Meta-Learning of Dynamic Policy Adjustments in Inhibitory Control Tasks

Soumya Chatterjee*, Aakriti Kumar*, Pradeep Shenoy

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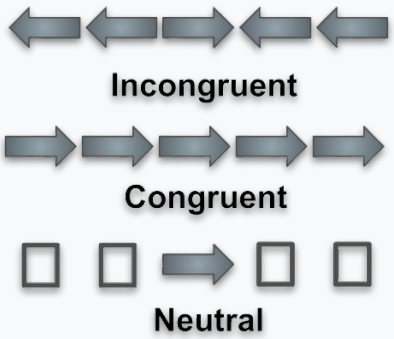
Background

- Simple tasks used to assess aspects of cognitive processing *in individuals*
  e.g., conflict resolution



Eriksen flanker task

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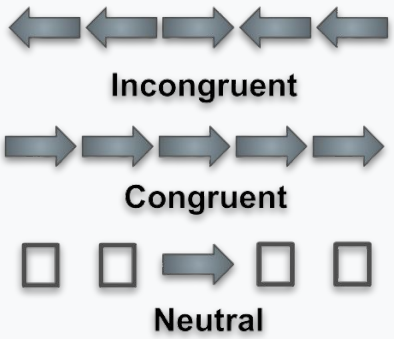
Background

- Simple tasks used to assess aspects of cognitive processing *in individuals*
  e.g., conflict resolution
- Simple measures of performance
  e.g., response-time differences



Eriksen flanker task

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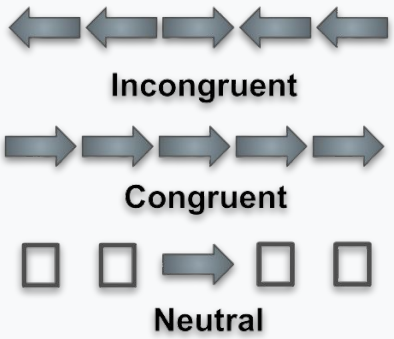
Background

- Simple tasks used to assess aspects of cognitive processing *in individuals*
  e.g., conflict resolution
- Simple measures of performance
  e.g., response-time differences
- Measures are *noisy, "non-repeatable"*
  low test-retest reliability



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Proposal

Model-based fits to capture behavior

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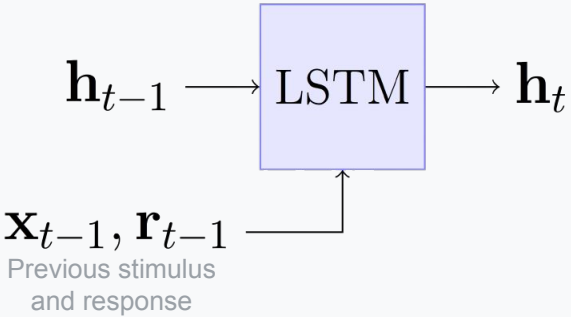
Proposal

Model-based fits to capture behavior

- Exploit inter-trial dependencies for better prediction



Our Proposed Model - RecNet(SE)

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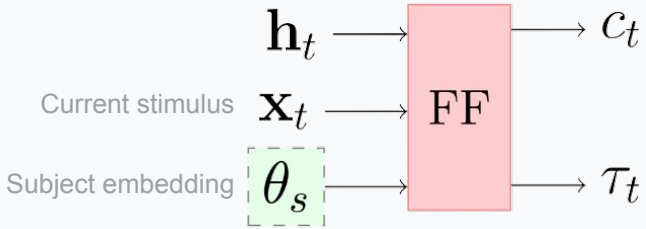
Proposal

Model-based fits to capture behavior

- Exploit inter-trial dependencies for better prediction
- Per-subject parameters for individual fits



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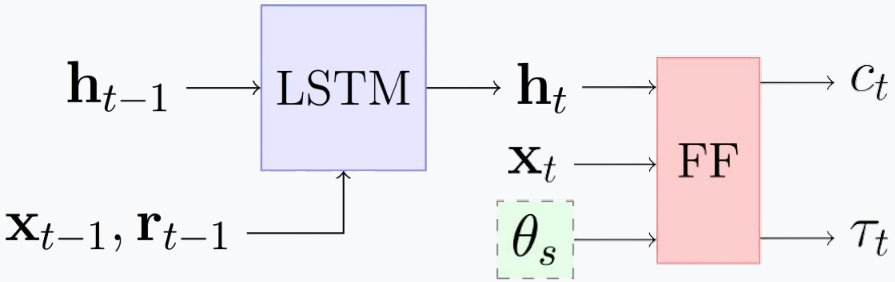

Our Proposed Model - RecNet(SE)

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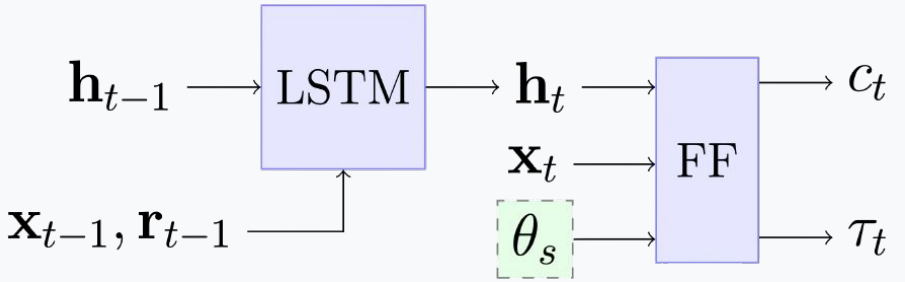
Proposal

