TemporaLSM: A Simulation Framework for Temporal Neural Liquid State Machines

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Abstract—**Liquid state machines (LSMs) are a type of reservoir computer that aim to construct more biologically plausible neural network architectures than artificial counterparts. Rather than purposely constructing neurons in particular arrangements, an LSM self-organizes its neurons into a 'liquid', which is read out to perform a task. Many arguments against LSMs stem from this difficult-to-control random procedure, and due to their complicated setup, current LSM designs are not well explored.**

Through this work, we present TemporaLSM, a simulation framework for liquid state machines using good-for-hardware temporal neuron designs. Furthermore, we analyze a series of liquids generated by TemporaLSM to determine how different hyperparameters affect the construction of the liquid, and attempt to identify similarities between liquids on differing tasks.

Index Terms—**liquid state machines, temporal neural networks**

I. INTRODUCTION

II. NETWORK CONSTRUCTION

This work mainly follows the temporal neuron as defined in [1]. As such, this section presents an overview of the network construction process and the individual (hyper)parameters of a constructed network.

A. Overview

B. Seed Configuration

C. Neuron Activation Function

D. Network Training

III. PROBLEM-SPECIFIC ANALYSIS

A. Amazon Product Reviews (Text Classification)

B. MNIST Handwritten Digits (Image Classification)

IV. CONCLUSIONS

A. Network Similarities

B. Future Work

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