**Poster: FLLEdge: Federated Lifelong Learning on Edge Devices**

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**Motivation**

**Federated Learning (FL)**
FL learns generalized central model learns generalized knowledge by aggregating collective wisdom from each independent client.

**Lifelong Learning (CL)**
LL can effectively resist catastrophic forgetting when models train on a sequence of unique tasks by retaining knowledge of previous tasks.

**Low-power Devices**
Single low-power devices may be challenging to train on computationally expensive machine learning tasks. But they are cheap and numerous, can be used to overcome hardware constraints.

**Challenges**

**Challenge 1: Contents**
FLLEdge agents must share knowledge useful to other agents’ generalization.

**Challenge 2: Communications**
An efficient asynchronous communication scheme is needed for sharing agent knowledge.

**Challenge 3: Computation**
Lifelong Learning algorithms are computationally expensive to run on low power devices.

**Challenge 4: Catastrophic Forgetting**
Deployed Lifelong Learning algorithms must effectively balance new and old knowledge.

**System Overview**

- Each FLLEdge agent is deployed on a Jetson Nano.
- Each FLLEdge agent trains on a unique sequence of Atari games.
- All agents maintain a distributed database for knowledge sharing.

**Experimental Results**

- Figure 7: Rewards of 5-agent vs. 1-agent LL training in limited training time
- Figure 8: Scalability of speedup in number of agents
- Figure 9: Scalability of speedup in number of frames
- Figure 10: # seconds spent on training 10 tasks with 5 FLLEdge Agents

Each task is trained for 1000 frames. Until 2nd round, all new tasks are seen. Hence, in all remaining rounds, each agent replays memory shared experienced buffers. Memory replay generally takes about 0.01 seconds to complete, while training from scratch (see rounds 1 and 2) takes about 870 seconds.

**Algorithms**

- Step 1: Perform Task Similarity Comparison
- Step 2: Perform Lifelong Learning
- Step 3: Send Compressed Features to accepting agents

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