Model-based fits to capture behavior

- Exploit inter-trial dependencies for better prediction
- Per-subject parameters for individual fits
- Meta-learning for population-level predictive fits



Our Proposed Model - RecNet(SE)

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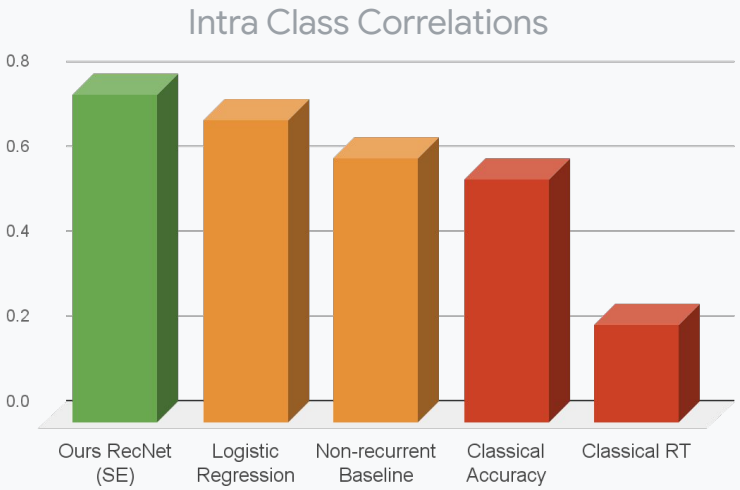
Results

1. RecNet(SE) has highest test-retest reliability†
   Modelling sequential adjustments helps improve reliability (ICC)



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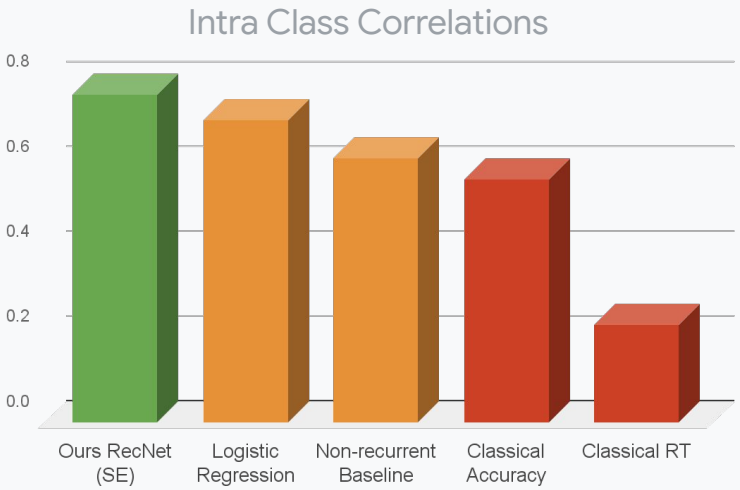
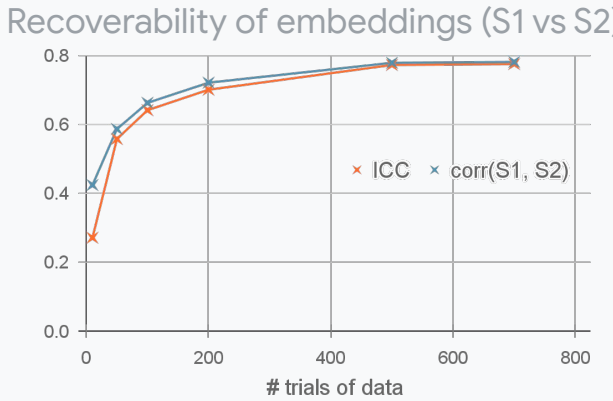
† 107 subjects performing the Eriksen flanker task in 2 sessions. ICCs are for across-session reliability.

Results

1. **RecNet(SE) has highest test-retest reliability**[†]
   Modelling sequential adjustments helps improve reliability (ICC)
2. **Meta-learning allows fast estimation of subject parameters**
   ~200 trials are enough to get good estimates of individual subject parameters





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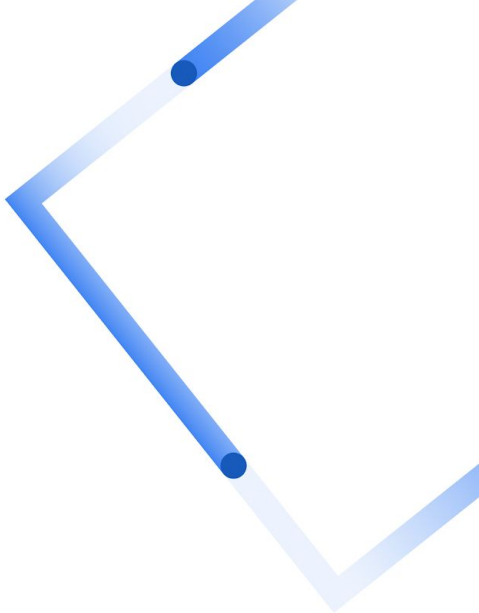
[†] 107 subjects performing the Eriksen flanker task in 2 sessions. ICCs are for across-session reliability.

Future work

- Extend to *multi-task* settings; capture full cognitive assessment battery
- Examine *interpretability* of subject embedding along cognitive dimensions

Thank You



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