

# VertoPellis 2016

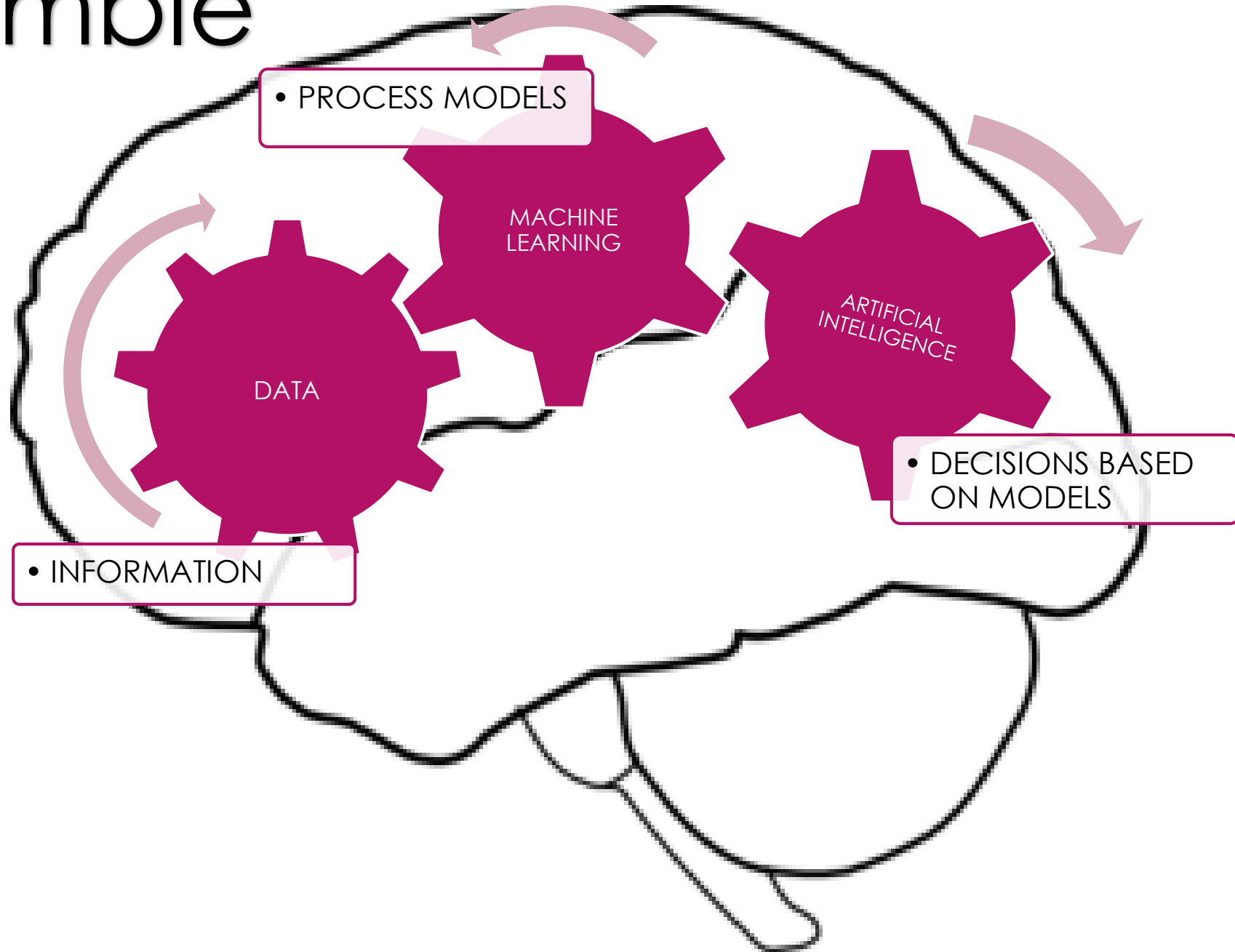
SHAPESHIFTING TECHNOLOGY

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# Agenda

- ▶ Machine Learning Primer
- ▶ Inception of Idea
- ▶ Why VertoPellis?
- ▶ What is VertoPellis?
- ▶ How have we built VertoPellis?

