Augmented Literacy Learning Platform

MIDS W210 Capstone
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Education and Literacy

- Literacy gaps exist with different Socioeconomic conditions*
- School Conditions and teacher experience are correlated to literacy achievement*
- Smaller Class Sizes are expensive**

What if we could democratize Literacy by using Big Data?

* Education on Socioecominc conditions
http://www.apa.org/pi/ses/resources/publications/education.aspx

** Research on Class Size and FUnding
https://www.brookings.edu/research/class-size-what-research-says-and-what-it-means-for-state-policy/

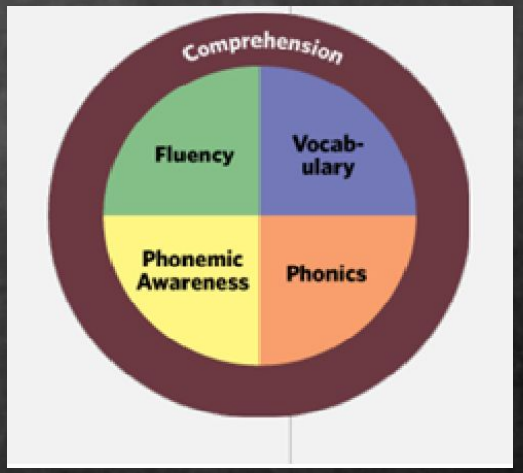
Components of Literacy

Phonemic Awareness

Focus on and manipulate phonemes into spoken syllables and words

Phonics

Relationship between written letters and sounds in language



Fluency

Read Orally with appropriate speed, accuracy, and expression

Vocabulary

Ease of making sense of text by reading, repetition, multiple exposure, context and use of technology

Comprehension

Understanding of what has been read.. Develops through Q&A and summarization

Augmented Literacy Platform

Any Book, Any Child, Anywhere

Optical Character Recognition

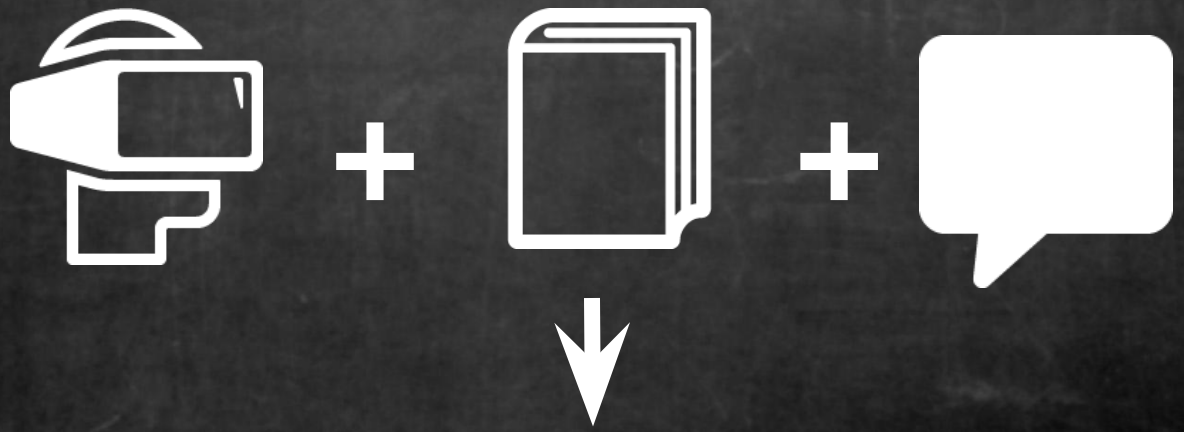
Speech to Text from Big Data

- online first
- offline next

Natural Language Processing

DashBoard Design

Raspberry Pi Hardware



10x idea, one semester

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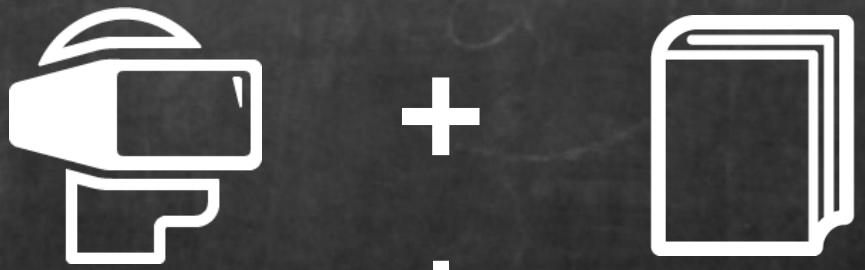
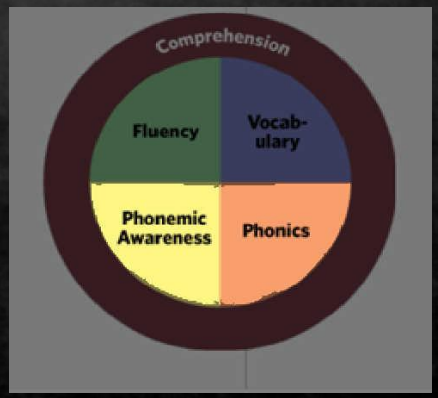




