

# Continual Learning of a Mixed Sequence of Similar and Dissimilar Tasks

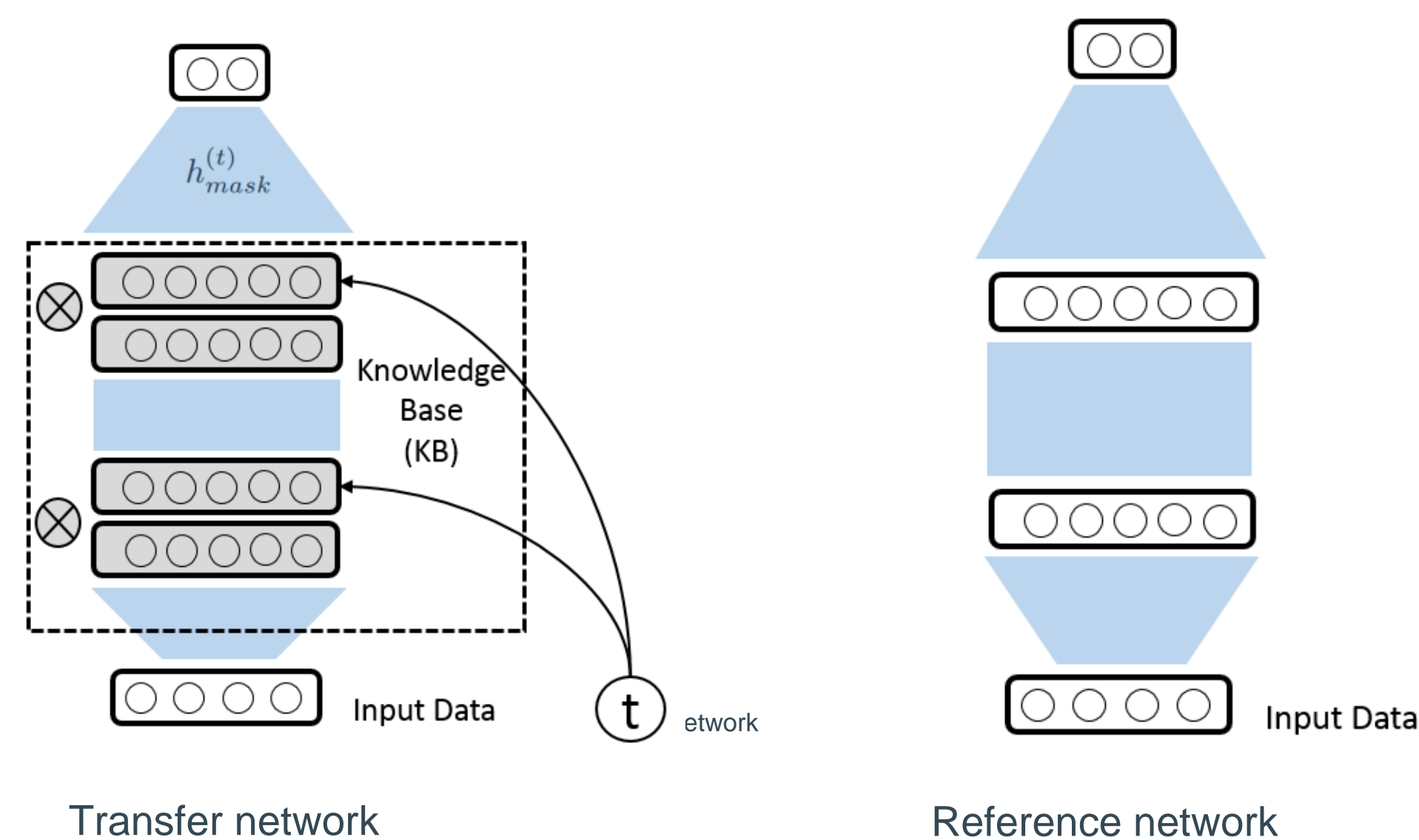
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## Continual Learning with Forgetting Avoidance and Knowledge Transfer

