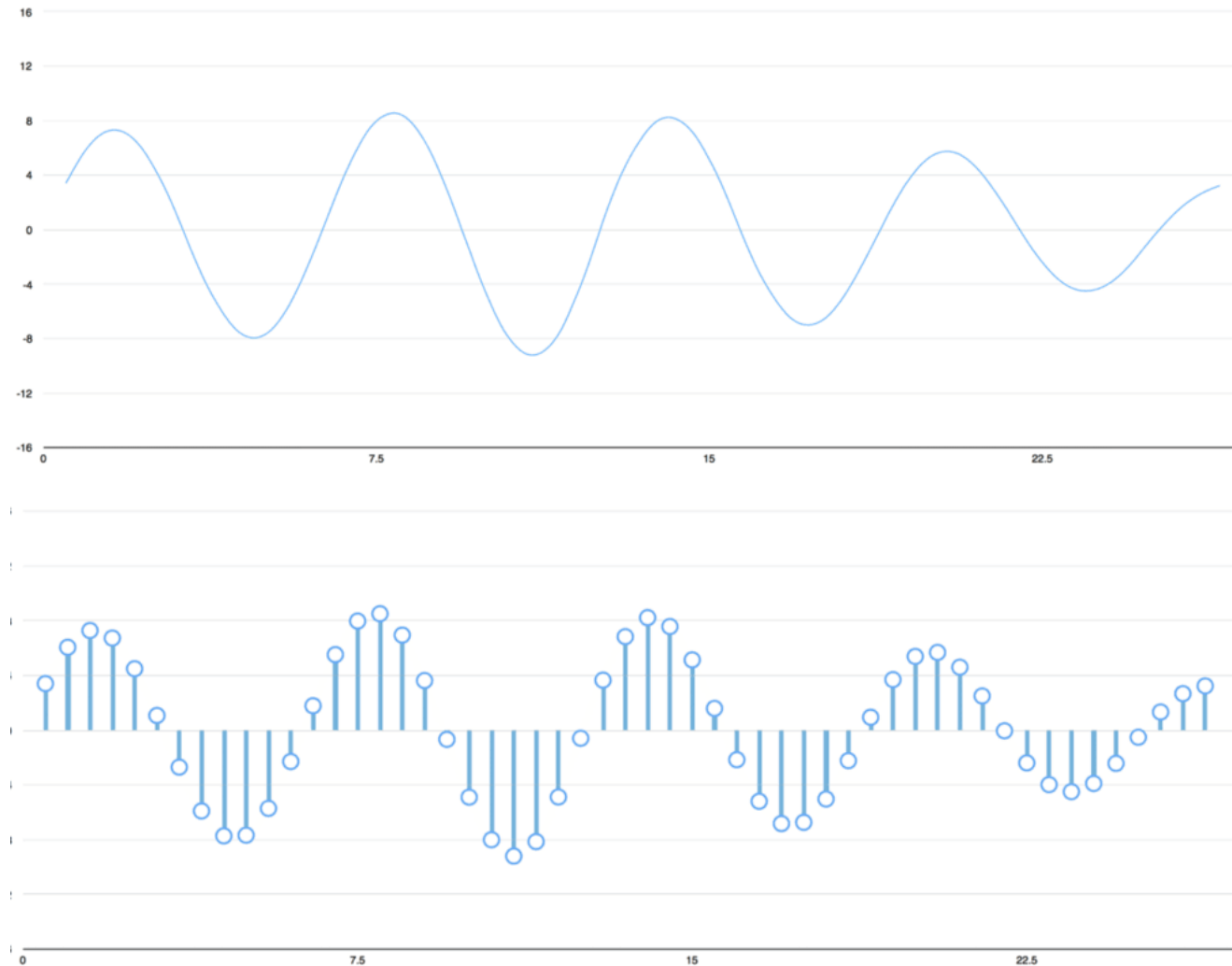
Seasonality refers to periodic fluctuations.