# Preamble



Why

# Field Needs More Excitement!

- ▶ Connecting dots from different fields
- ▶ Get the attention of the general public
- ▶ We're engineers so.... Basically wizards!
- ▶ **Goal:** Voice Recreation



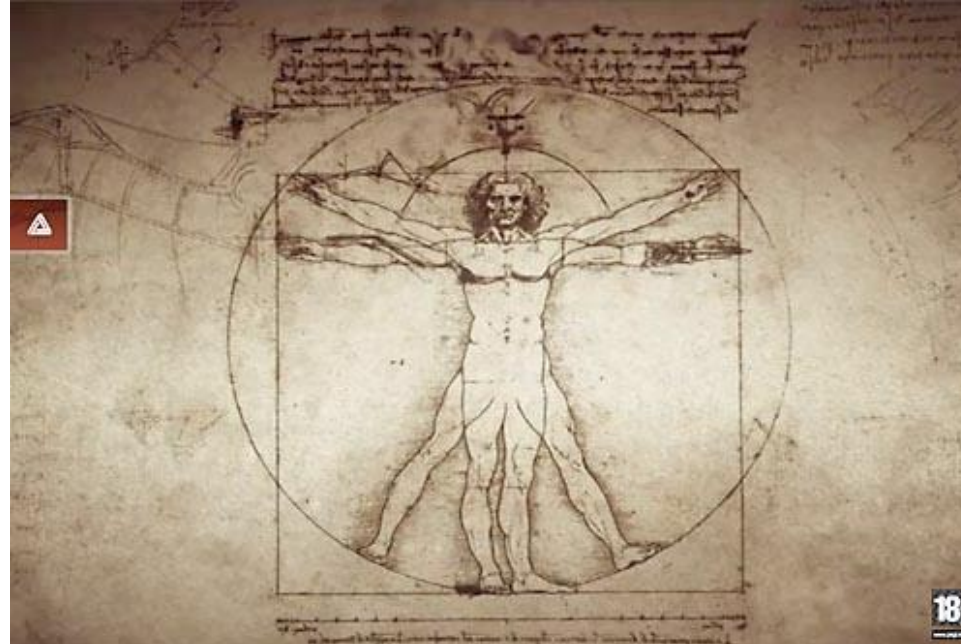
**MISSION:IMPOSSIBLE**  
ROGUE NATION



What

# VertoPellis

- ▶ Means ShapeShifting in Latin
- ▶ Can we recreate a person through machine learning and artificial intelligence?
  - ▶ Big Goal
    - ▶ Voice
    - ▶ Facial Expressions



