

System 1 – System 2

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Motivation & Research goals

System 1 – System 2 is based on the idea of thinking fast and slow to save energy with a simple and energy-efficient system 1 and increase performance with a performant system 2 when required. With the advent of viable neuromorphic machine learning, System 1 – System 2 could combat the accelerating consumption of energy in large to huge models. The figure below visualizes our solution in various configurations and possible technologies involved.



Cascades

Previous work with multi-model schemes involve cascades, leveraging inherently well suited models i.e. ensemble techniques¹. Cascades are relatively immature within Spiking Neural Networks. Cascading Neural networks involves adding an output layer to all of the hidden layers.²



Applying to System 1 - System 2

The project have explored the idea of policy networks for system 1 - 1system 2. The same approach was done in several configurations for system 1 – system 2 with limited success. Moving forward, in order to fit System 1 – System 2 the policy network effectively need to promote a distribution between the systems, using a new type of loss. Bringing

insights from dynamic timesteps the project also aim to explore other areas as well, for example pondering⁴.



Dynamic Timesteps

Moreover, it is not obvious how to best train and integrate Neuromorphic learning. For example how to optimize for latency and computational overhead. Policy networks could be a step toward an autooptimization for when to quit, determining before inference the optimal number of timesteps.³



References

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