Stationarity is constant mean and variance, and covariance is independent of time.
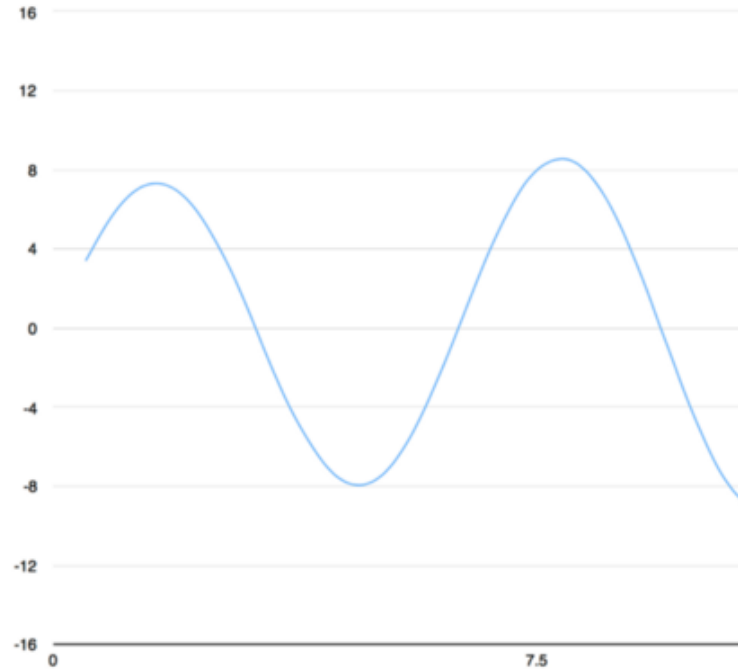
Time Series for Audio Recognition

Input

Output

Neural Network

Sound wave of
me saying "Hello"

"Hello"

Plain text
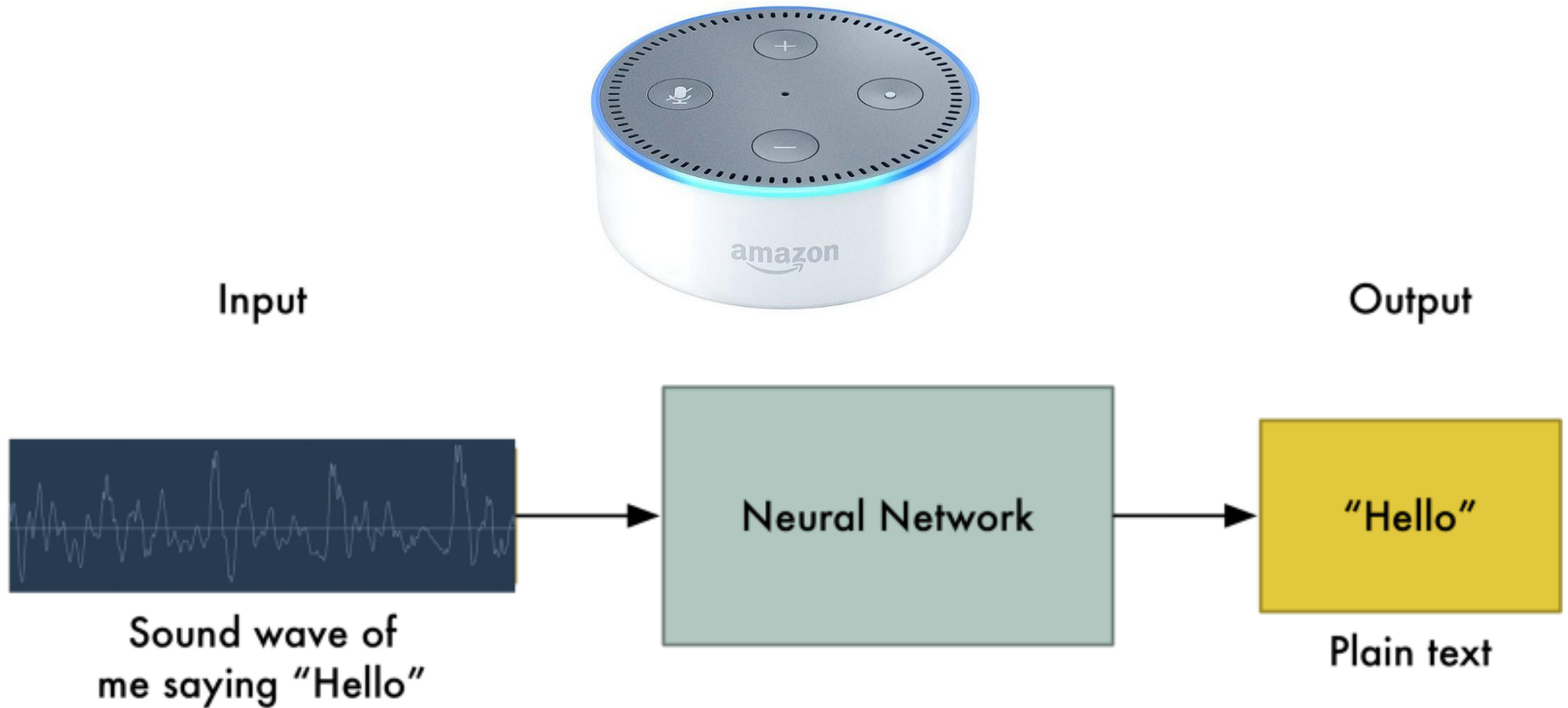
Time Series for Audio Recognition

