Towards Classifying Human Phonemes without encodings via spatiotemporal liquid state machines

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Recently, we showed that liquid state machines [1] can be adapted to give robust pattern recognition of temporal patterns [2]. Moreover we showed how certain natural modifications in the neurons enables the liquid state machine to compute on complex continuous real valued patterns without the need for discretization and digital encoding [3]. In attempting to apply this technique to signal processing on phoneme recognition from a continuous voice signal, we found this to be intractable; because of problems in both making the system accurate while maintaining good generalizability properties. It seems that the combination of the separability of the liquid with the digital encoding conflict with the generalizability.

Current machine learning and other techniques are fairly accurate in classifying phonemes after substantial preprocessing. However this is not a very natural methodology and can not be related to human decoding of speech.

In this work we investigate whether recent spatiotemporal methodologies can successfully decode the raw speech signal into phonemes without such special preprocessing. Our methodology uses a recent robust version of Liquid State Machines [4].

We have successfully shown that the method (i) can decode specific signals and (ii) can successfully decode artificially induced noisy versions of the signals and thus has good generalization capabilities. The next step is to try the method on human variants of trained signals. This may require additional structure on the Liquid State Machine.

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