Design Doc for Police radio transcription project

**Software**

Required software:

* Streamripper
  + Can be found here: <http://streamripper.sourceforge.net/>

Required Packages:

* requests\_html
* logging
* Re
* Pandas
* Os
* Usaddress
* pyAudioAnalysis
* pydub
* noisereduce
* scipy
* Matplotlib
* Numpy
* Wave
* Sys
* Math
* contextLib
* Soundfile
* Datetime
* Speech\_recognition

**Work Flow**

Crawler -> scraper -> preprocess -> transcription -> parse

All data scraped from **Broadcastify.com**

**Breakdown of modules**

Crawler:

* Written by Sungwong Chung
* The crawler is used to find urls for every broacast on brodcastifty.com
* Not finished, needs to be able to set relays for every url, currently only does one
* Inorder to select a specific stream for testing, go into crawler.py, go to the method set\_relay(self), and change the variable feed\_id to the feed you want to test
  + The feed)id can be found by going to the url of the stream you want to scrape, and copying the number after feed/
  + Example: for the stream <https://www.broadcastify.com/listen/feed/2776>, you would copy the 2776 into the feed\_id

Scraper:

* Written by Sungwong Chung
* Uses streamripper to rip the stream using console commands
* Currently only scrape\_one function is implemented, need to implement scrape\_all
* Can change the name of the output mp3 file by changing the last part of the string
  + Currently it is set to “test\_audio\_cc”
* Can change how long it is scraping by changing the number before the -a flag
  + Currently is set at “600” for 600 seconds

Preprocess:

* Written by Tucker Johnson
* Has a variety of functions for preprocessing, the main ones being:
  + convert\_mp3\_to\_wav(audio\_path)
    - Takes as input a string of a path to an mp3 audio file, will create a wav file with the same name in the same input directory
  + remove\_silence(audio\_path, out\_directory)
    - Segments a wav audio file, removing all periods of silence
    - Takes in a string path to an audio file
    - Out\_directory is a string path to where the segments will be saved to
  + noise\_reduction()
    - Should not be used in final production
    - Was trying to reduce noise using method found here:
      * Jupyter notebook: <https://timsainburg.com/noise-reduction-python.html>
      * Github: <https://github.com/timsainb/noisereduce>
    - Was found to be less effective than frequency filtering
    - Note: if used, outputted wav files need to be converted from pcm-32 to pcm-16, this can be done using the convert\_to\_pcm16(audio\_path) method
  + frequency\_filter(audio\_path, out\_path, frequency)
    - Takes in a file from the audio path, and will write a filtered wav file to the outpath
      * Note, outpath should also include outfiles name
      * Ex: “directory/filtered\_segment.wav”
    - Frequency is the cutoff for the max frequency allowed
    - After a lot of testing, best frequency found to be 400
    - Based on Moving average frequency filter which can be found here: <https://stackoverflow.com/questions/24920346/filtering-a-wav-file-using-python>
  + boost\_audio(audio\_path, boost)
    - Boosts the decibels of inputted wav file
    - Will replace the wav file found in the audio\_path with a boosted version
    - The boost variable is the number of decibels it will boost by
      * Found to work best in the 6-10 range

Transcriber:

* Written by Tucker Johnson
* Takes in a speech\_recognition.AudioSegment() class as input
* Uses google speech recognition software
* Returns a string of transcribed text, or “Couldn’t Transcribe” if it is at too low of confidence for the transcription
* The built in reduce\_ambiant\_noise method of the speech\_recognition package does not work well, would not recommend using it

Parse:

* Written by Tucker Johnson
* NEEDS A LOT MORE TESTING, more of a proof of concept parser than a fully functional one
* Called using parser.parse\_lines()
* Parses out addresses using usaddress package found here: <https://github.com/datamade/usaddress>
  + Might also recommend using libpostal if you can get it to work
* If an address is within 3 lines of crime, will save a tuple of (address, crime meaning) in a class variable named street\_crimes
* Can pull street crimes using get\_street\_crimes() method
* Can pull a pandas dataframe of all codes used and the number of appearances for each one in the text file using get\_crime\_counts() method

**What still needs to be done:**

* Paralyzation of scraping, preprocessing, transcribing, and parsing
* TESTING OF PARSER
* Potentially using a different (maybe payed for?) transcription software
  + Current software naturally has 16% error rate, this is compounded by bad quality of police broadcast audio

**What has been tested:**

* Best results found when audio is segmented by noise, filtered with a frequency of 400, then boosted by 10 decibels (I’ve been using 10)
* Other things tried:
  + Frequencies above 400
  + Boosting at different DB levels
  + Bosting, then segmenting, then filtering, then boosting
  + Filtering, then segmenting, then boosting
  + Filtering, boosting, segmenting
  + Noise\_reducing, filtering, segmenting, boosting
  + Filtering, noise\_reducing, segmenting, boosting
  + Segmenting, filtering, noise\_reducing, boosting
  + Segmenting, noise\_reducing, filtering, boosting
* Noise reduction only seems to hurt results, especially compared to filtering

**NOTE: Example.py has not been tested, might need to change a couple file paths in order to get it to work. It should be used as a general guideline for the workflow for testing purposes**

If you have any questions, contact me on linkedin: <https://www.linkedin.com/in/tucker-johnson-398a01141/>

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