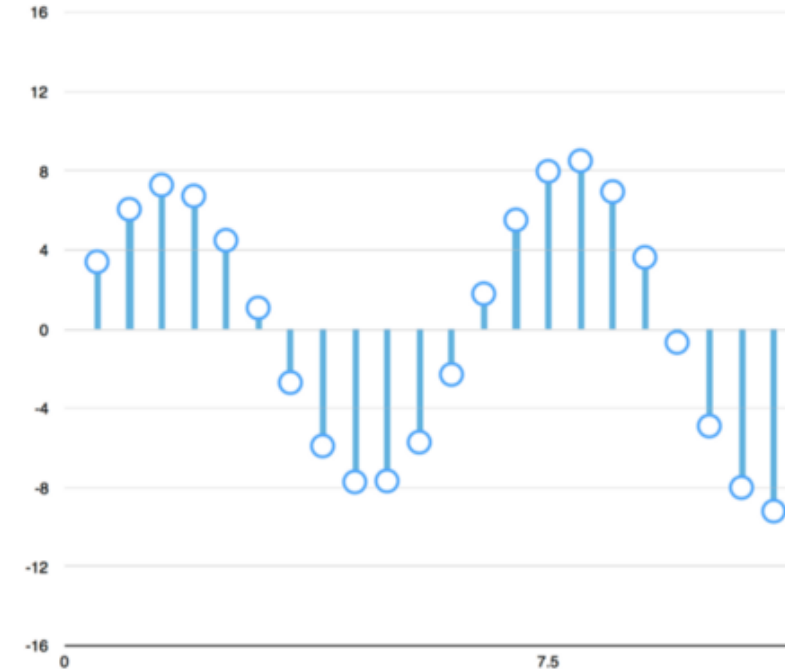# Time Series for Audio Recognition

Original Analog Signal
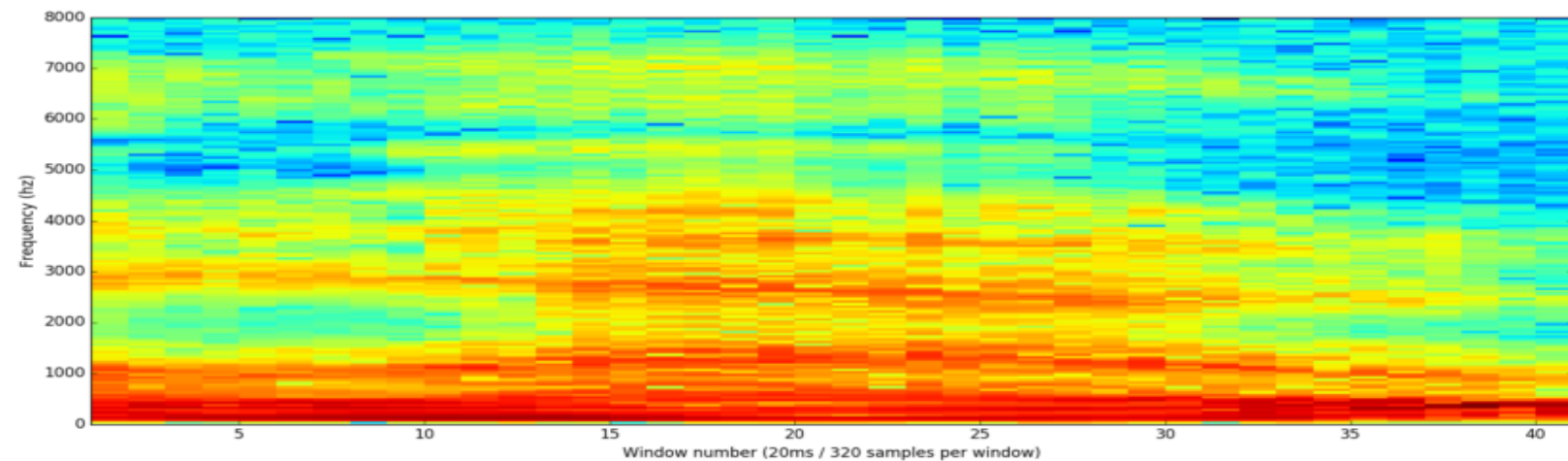