# Computational Approaches to Language and Mind (CALM)

Gerry Altmann – PSYC 3884/5570, Mondays 2pm–4pm, ARJ 340

*2025 schedule*

| DATE | TOPIC | CONCEPTS | Preparation |
|---|---|---|---|
| 1/27 | 1. Introduction & Planning <br> Introduction & Planning | Understanding AI vs. Building AI; complexity through simplicity. | No preparation |
| 2/3 | 2. What is Meaning? <br> From Latent Semantic Analysis to Simple Recurrent Networks | Words as vectors; semantic space; neural networks, recurrence; prediction. | No preparation |
| 2/10 | 3. Scaling up I <br> Backpropagation is a problem, Word2Vec is a solution | Word2Vec; word embeddings; negative sampling. | Attempt a couple of Medium articles |
| 2/17 | 4. Scaling up II <br> Recurrence is a problem, LSTMs and GRUs are a solution | The "vanishing gradient problem"; LSTMs and GRUs as "echo-amplifiers"; deep neural networks. | Attempt a couple of Medium articles |
| 2/24 | Homework | | |
| 3/3 | 5. What constitutes comprehension? <br> Recurrent Neural Networks and Event Structure in Time | Syntactic ambiguity; incremental processing; event representation; affordances; object representation. | Read Davis & Altmann (2021) |
| 3/10 | 6. Attending to the context <br> Transformers, Attention, & BERT | Transformers; attention; BERT. | Medium articles and YouTube videos |
| 3/17 | SPRING BREAK | | |
| 3/24 | 7. Fine-tuning 1.76 trillion "parameters" <br> ChatGPT, Mixtral MoE (aka Goliath meets David), Mamba (a state-space model) | Fine-tuning (aka a mystery); chatbots; mixture of experts; taking LSTMs to the extreme. | More Medium articles. |
| 3/31 | 8. ChatGPT can't handle the truth <br> A detour into vision, Generative Adversarial Networks, and Diffusion models in computer vision | Image generation; adversarial networks (aka a Turing Test built into training). Stable Diffusion | YouTube video; go play with any of several AI image generators |
| 4/7 | 9. Beware the Patellar Reflex <br> Piantadosi (Chomsky has been proven wrong) vs. Marcus (the Emperor has no clothes!) & Chomsky (amoral, linguistically incompetent, and uninterestingly evil) | Over-interpretation; faulty logic (on both sides of the "debate"). | Critiquing papers on both sides of the "debate". |
| 4/14 | Homework | | |
| 4/21 | 11. Different substrate, different values? <br> Ethics in AI/LLMs | Are we ready to legislate ethics of LLMs when we turn a blind eye to ethics of humans? | *Guest presenter*: Arash Zaghi, Engineering |
| 4/28 | 12. The $64,000 question <br> What Makes a Mind? | Some philosophical considerations. | Come up with a list of criteria… |