

# Oral Presentation #2

## Clinical Analysis of Speech Rhythms in Language Development using MATLAB

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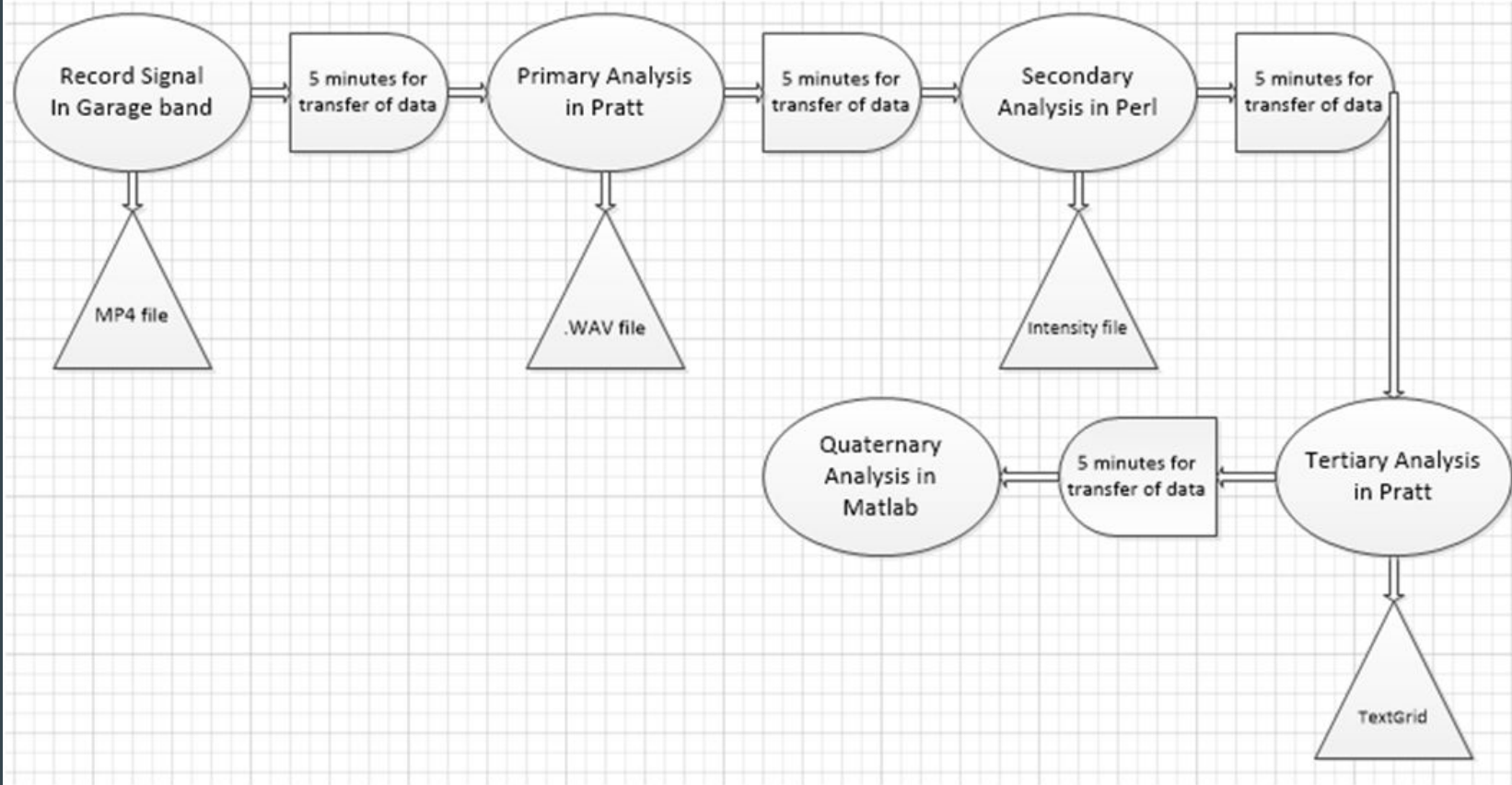
# Problem Statement

Preliminary research has been conducted that indicates a correlation exists between an **individual's rhythmic capabilities and language development**.

Currently, the data analysis process used to determine an individual's rhythmic abilities is **inefficient** and **impractical** in a clinical setting.

No data analysis process or system exists to assess an individual's speech rhythm. There is a need in the industry for **a diagnostic technique** that efficiently analyzes the individual's recorded speech to determine whether their rhythm is considered good or bad.

There is an immediate need in the Gordon lab for **a data analysis** process that quickly and efficiently judges rhythm in speech. Beyond the Gordon lab, there is a **clinical need for a device** with an intuitive interface that is capable of immediate analysis and display of feedback

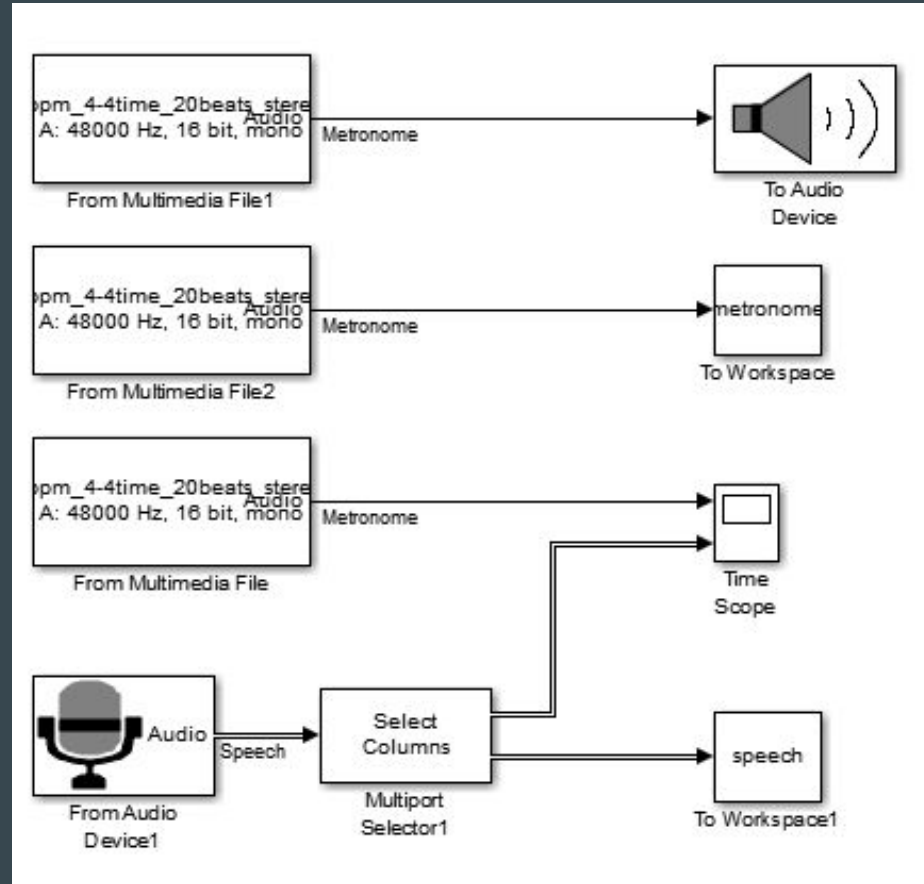


# Design Components

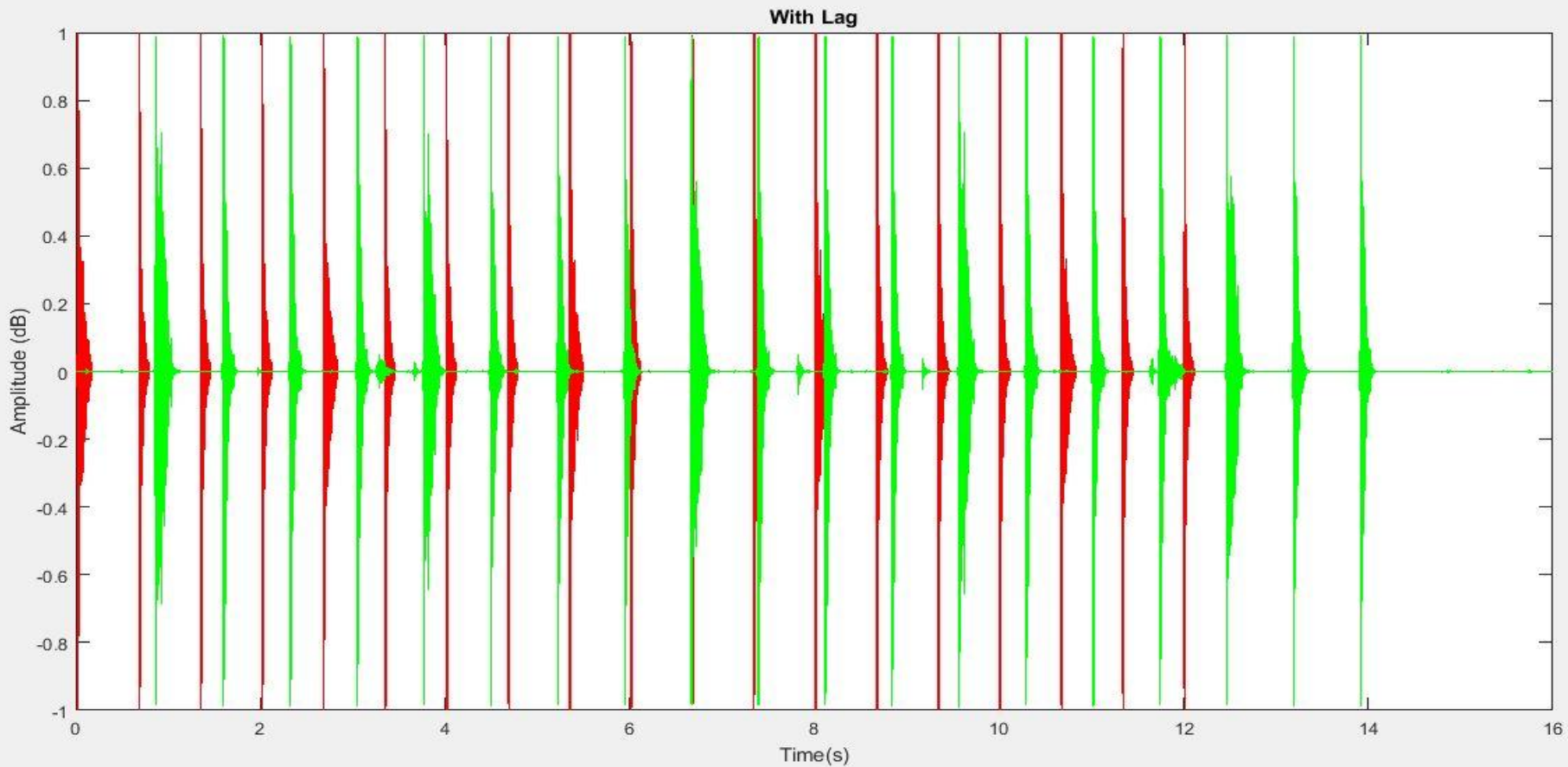
- *MATLAB program:*
  - *Collect and analyze speech and metronome tracks*
  - *Utilization of toolbox functions and circular statistics*
  - *Feedback and user interface to assess patient rhythm consistency and accuracy*
- Data analysis program must be compatible with:
  - Various computer operating systems
  - A microphone
  - Headphones
  - Analog filter
- The design of the study will:
  - Determine the rhythm baseline by sampling a population of individuals with normal speech development
  - Longitudinally assess impact of musical training on speech rhythm therapy