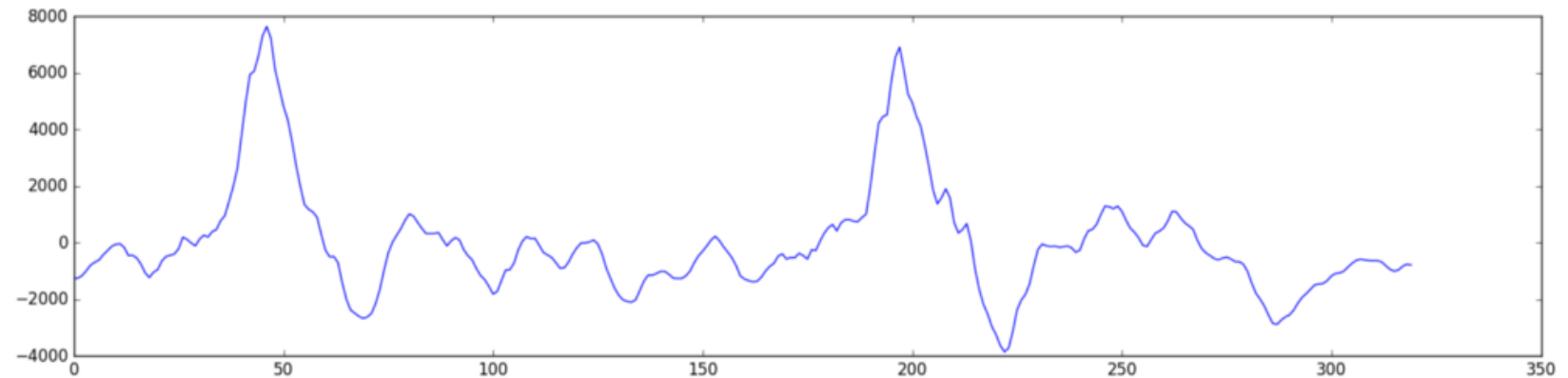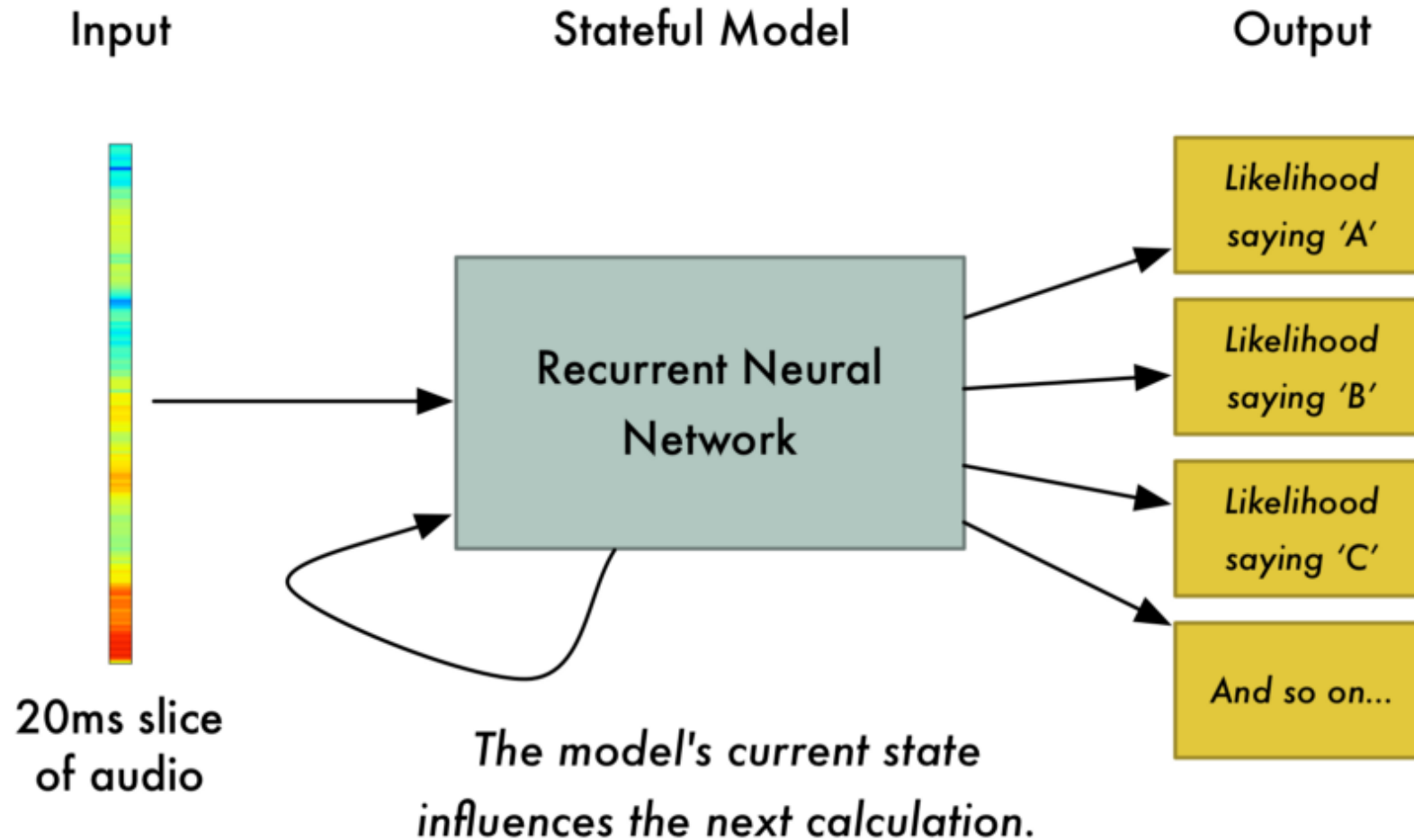
Sampled Digital Signal