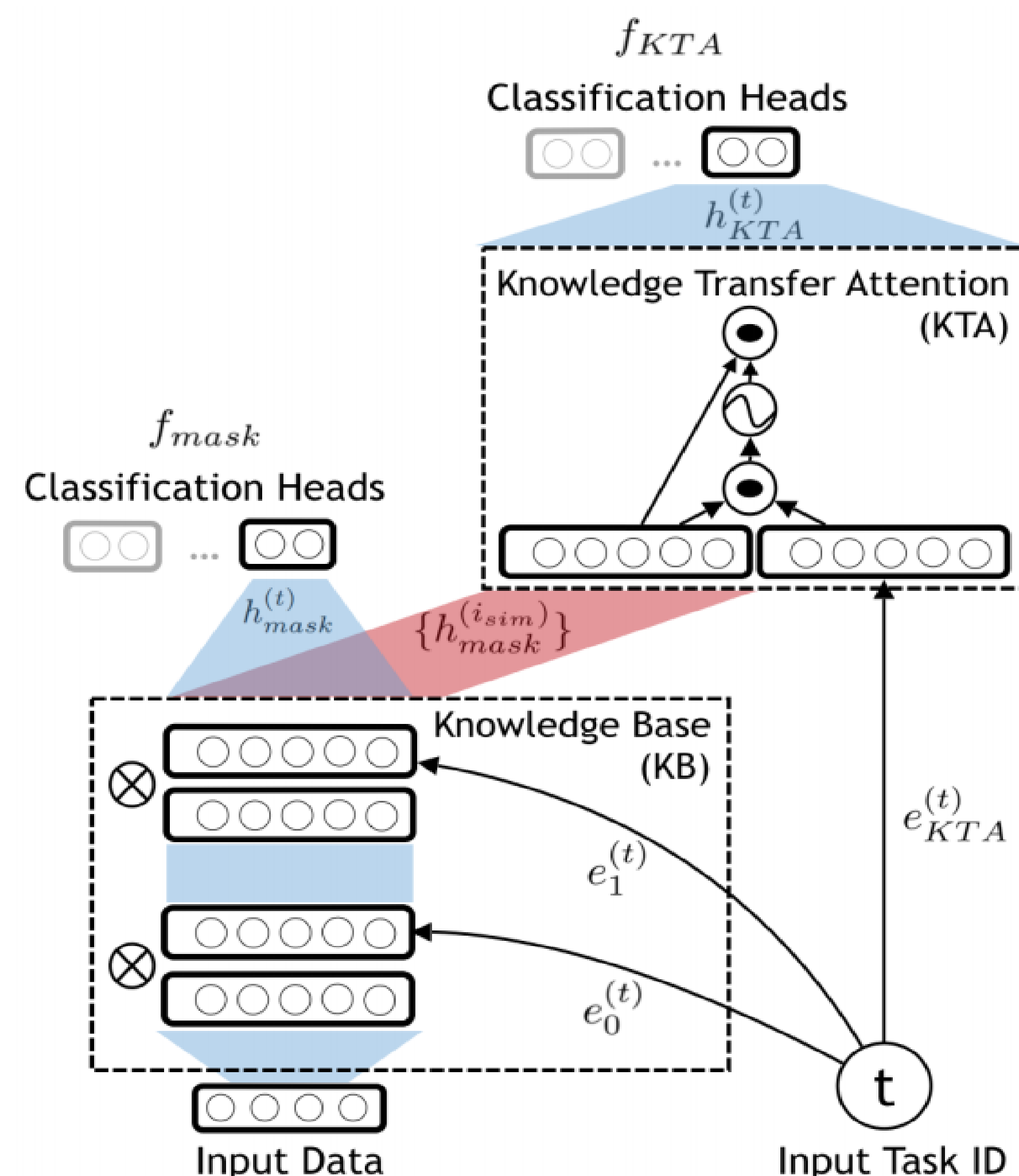
- Continual Learning learns a sequence of tasks
- Existing research mainly focused on **Overcoming Catastrophic Forgetting**
- Some works also addressed the issue of **Knowledge Transferring**
- (Leveraged the past knowledge to help learn the new task when tasks are similar and have shared knowledge.)
- **Our goal:** Achieve both **Forgetting Avoidance** and **Knowledge Transfer** at the same time
- **CAT** can learn a **mixed sequence** of **similar** and **dissimilar** tasks and achieve above two objectives

