



LingoPros

AuToBI Toolchain and Web Hosted Analyzer

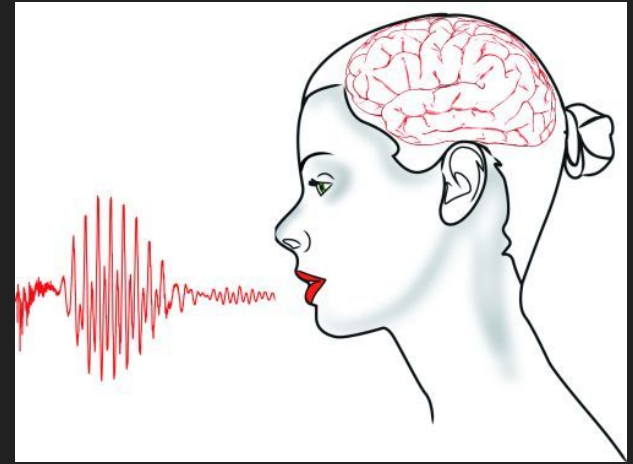
Josh Shaffer, Matthew Quintana, Erik Strauss &
Luis Montes

Mentor: Ana Paula Chaves Steinmacher

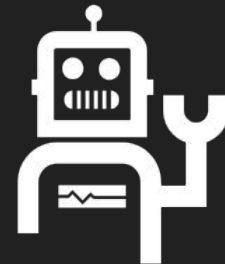
Linguistics and Computer Science

Crossover

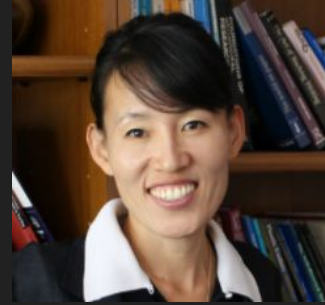
- Semantics and Syntax
- Language Translation
- Automatic Speech Recognition



<https://www.fel.cvut.cz/en/vv/tymy/sami/11.jpg>



Dr. Okim Kang and Dr. David O. Johnson



Applied Linguistics Speech Lab (ALSL)

- Native vs Non-native English speakers
- Technology to further research
- Developed an experimental model for speech analysis



ToBI Problem

Standard framework using Tones and Break Indices (ToBI) model

- Experimental vs Standard
- Issues:
 - Criticized for not being the standard in speech analysis
 - No current proficiency analyzer to compare with

Research Problems

- Students have to do analysis by hand
- Difficulty annotating audio samples
- Need a better and more efficient system



ToBI Based Toolchain



Web Analyzer Solution



Hosted on:



Web Requirements

- Website
 - User Login
 - Upload Audio File
 - Analysis Ran on Audio File
 - Results are displayed from the server-side application and stored on server.
 - Admin page for verifying users
- Program hosted on server for designated users


AuToBI Requirements

- Run AuToBI analysis on multiple audio files
- Feature selection
- Machine Learning on features
- Calculate proficiency score

