**Thesis:** Important Features For Speech Recognition Task

**Abstract:** Automatic speech recognition (ASR) performs on par with human listeners on several clean speech datasets. However, the ASR is still much less noise robust than normal human listeners, presumably because the ASR does not use the same information as humans. Therefore, we conduct research on identifying speech importance maps (IMs) to understand the listening strategies of humans and ASR and also on evaluating these importance maps. IMs are time-frequency regions in the spectrogram that a listener pays attention to when making a transcription. The importance maps are 2-D as they indicate the important time-frequency points. While sequence to sequence models typically use an attention signal, which can be considered to be an importance map, it is restricted to operating only over time. First, we propose an adversarial-based approach to identify the 2-D IMs without ground truth IMs. The importance maps predicted by the adversarial-based approach show patterns similar to analyses derived from human listening tests. Second, we compare the important time-frequency regions that humans, non-neural network ASR, and neural network ASR focus on. Our analysis concludes that the neural network ASR has importance maps much more similar to the human ones than the non-neural network ASR's maps, but does not capture all the cues that the human listeners utilized. On this basis, we suspect that the ASR's performance in noisy conditions can be improved by encouraging it to pay better attention to the cues used by human listeners. Third, we develop a new evaluation metric, which is the first metric to evaluate importance maps in a structured prediction task. This metric is different from existing ones, in which the accuracy of other words in a sentence and the predicted important speech energies are taken into account. In the proposed work, we plan to use importance maps to directly improve an ASR on the Google speech commands dataset in a noisy environment.

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