# Progress-Simulink

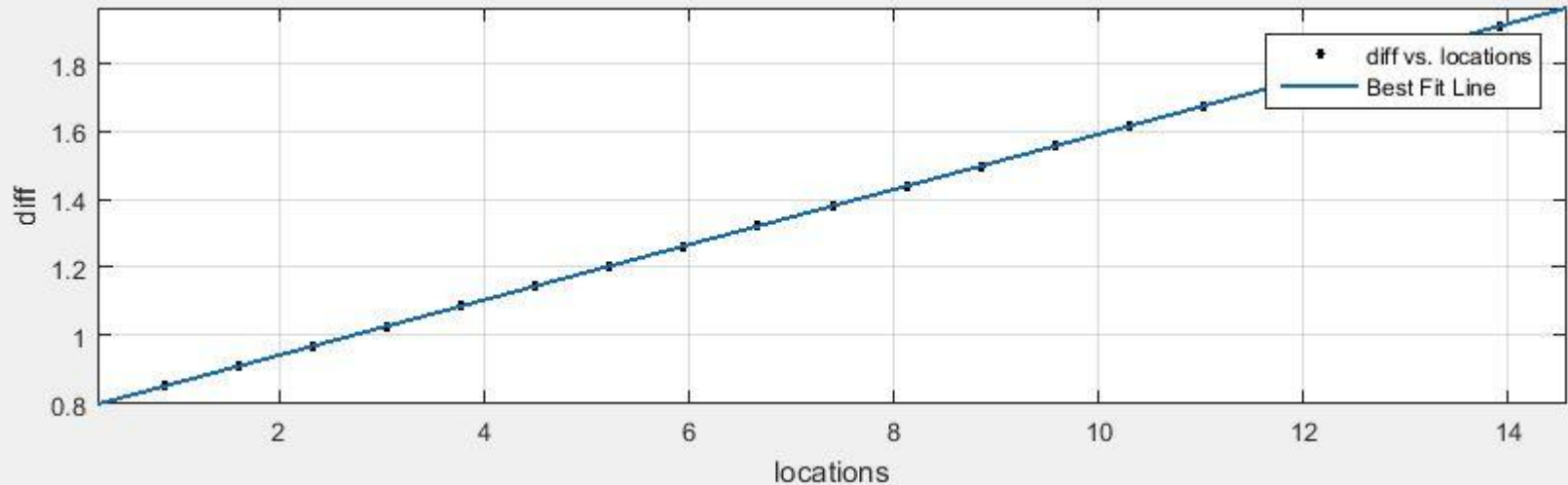
- We have used Simulink to successfully:
  - Save a metronome track
  - Simultaneously play the metronome track while also recording
  - Graph (in real time) the metronome while being played & the recording
  - Export data into MATLAB



# Progress-Lag



# Progress-Lag



Linear model Poly1:

$$f(x) = p1*x + p2$$

Coefficients (with 95% confidence bounds):

$$p1 = 0.08128 (0.08116, 0.08139)$$

$$p2 = 0.7792 (0.7782, 0.7801)$$

Goodness of fit:

