Using Deep Neural Networks to Understand the Human Mind and Brain

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How does learning to draw change what you see?

Web-based platform that uses deep neural network to recognize sketches

Choose two objects to draw (e.g., bed, chair) and keep other two as controls (e.g., bench, table)

Measure object recognition before and after training

Quantify changes in terms of accuracy of recognizing morphs

Drawing makes objects look more distinctive

How do memories overlap and change over time?

Synthesize images from deep neural network to induce memories that compete

Related memories overlap in the brain, retrieving one activates others, causing them to change

Become either more similar (integrate) or different (differentiate)

Match lower layers, vary similarity at higher layers

Visual hierarchy flat early in development

Competitio for retrieval causes non-monotonic changes to memories

How do babies see the world compared to adults?

Dissect videos into different visual features across layers of deep neural network

fMRI in infants (>3 months old), toddlers, and adults who watch movie once or twice

Compare how brain regions and model layers respond over time to the movie

Credit: Judy Fan (soon faculty at UCSD)
Credit: Jeff Wammes (soon faculty at Queens University)
Credit: Cameron Ellis (PhD candidate at Yale)