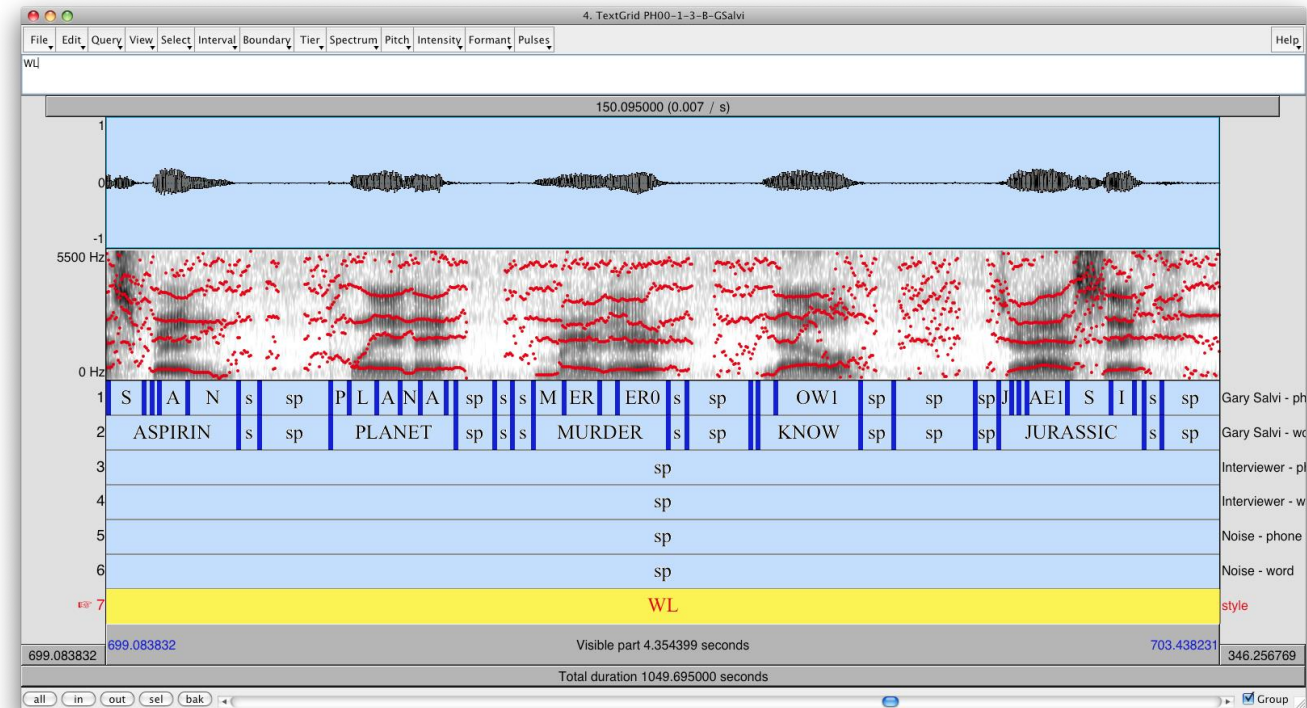
How

# Voice

- ▶ Language is made up of parts
- ▶ Focusing on words
  - ▶ Syllables
    - ▶ Vowels and consonants
- ▶ Phonemes (units of sounds to distinguish word)
  - ▶ ARPABET – Phonetic Transcription Code

▶ Test = TE – ST

▶ Test = T – EH – S – T



How

# Capturing/Understanding The Voice (DATA)

- ▶ Speeches broken down into sub-segments.
  - ▶ CMUSphinx for Speech Recognition
    - ▶ Teaching the model to understand subject's voice.
    - ▶ Sphinxtrain to better model for understanding the subject's voice.
- ▶ Model to +90% recreation of voice

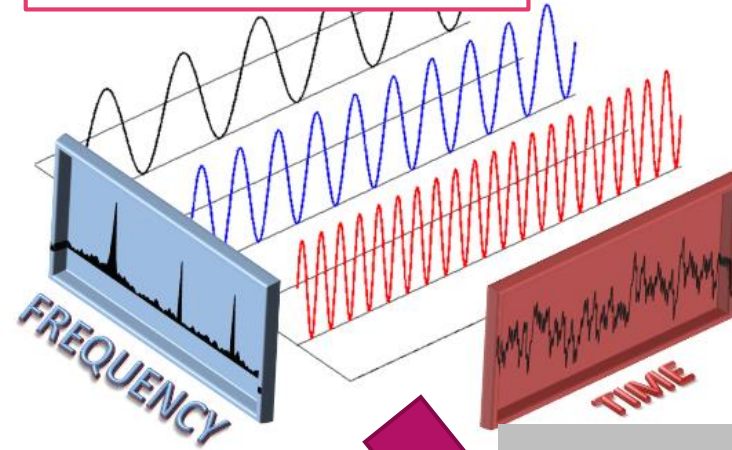


How

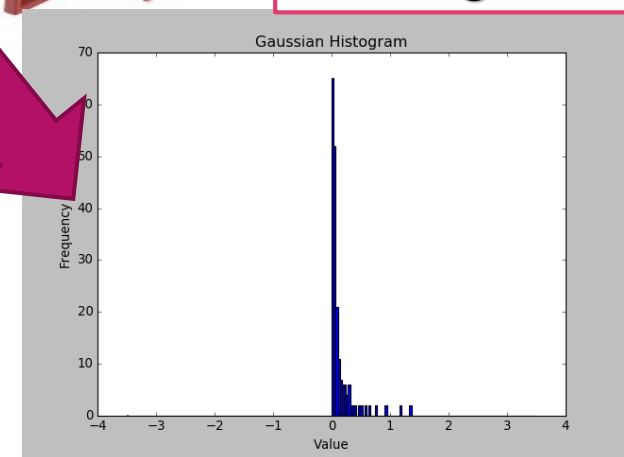
# Processing the Phonemes (Process Model) – Feature Extraction

- ▶ Librosa for feature extraction from audio files
  - ▶ Different feature extraction algorithms.
  - ▶ Fourier Transforms
  - ▶ Coalescing Fourier data into histogram
  - ▶ Finding bounds was an iterative process.