## Proposed CAT Model: Detect Task Similarity



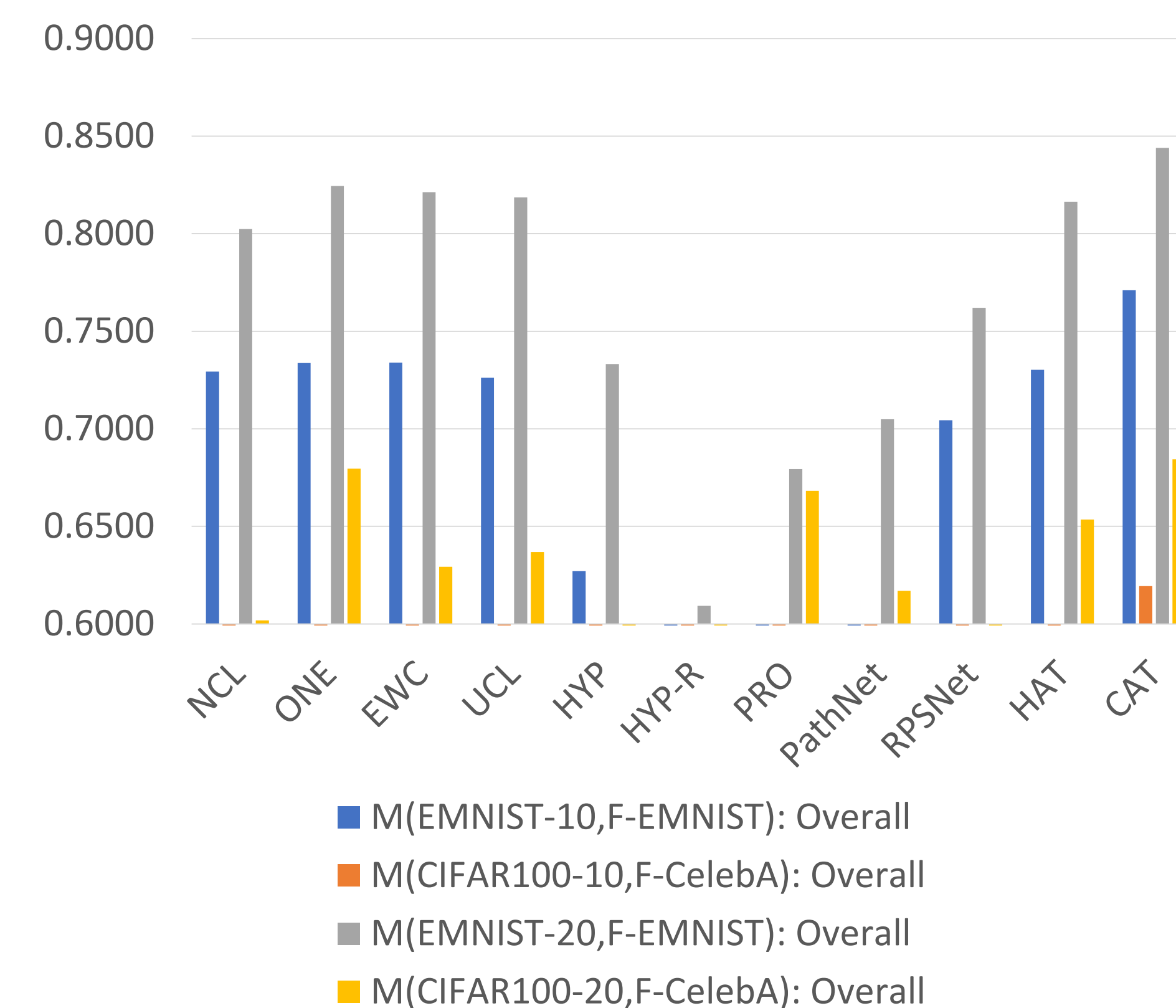
- **Transfer Network:** Check whether each old task  $i$ 's knowledge is transferable to the current/new task  $t$ . Note that only a small readout function is trainable.
- **Referent Network:** A similar independent network trained from scratch for the new task.
- The **performance comparison** between these two networks indicates the similarity of a previous task  $i$  and the current task  $t$

## Proposed CAT Model: Overall Architecture



- **CAT** is for task continual learning (TCL)
- **CAT** takes as input the image and task ID
- For dissimilar tasks, Task Masks are trained using task ID embedding to block all used/important units of the task
- For similar tasks, an attention layer is trained to encourage knowledge transfer

## Experimental Results



- In all 4 mixed datasets, **CAT** outperforms all baselines

## Summary

- ✓ Avoid forgetting of **dissimilar** tasks by blocking their used units
- ✓ Encourage **knowledge transfer** among **similar** tasks by training attention
  - **Forward** knowledge transfer (past knowledge helps new task)
  - **Backward** knowledge transfer (new knowledge helps improve old tasks)
- ✓ **Automatically** detect the task similarity
- ✓ Effectively learn a mixed sequence of **similar** and **dissimilar** tasks

Code and data: <https://github.com/ZixuanKe/CAT>