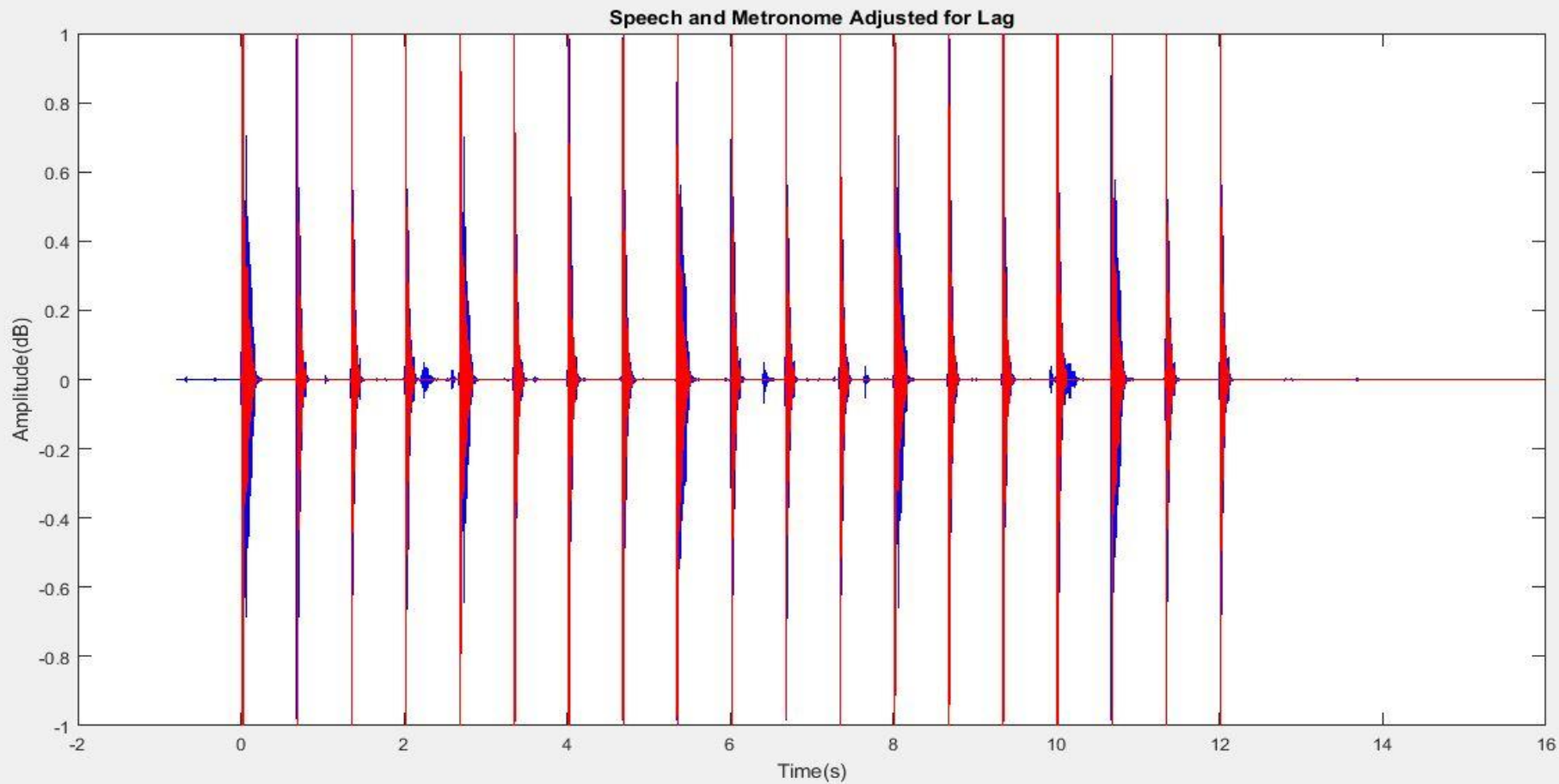
SSE: 1.453e-05

R-square: 1

Adjusted R-square: 1

RMSE: 0.0009245

# Progress-Lag

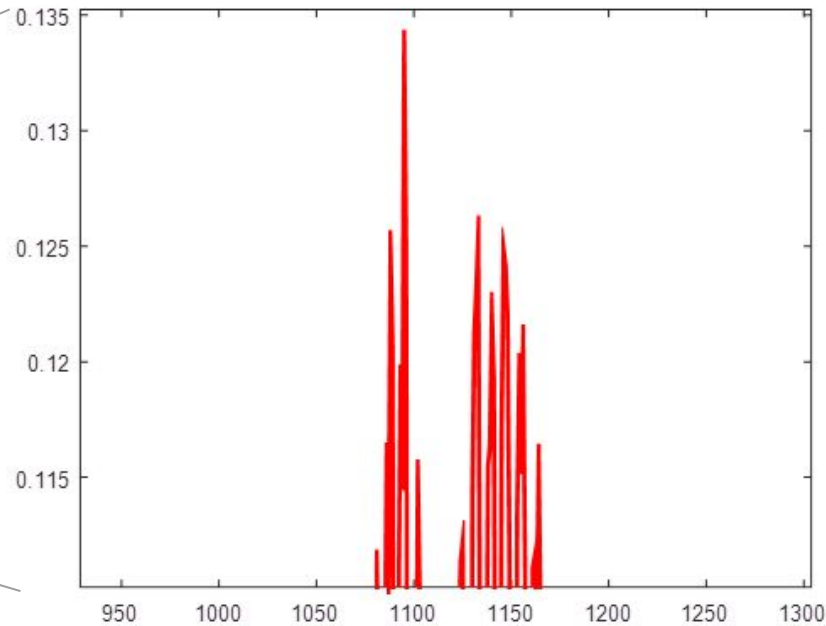
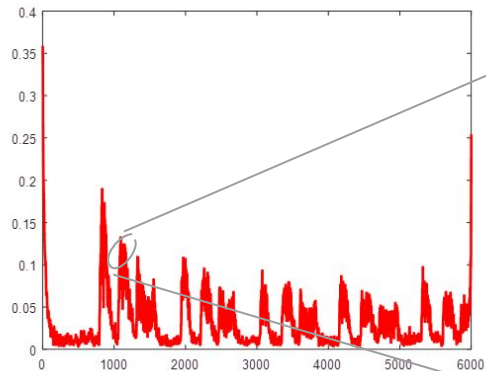




# Next Steps

- Eliminating initial spike in amplitude - ✓
- Obtaining the metronome signal in MATLAB - ✓
- Determining the best way to compare the two signals- ✓
- Further investigation of lag with headphones- ✓
- Testing variability in recording distance, pitch, etc.
- Further research and use old analytics code
- Filter and smooth the sound signal to get an intensity curve

# Peak Identification



# Deepening Project Understanding



- Director of Centre for Interdisciplinary Research in Music and Media Technology. CIRMMT
- Guest lecturer brought in for Science and Music NSC class
- Attempting to use playing the flute (a high velocity low pressure instrument) to help COPD patients