## Fourier Transform



## Histogram



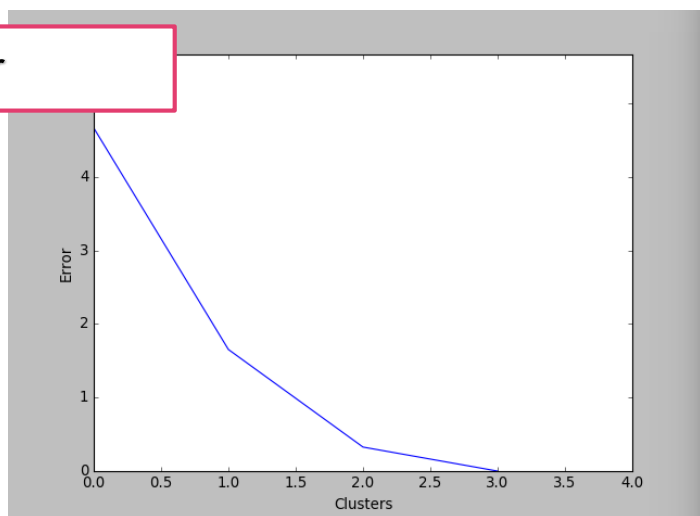


How

# Processing the Phonemes (Process Model) – k-means clustering

- ▶ Iterative Algorithm that creates clusters of n-dimension.
- ▶ We store the cluster centers
- ▶ **Weighted Average Phonemes** pertaining to each cluster
- ▶ Helps reduce data and optimize model

K-Error



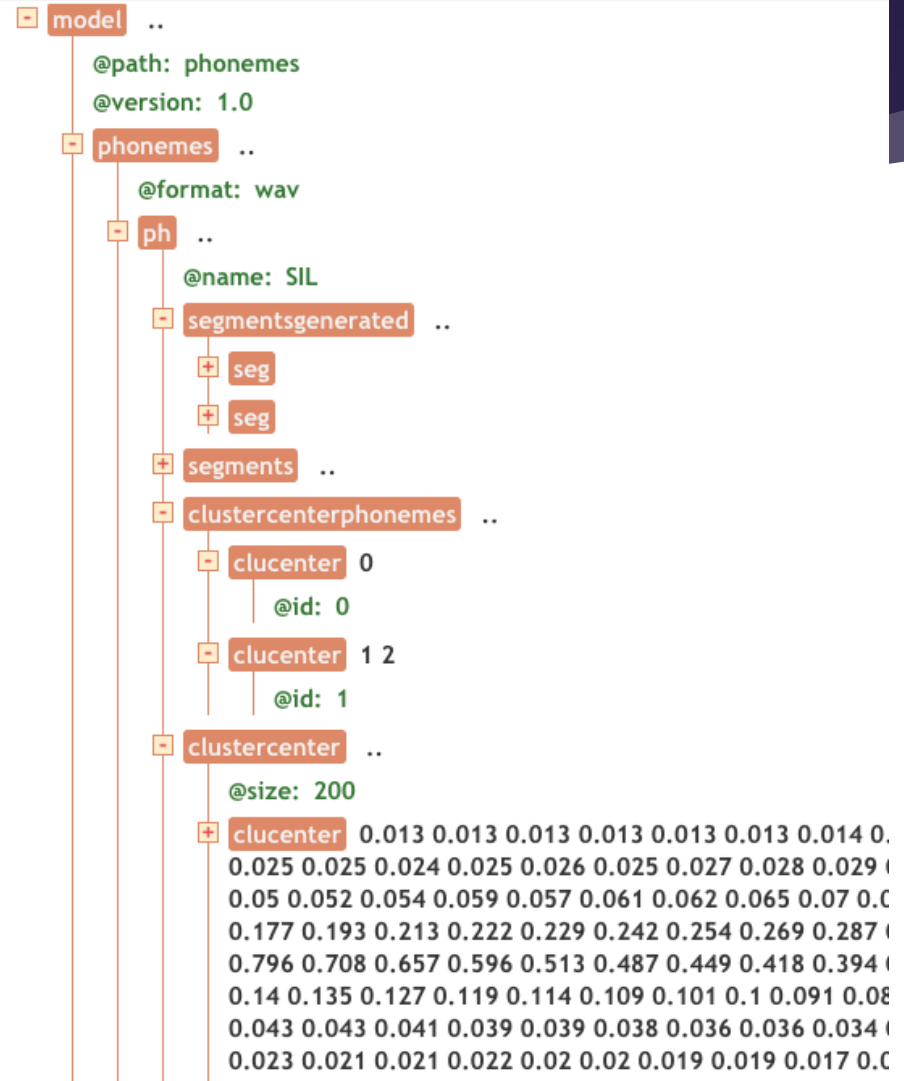
2D Graph kClustering  
(example)