Nyquist sampling theorem : fs >= 2 fc

Time Series for Audio Recognition

Time Series for Audio Recognition

Input

Stateful Model

Output

Recurrent Neural Network

20ms slice of audio

The model's current state influences the next calculation.

Likelihood saying 'A'

Likelihood saying 'B'

Likelihood saying 'C'

And so on...

Time Series for Audio Recognition
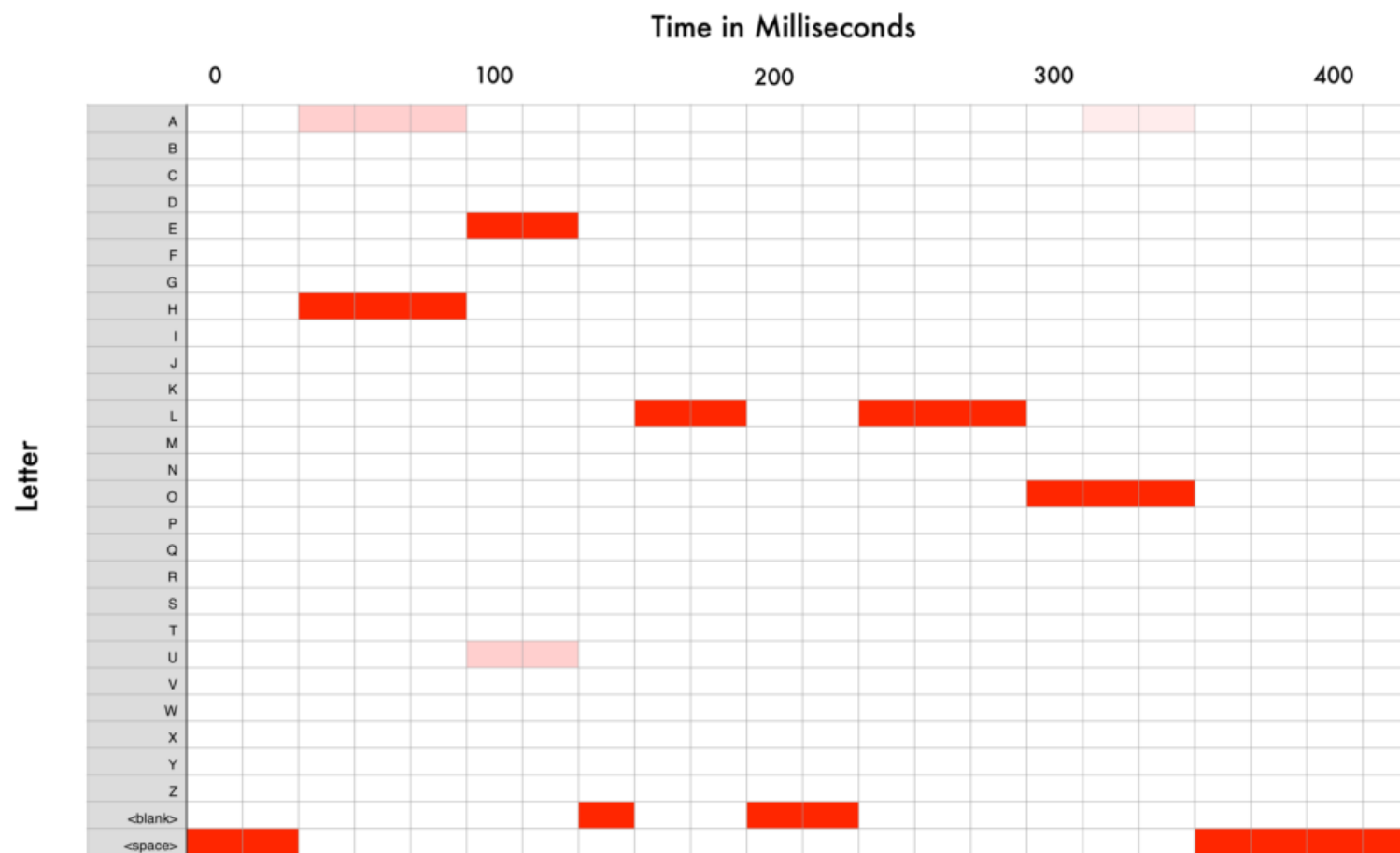
Mapping to the most likely letters

