

Perceptual decision making is supported by a hierarchical processing cascade in both biological and artificial neural networks

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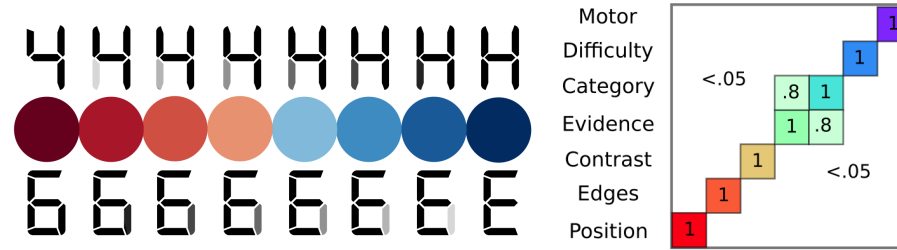


1 Introduction

- Ambiguity is ubiquitous in the world around us, yet humans are able to derive meaning with little error
- Performance-optimised deep neural networks (DNNs) are also highly specialised in solving perceptual ambiguity in the visual domain

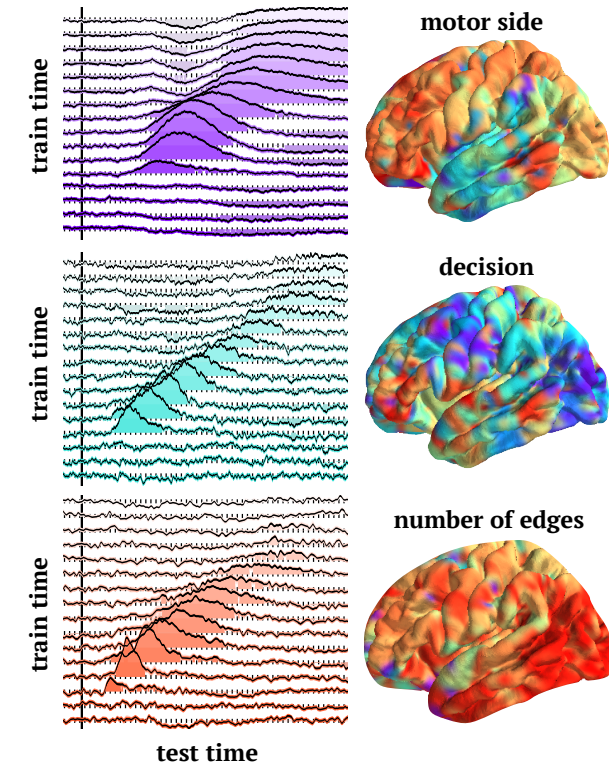
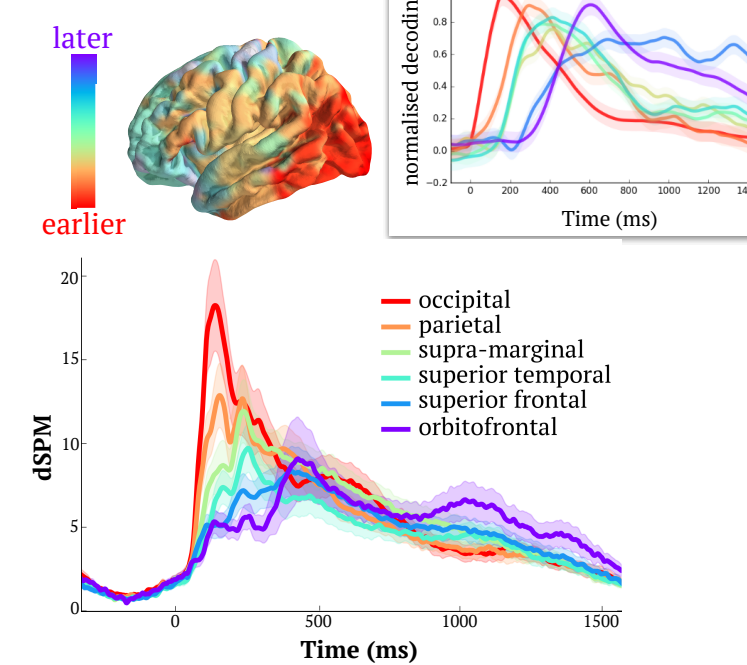
How does the human brain resolve ambiguity in visual inputs, and is this similar to artificial neural networks?