How

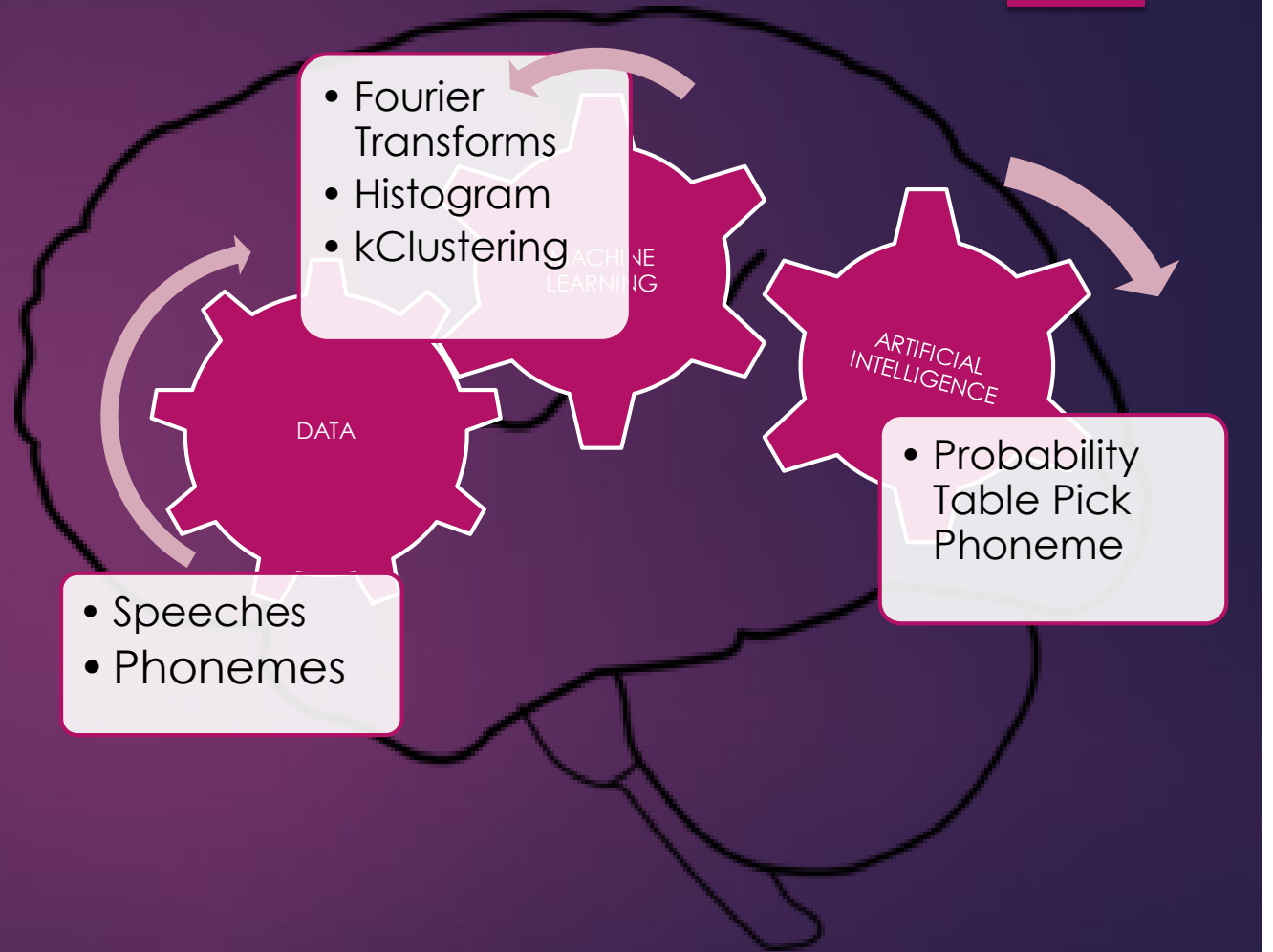
# Processing the Phonemes (AI) – Usage

- ▶ Text input is
  - ▶ Converted into phonemes
  - ▶ Phonemes are retrieved from model
    - ▶ Using a probability distribution table
      - ▶ (built during learning phase)
    - ▶ Pick the right phoneme
  - ▶ Pass the phonemes to audio synthesizer.
    - ▶ Voice modulation
    - ▶ Binding phonemes together



DEMO

# Q & A





# THANK YOU!

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