



Project Overview		Broad Investigation Results		Recommendations
<p><b>Background</b> Regulatory agencies of aviation are looking to reduce the amount of noise generated by aircraft while the number of flights worldwide continues to increase. The noise certification process for aircraft is expensive and requires monitoring personnel. Due to the remote location of these tests, contamination of the audio data is possible from birds, insects, various wildlife, and road traffic.</p> <p><b>Objective</b> Research the feasibility of automating the detection of environmental noise contamination contained in acoustic measurements for aircraft community noise testing.</p>				<p>This section is currently a work in progress as we have not finalized our Deep Investigation.</p> <p>One recommendation that we do have at this time is that these models don't perform well on classifying contamination signals that have not been seen before. We suggest that more data is provided to fully enumerate the possible contamination classes that would exist near the test site.</p>
Data		Deep Investigation Results		Challenges
<p>This project leveraged 66 audio files that were provided by Boeing Test and Evaluation and 6 audio files from the US National Parks Service. Altogether we have 49 recordings of aircraft and 10 ambient recordings to make up our clean signal data. We have 13 different files to use as contamination. The data provided by Boeing have been anonymized through normalization.</p> <p><b>Process</b> To generate the data set a clean signal file is first split into blocks of length <math>t</math>. If designated to be a file with contamination audio, an unclean signal is added at the desired signal-to-noise ratio to allow for finer-grained control. Features are then generated for each block and the resulting feature set can be handed to a model for training.</p>				<p><b>How To Turn Audio Into Features</b> We separated each audio file up into blocks of an equivalent length and then processed the features for each block. Blocks from which features were generated could contain overlapping audio.</p> <p><b>How To Quantify Contamination Levels</b> The audio recordings that were used only had a single source of noise allowing us to combine aircraft or ambient signals with contamination to create a larger data set than the 66 files. This also allowed us to control the signal-to-noise ratio.</p>
Methods				Limitations
<p>Our investigation into the viability of automated detection of environmental noise contamination is broken into two parts. A broad assessment of feature sets and models followed by a deeper investigation into three of the best performing pairs.</p> <p><b>Broad Investigation</b> To get a general idea of how different feature sets and models perform on this classification task, our initial broad investigation's goal was to enumerate as many feature set, model pairings as possible while limiting the block size and holding the signal-to-noise ratio constant.</p> <p><b>Deep Investigation</b> After selecting three of the best performing feature set, model pairs, our more thorough investigation includes each of the following steps to understand how they might behave in a more real-world scenario.</p> <ol style="list-style-type: none"><li>Optimize the models hyperparameters.</li><li>Randomize the signal-to-noise ratio.</li><li>Randomize the percent of a block that contains contaminated audio.</li><li>Randomize which blocks are contaminated.</li><li>Vary all of above parameters through Monte-Carlo simulation.</li></ol>				<p>Due to the small size of potential contamination audio, the models might not be accurate when classifying new sources of contamination.</p>
				Acknowledgements
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