CS539 - Embodied AI

Paper Review - Learning to Navigate in Complex Environments

- **Summary:**
  - The paper is about formulating navigation in complex environments as a reinforcement problem, augmenting the learning process with auxiliary losses like depth estimation, loop closure and position estimation within the maze.
  - The main contribution is the use of auxiliary losses in training the agent, depth prediction contributing the most.
  - Approach has been to train the agent in various 3D maze settings, sparse rewards, fixed position vs randomised goal location in small vs large mazes. The addition of LSTM and auxiliary losses help remember the map and navigate better. Eventually the agent learns the location of the goal and remember in successive spawns. But this approach hasn't been shown to scale to larger maze sizes. Possibly due to the memory constraint of the LSTM.

- **Strengths:**
  - Trained agents learned to navigate towards the goal better after initial discovery in the smaller mazes.
  - Introduction of auxiliary losses in training the agent provided significant benefit
  - The experiments were well executed on the various architectures, auxiliary components while training the agent.
  - Shows possible direction to investigate into additional losses components

- **Weaknesses:**
  - Approach doesn't scale to large maze sizes
  - Distribution strategy for sparse rewards is unknown, shouldn't they be more near the end goal ?
  - Limited novelty
  - Task setting is limited to only 5 maze types, performance is evaluated just based on these mazes.

- **Reflections:**
  - Trying better architectures with more memory, addition of components which help in better remembering and avoiding places where the agent has already been should help navigate in an efficient way. Since goal locations can be random, being efficient with its steps is the only direction.
  - Method provides a good framework to plugin additional losses, add LSTM units, training agent with different RL algorithms.

- **Most interesting thought**:
  - That an agent can learn to navigate itself just based on visual cues, depth and remembering where it has already been. I guess things to try would be focus experiments/ methods more on testing its spatial understanding of the map and where it locates itself within the map. All things mostly point towards incorporating more memory in the agent network.