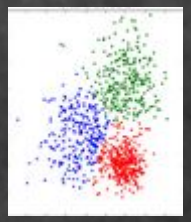
Phonemics: Problem to Solve

- Correct readings generate transcripts that are not exactly like the original text.
  - App would correct children when it is not needed
  - Speech to text recognition API constraints
    - additional APIs being researched
- Not a NLP problem necessarily...yet
- Unlabeled data for this case.

Phonemics: First Approach

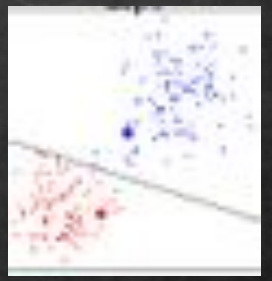
Unlabeled data

clustering for .wav files vector equivalent for a single phrase (many children)



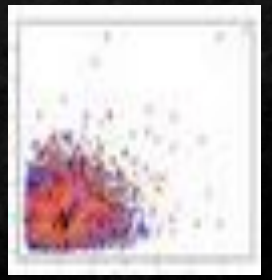
Expectation

- clusters around transcripts equal to text (no .png file) and very far from it.
- example for k-means with 2 clusters



Reality

- many perfect transcripts lectures on different clusters.
- Many incorrect transcripts on different clusters.
- Not much better behaviour when incrementing k.



Phonemics: next steps

- Clustering not the numeric vector but the transcripts themselves
  - word + phonemics files turned into numeric vectors
- Labeling a few as correct or incorrect according to audio (manually)
  - semi supervised model.
- Recognize text in transcripts different to text that doesn't mean incorrect reading
  - offline identification and database generation for words with accepted transcripts.
- Online search and reject / accept visualization for each word.

Demo

- Software
  - Xamarin for mobile development
  - Tesseract for OCR
  - Android OS for speech-to-text and text-to-speech
- Hardware
  - Honor 7X phone
  - Aryzon prototype AR headset

