imgs/qrcode_TODO.jpeg

Modeling Hippocampal-Cortical Interaction During Event Processing

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Summary

- Saving episodic memories at event boundaries reduce is protective aganist lure memories during retrieval.
- There is a speed-accuracy trade-off on "retrieval-conservativeness".
- Inhibiting recently-retrieved memory is necessary.

Model Architecture

Cortex

- Context-dependent state prediction.
- Actively maintains the current situation model.

Hippocampus

- Encoding: store episodes.
- Retrieval: pre-load situation models.

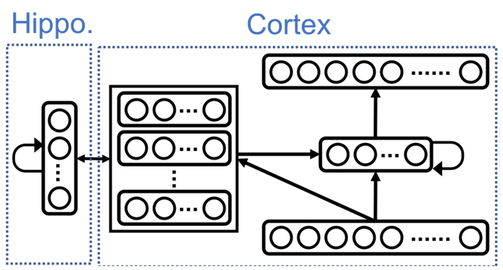

Figure 1: The model architecture. Cortex is an RNN that predict the next state, and it has a buffer. Hippocampus is another RNN with some encoding/retrieval mechanism.

References & Acknowledgement

[1] Ben-Yakov A., & Dudai, Y. (2011). J Neurosci
[2] Ben-Yakov A., Eshel, N., & Dudai, Y. (2013). J Exp Psychol Gen
[3] Ben-Yakov A., & Henson, N. (2018). biorxiv.
[4] Chen, J., et al. (2016). Cereb Cortex

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Download the poster: `http://blablabla.com/`

Task formulation

- **Schema structure** is encoded in the default transition matrix.
- The transition matrix also depends on some trial-specific **context**.

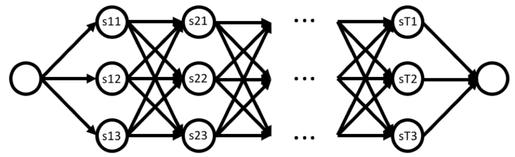


Figure 2: In this schema graph, each node represents an event, and each edge has a default transitional probability.

Shared situation model enhance inter-subject correlation (ISC)[4]

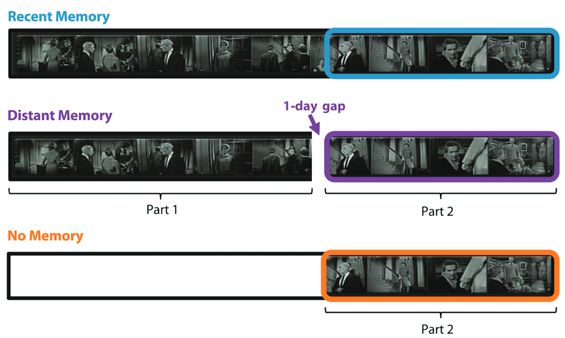


Figure 3: Experimental design[4]. Participants watched an twilight zone episode while being scanned.

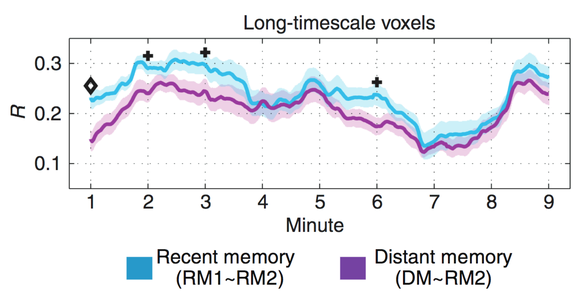
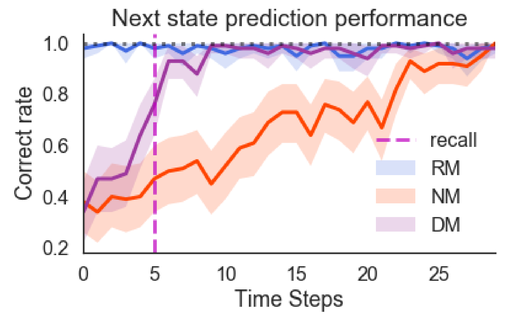


Figure 4: Empirical fMRI inter-subject correlation (ISC)[4] during the second half of the movie.

ISC simulation

Model simplifications, hippocampus

- Encoding: save the situation model from the 1st part of the movie as one chunk.
- Retrieval: we force all models to retrieve at t=5.



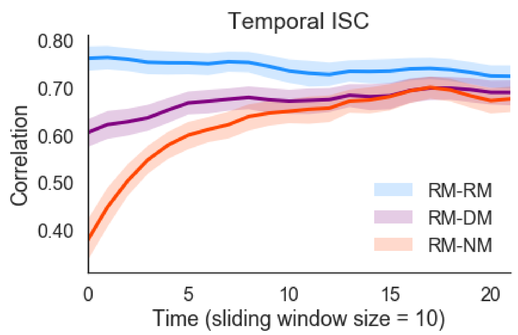


Figure 5: Top: Model state prediction accuracy; Bottom: after functional alignment, model ISC pattern qualitatively capture the empirical result[4], shown in Figure 4.

Parameterize hippocampus

Retrieval:

- Value of a episode = # match - # mismatch
- Min-match and Max-mismatch.
- Inhibit recently retrieved memories.

Encoding:

- Chunksize: chunk the observed event sequence into pieces.
- Lure episode = actual episode + noise

Recall performance

Metric: how often does the model pre-loaded the required situation model parameters.

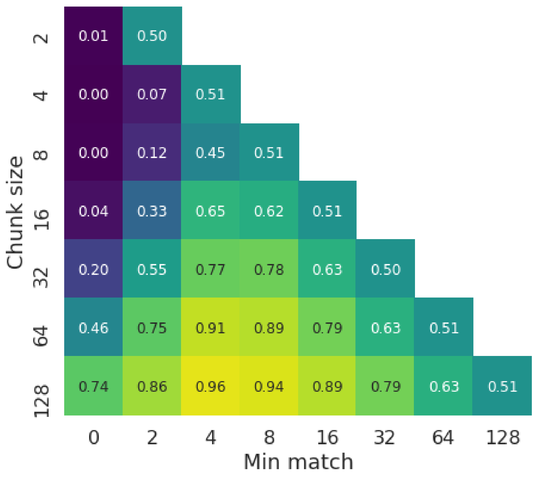


Figure 6: Recall performance.

Chunk size: Larger chunk size is better

- protect the model from retrieving lure episodes.

Min-Match: speed-accuracy trade-off

- Too small: error prone
- Too big: delay retrieval

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Figure 7:

`plots/lines2.png`

Figure 8: