We consider a typical neuroscience study of decision-making processes in humans, in which the data to the choices of subjects (with learning-rates etc. as the model parameters) and then finding the

Understanding the decision-making system in the brain is important

We define the overall loss function as the weighted sum of the behavioral and fMRI loss functions.

Thus, we can decompose:

The sum of individual voxel contributions at each point in time is determining the contribution of the fMRI loss function, and

The equation also requires that $|\bar{z} - \bar{z}'| \leq 2\mu$

We have introduced a new architecture for investigating the neural substrates of decision-making in the brain.

Our approach does not require neuronal activity but is able to learn computational processes directly from the data. Further work showed that the model can be trained to uncover the temporal engagement of different brain regions in choice and reward prediction.

Besides being used as a standalone analysis tool, this approach can inform model-based PPMI analyses to investigate whether the model correctly tracks the brain's internal mechanisms. The model A is a learned model, which is not just a pass-through model. The use of cross-validation could mean that the model was not stressed, but information is not represented at all the relevant neural signals involved in decision-making and requires further validation.

Conclusions

The models show that for each action, the top 15% of voxels covers three key cortical and subcortical brain regions known to be critically involved in neuroimaging and decision-making: i) ventromedial prefrontal cortex (vmPFC), ii) anterior cingulate cortex (ACC) and iii) supplementary motor area (SMA).

The temporal order of engagement of these regions is also consistent with their functional role in decision-making.