Time Series for Audio Recognition

Most likely Letters

- HHHEE_LL_LLLOOO becomes HE_L_LO
- HHHUU_LL_LLLOOO becomes HU_L_LO
- AAAUU_LL_LLLOOO becomes AU_L_LO

Convert duplicate letters to one letter

- HE_L_LO becomes HELLO
- HU_L_LO becomes HULLO
- AU_L_LO becomes AULLO

Database matching

- HELLO

Time Series for Audio Recognition

Google Now! 와 *Siri* 또는 추가비용이 없이 $50에 팔고 있는 *Alexa*는
당신이 **이를 가능한 한 많이 사용하도록** 유도

*Google Now!*가 설치된 Android

https://myactivity.google.com/myactivity?restrict=waa&promo=vaa
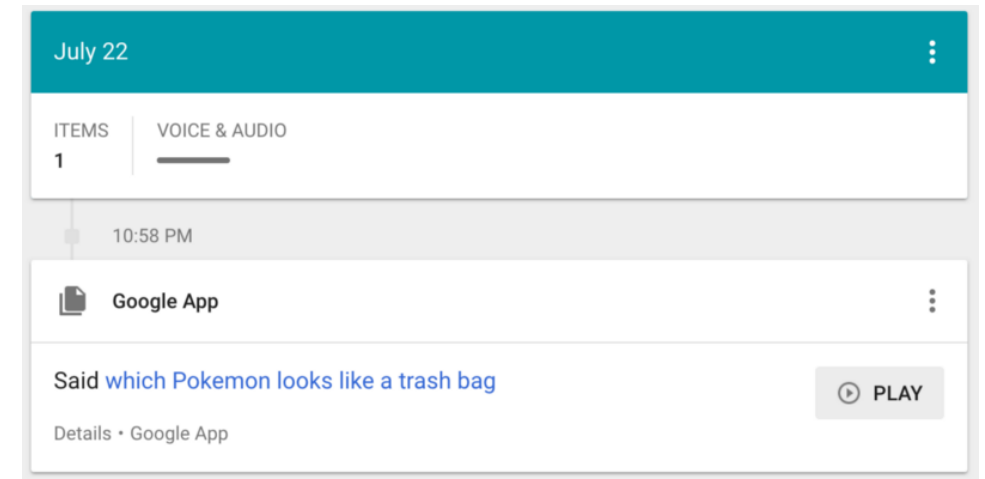
AI Robot

Time Series Deep Learning

전처리 기법 : FT, FFT, DFT, STFT, MFCC, MelSpectrogram

시계열 모델 : RNN, GRU, LSTM

기법 : Bi-directional, Attention

- *Thank you*