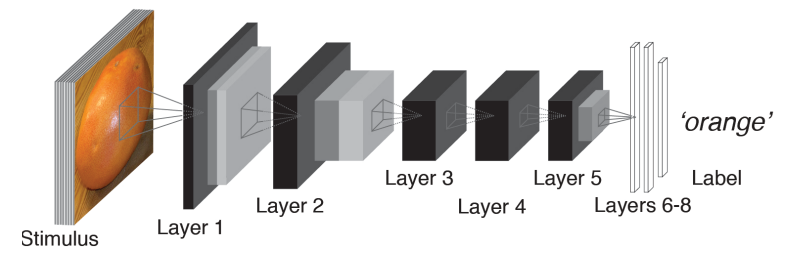


What is the Relationship Between Biological Brains & AI?



Relationship *at what level?*

Marr's Levels: Computational theory vs Representation/algorithm vs Hardware

I. Computational theory: What is the nature of the problem to be solved?

This part is by definition the same for brains and for AI systems solving the same problems.

The cool question: When AI systems & brains do the same task, will the algorithms be similar?

II. Representation/Algorithm: Similarity at this level is A Really Awesome Empirical Question!

Can compare representations in brains & deep nets using RDMs and regression methods.

With already some impressive findings of similarities between brains & deep networks:

- Yamins et al 2014 (PNAS) on visual recognition (this paper is revolutionary)
- Kell & McDermott (2018) for auditory perception of speech and music
- Schrimpf Fedorenko et al (2020) NLP models ~match the brain's response to language.

Of course the representations in current models do not match brains perfectly;

that is not a problem, but an opportunity. It tells us to improve the models (and maybe how)

III. Hardware is obviously different between AI and brains, but is that a problem?

If representations are different, maybe hardware matters for this computation.

When representations are similar btwn brains & models despite very different hardware, that is deep!

That is Marr's point: *"The nature of the computations that underlie perception depends more upon the computational problem than on the particular hardware in which their solutions are implemented."*