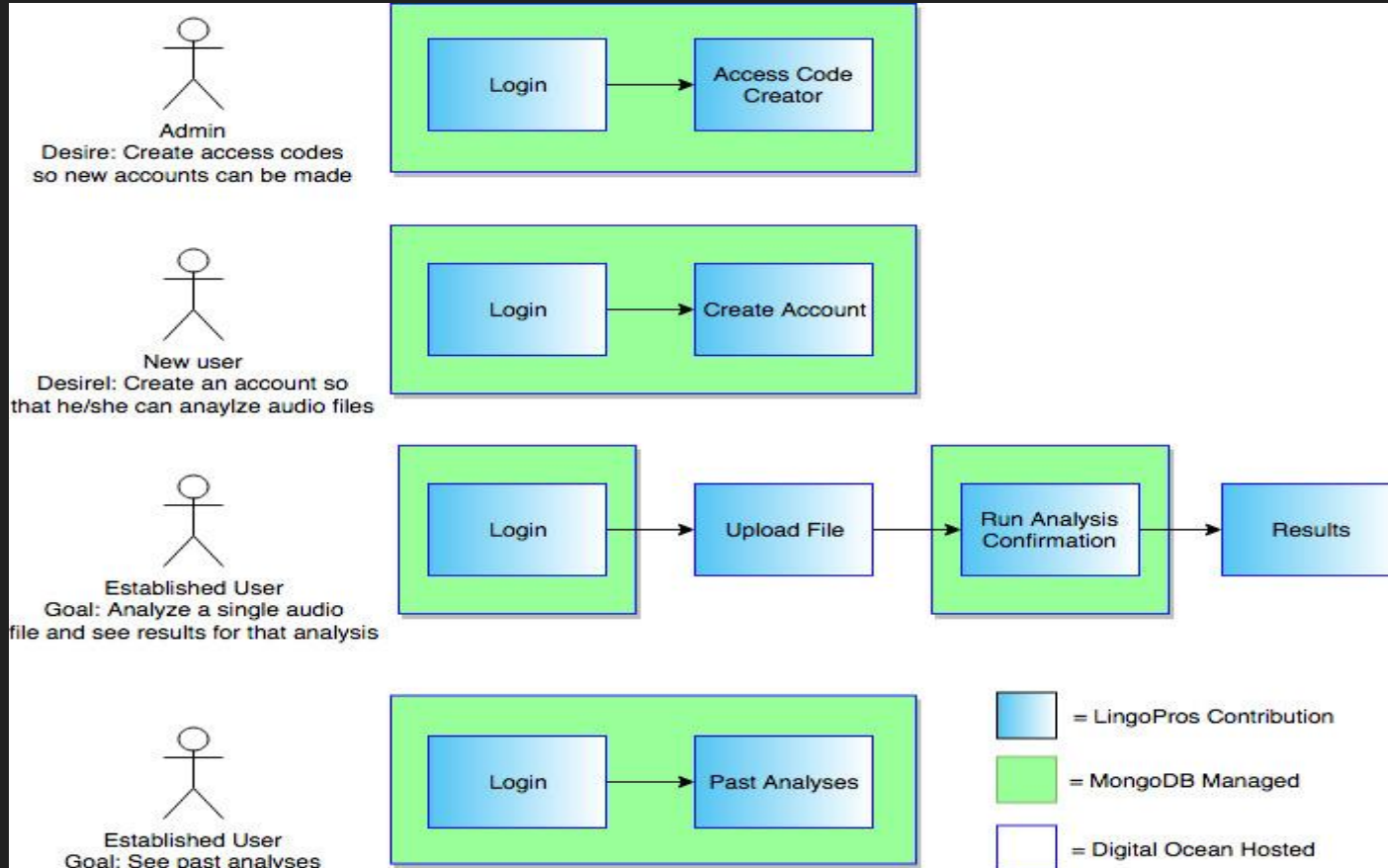
ToBI Toolchain Implementation

AutoToBI Toolchain



 = LingoPros Contribution

Web Analyzer Implementation



ToBI Toolchain Prototype

```
@attribute stdev[delta[rnormC[I]]] numeric
@attribute valleyLL[delta[rnormC[I]]] numeric
@attribute mean[znormC[I]] numeric
@attribute diff[mean[znormC[f0]]] numeric
@attribute max[delta[prodC[znormC[log[f0]]_rnormC[I]_0.1]]] numeric
@attribute risingLL[delta[rnormC[I]]] numeric
@attribute zMax[prodC[znormC[log[f0]]_rnormC[I]_0.1]] numeric
@attribute stdev[delta[log[f0]]] numeric
@attribute diff[stdev[znormC[I]]] numeric

@data
0.4883720930232558,0.394279897601361,0.20667178470344114,0.0893878402689146,1.9
0.25000000000000002,0.9387002962422741,0.4600498433082702,-0.0893878402689146,1.
0.42857142857142927,1.1011662234132074,0.7109755931887016,0.046049249308834625,
0.1515151515151516,0.6723220554921822,0.31459668945980473,-0.046049249308834625
0.3235294117647063,0.4622604554715823,0.2193875172732293,0.11776065984689663,1.
0.2424242424242432,1.2276409299404571,0.37855795822243543,0.11766797521860026,1
0.26315789473684237,0.8631616953381546,0.47283801173622897,0.005815363936912898
0.5882352941176483,0.7248886470110472,0.4648823723726189,-0.24124399900240978,1
0.6249999999999972,0.8097800011944809,0.4430157458163785,0.1332446299004124,1.4
```

