11-877 Advanced Topics in Multimodal Machine Learning

Week 3: Multimodal Co-learning

Due date: 11PM EST, Wednesday, Feb 2 2022

Submission: https://forms.gle/zatnVka1T8jnSm4D7

We designed the reading assignments to help you prepare for the live discussions. Discussion probes were drafted related to this week's topic. These were written to help conceptualize the problem and guide your thought process. Take the time to read them first. The goal is not to answer each of these questions and probes individually, but they are meant to be taken as a whole. We also selected research papers relevant to this topic. Required papers should be read completely. Suggested papers should at least be skimmed. The purpose of the reading assignment is to start your critical thinking process, so your responses should demonstrate constructive thoughts, with a good understanding of the current research in this area, and expressing your own insights.

Your response to this reading assignment should be submitted in the online Google Form (see link above). Your response should consist of four main components:

(1) **Scouting:** As you start thinking about the discussion probes, it is always good to also scout papers, blog posts and other resources related to the topic. We ask that you search for related resources and share with us 1 or 2 extra links to these new resources.
(2) **Reading notes:** As you read the required papers, suggested papers and the extra resources you scouted, please write down at least 4-6 notes related to the discussion probes. Each note should be 1-3 sentences long. These can be empirical results you observed, ideas or theories expressed by other researchers, or any interesting fact that is worth noting when summarizing your reading.
(3) **Your thoughts:** Separate from your reading notes, we ask that you reflect more holistically about the discussion probes. Please write 3 discussion points you would like to share on this topic. Each discussion point should be one paragraph (3-5 sentences). These discussion points should go beyond the reading papers, and try to address as many aspects of the discussion probes as you can. We do not expect that you answer all discussion probes. For example, it would be ok to focus on only 1 or 2 probes if these bring the most ideas and thoughts for you.
(4) **Clarification requests [OPTIONAL]:** Please take a moment to suggest parts of the papers where clarifications would be useful. Try to be as specific as possible in your clarification requests. These requests will be shared with the Reading Leads in charge of creating a short presentation for the beginning of Friday course and answering other requests directly on Piazza.

Week 3 discussion probes:

- What are the types of cross-modal interactions involved to enable such co-learning scenarios where multimodal training ends up generalizing to unimodal testing?
- What are some design decisions (inductive bias) that could be made to promote transfer of information from one modality to another?
- How do we ensure that during co-learning, only useful information is transferred, and not some undesirable bias? This may become a bigger issue in low-resource settings.
- How can we know if co-learning has succeeded? Or failed? What approaches could we develop to visualize and probe the success of co-learning?
- How could we formally, empirically, or intuitively measure the additional information provided by auxiliary modality? How can we design controlled experiments to test these hypotheses?
- What are the advantages and drawbacks of information transfer during co-learning? Consider not just prediction performance, but also tradeoffs with complexity, interpretability, fairness, …

Required papers (you should read these papers in detail)

- https://arxiv.org/abs/2103.05677
- https://arxiv.org/abs/2011.08899

Suggested papers (you should skim through these papers, at the minimum)

- Survey: https://arxiv.org/abs/2107.13782
- https://arxiv.org/pdf/2010.06775.pdf
- https://arxiv.org/pdf/2106.04538.pdf

Other related papers:

- https://arxiv.org/abs/1812.07809
- https://arxiv.org/pdf/1301.3666.pdf
- https://arxiv.org/abs/1912.02315
- Survey: https://arxiv.org/pdf/1906.03926.pdf