2 Method & Analysis



- 17 participants made letter/digit judgements
- MEG was recorded with a 306 channel Elekta system
- Stimuli were orthogonal on 7 stimulus features
- We decoded each feature from whole brain MEG signals at each time instant, and three neural networks

4 Activity propagates along visual hierarchy

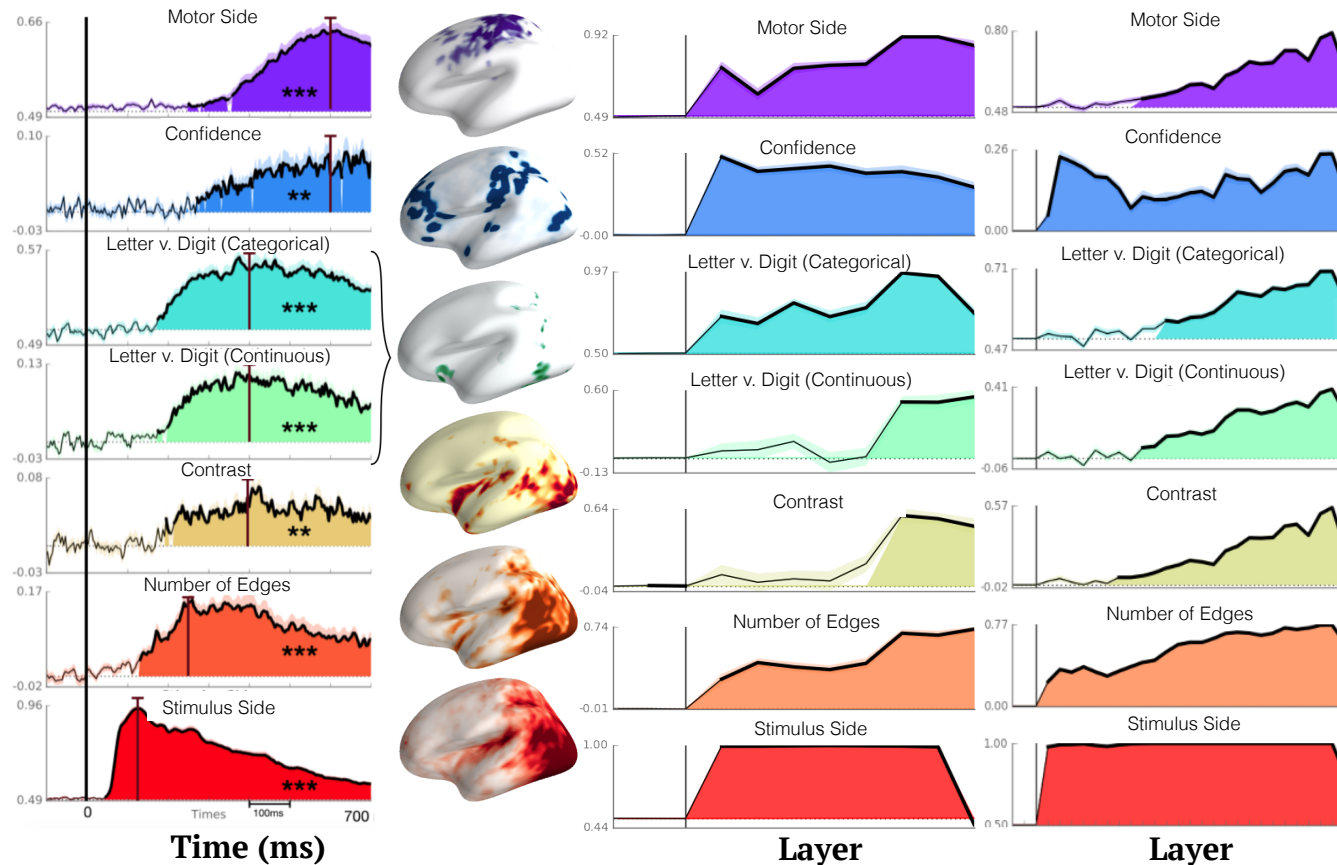


3 Cascade can be decoded from the human brain, and some DNNs

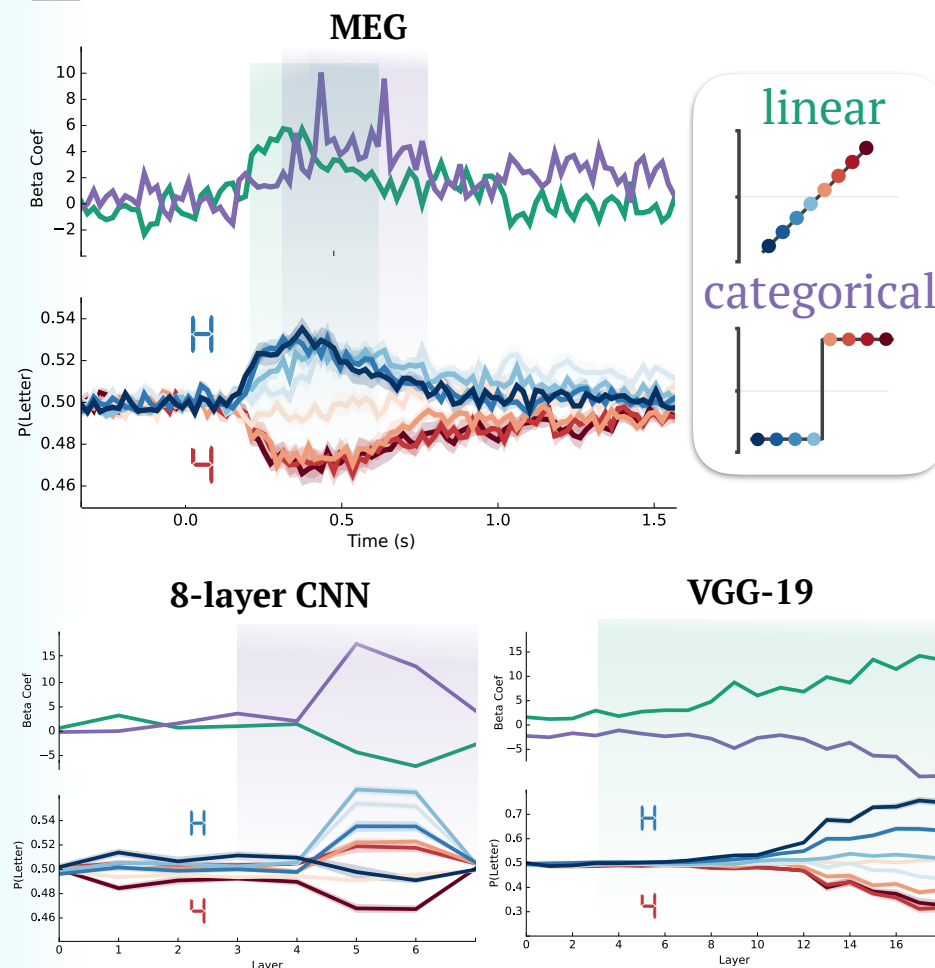
Human MEG

8-layer CNN task-specific training

VGG-19 generic image labelling



5 No linear -> categorical transform in DNNs



6 Conclusions

- The brain solves ambiguity with a hierarchical cascade architecture
- All features are maintained in parallel until the terminal process
- The brain transforms linear input into categorical (subjective) representations (DNNs do not)
- The brain shares representations, but not computations, with DNNs

Ambiguity is resolved by accumulating evidence with a nested cascade of dynamic processes