Example AuToBI Output File

```
[[163, 57, 97, 127, 132, 74, 71, 94, 62, 81]]
Running net now.
[0.7683124437971349, 0.3550306999867779, 0.3367531952221113, 0.26433032930406036]
Actual proficiency: CAE
Guess PET proficiency.

[0.7260711695390256, 0.3979878367355255, 0.3522343375771497, 0.33733963153554264]
Actual proficiency: CAE
Guess PET proficiency.

[0.7582129448952849, 0.39411537494171706, 0.3773851367698294, 0.27827378900571487]
Actual proficiency: FCE
Guess PET proficiency.

[0.7866799425200497, 0.4213675940092924, 0.3298225046937649, 0.2989004058274284]
Actual proficiency: CAE
Guess PET proficiency.

[0.5580529908225029, 0.6878299261705276, 0.6610834821380739, 0.6097229752099396]
Actual proficiency: FCE
Guess CAE proficiency.

[0.5519092818184534, 0.6691780617124948, 0.6395266359163262, 0.6038927846261245]
Actual proficiency: CDE
Guess CAE proficiency.

Marilia test
Actual proficiency: CAE
Guess CAE proficiency.
```

Neural Network Output

Website Prototype Review



☰ Prosodic Toolchain

Welcome to the Web Prosodic Analyzer

Please login!

Username:


Password:

Login

☰ Prosodic Toolchain

Upload a new access code for new users to be made.



Access Code Generator

☰ Prosodic Toolchain

Make New Account


First name:

Last name:

Username:

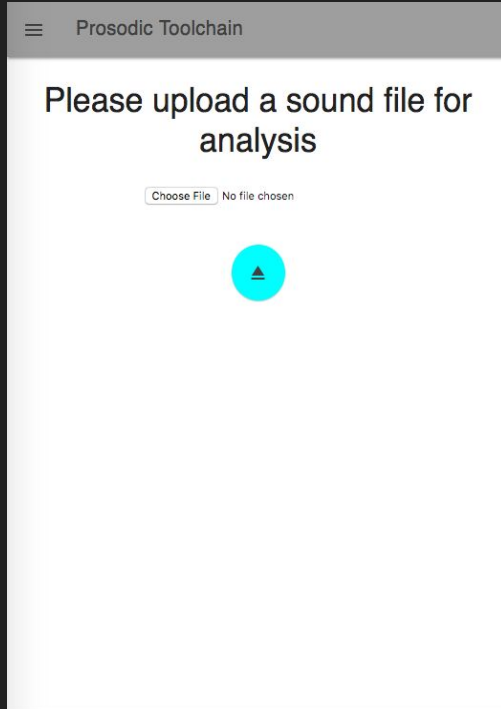
Password:

Access Code:

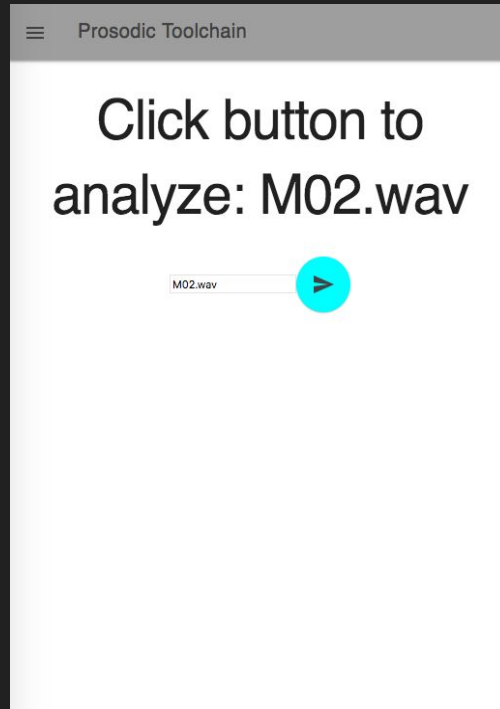


Create Account

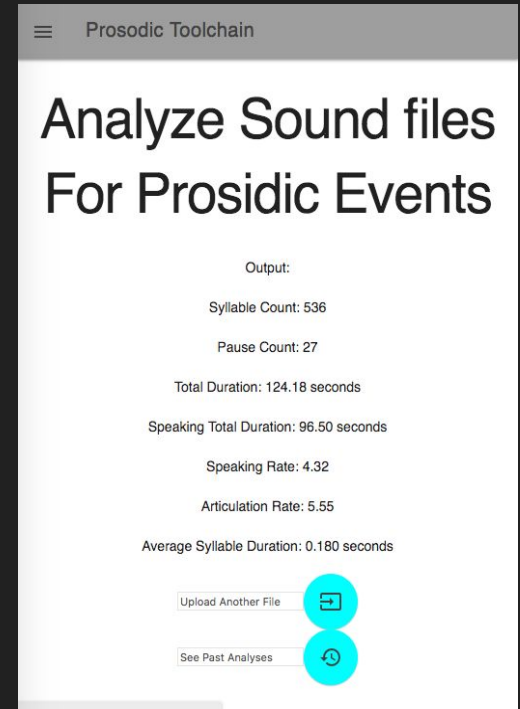
Website Prototype Review (continued)