honor

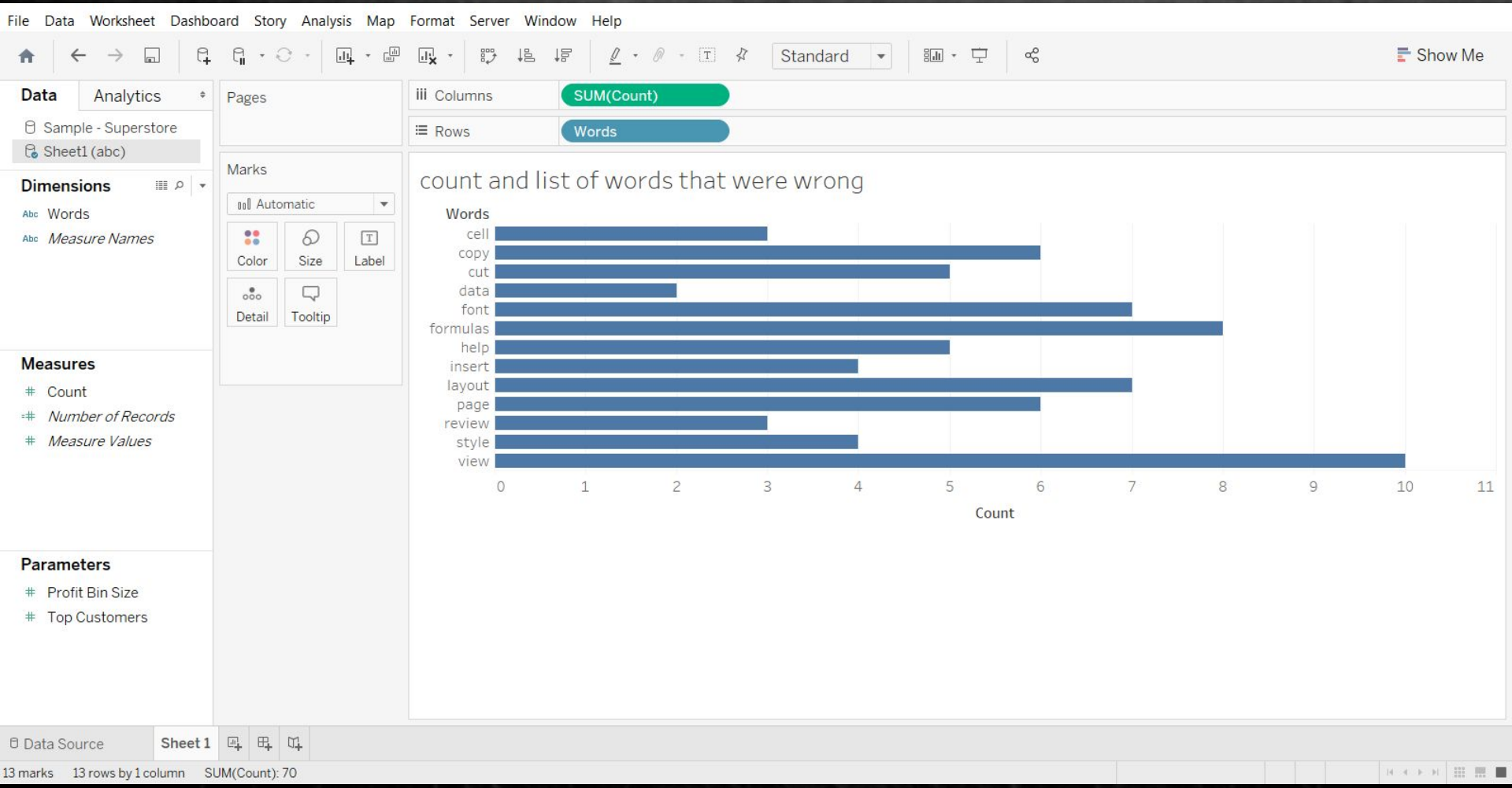
Demo

Phonic Dictionary Teacher Guidance

- Using OCR, the system essentially has labeled data for unknown books
- CMU Pronouncing Dictionary
  - Open Source Machine Readable with over 134,000 words
  - Phoneme Set
    - 39 phonemes
    - Learning Tool can determine which phonemes to focus on

Dashboard sample

dashboard currently under construction



Challenges & Iteration

- Agile Development
  - New to parts of speech
- Online and Offline Models
- Difficult to find users
  - It's summertime, teachers and children are harder to corale

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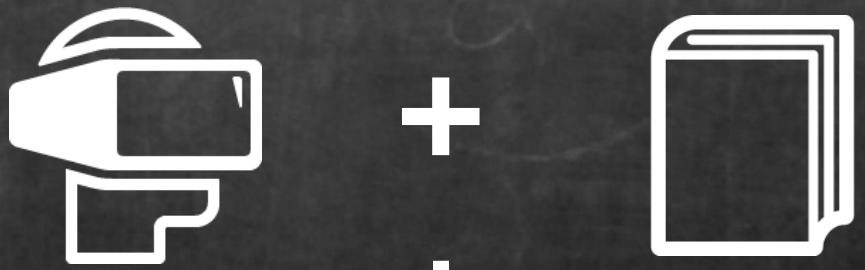

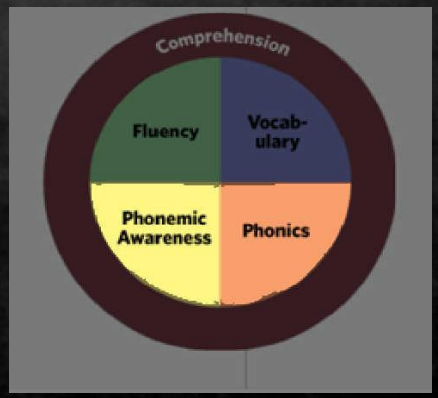

Questions?

One hundred years from now,
It won't matter what car I drove,
What kind of house I lived in,
How much I had in my bank account,
Nor what my clothes looked like,
But the world may be a little better
Because I was important in the life of a child.

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Appendix A: References

- Schools with students from the highest concentrations of poverty have fewer library resources to draw on (fewer staff, libraries are open fewer hours per week, and staff are less well rounded) than those serving middle-income children (Pribesh, Gavigan, & Dickinson, 2011).
- Children from low-SES families enter high school with average literacy skills five years behind those of high-income students (Reardon, Valentino, Kalogrides, Shores, & Greenberg, 2013).
- Students who were randomly assigned to higher quality classroom in grades K-3 earned more, were more likely to attend college, saved more for retirement, and lived in better neighborhoods (Chetty et al., 2011).
- CMU Speech: http://www.speech.cs.cmu.edu/tools/lextool.html

Appendix B: Block Diagram