Upload File



Run Analysis Confirmation



Results

Testing Plan

ToBI Toolchain

Unit Testing

- Valid input/output files
- Output file correctly edited

Integration Testing

- Neural Net accuracy high enough
- Output data transfers correctly

No Usability Testing

- Command Line

Website

Unit Testing

- Valid input
- Remove malicious input

Integration Testing

- Ensure client and server talk
- Ensure application and DB talk

Usability Testing

- Allow ALSL to test product

Testing Expectations and Results

Invalid user input or any other tested failures results in an error string letting the user know what went wrong.

After allowing our client and her students to test the code we will take their feedback and upgrade the website interface accordingly.

Input fields that take in potentially malicious content like script tags or database commands must perform proper stripping of such tags or commands.

Challenges and Resolutions

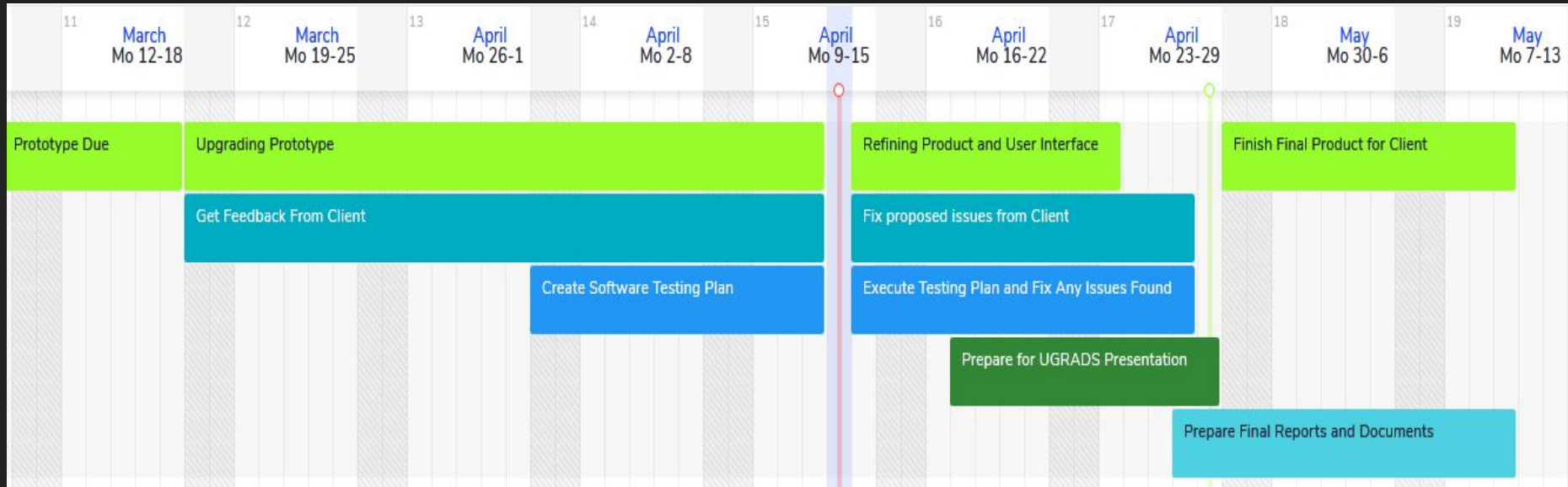
ToBI Toolchain:

- Feature selection
- AuToBI file generation - attribute error and data mismatch
 - Created a script that found the error and fixed the data mismatch

Website:

- Migration of local host to Digital Ocean
- Matlab hosting on the web server
 - Proposed solution that was still useful for client but allowed us to remove Matlab.

Rest of Semester Schedule:



Conclusion

- Website
 - Praat software
 - Fast, convenient, accessible
 - Audio files are analyzed online and previous analysis are stored

- ToBI Machine Learning Program
 - Use AuToBI output to pass to Weka Java API for feature selection
 - Pass to a neural network to calculate proficiency score.



Thank You

Joshua Shaffer - jls865@nau.edu,
Luis Montes, Matt Quintana, and
Erik Strauss