Towards Scalable and Self-Aware Robotic Perception
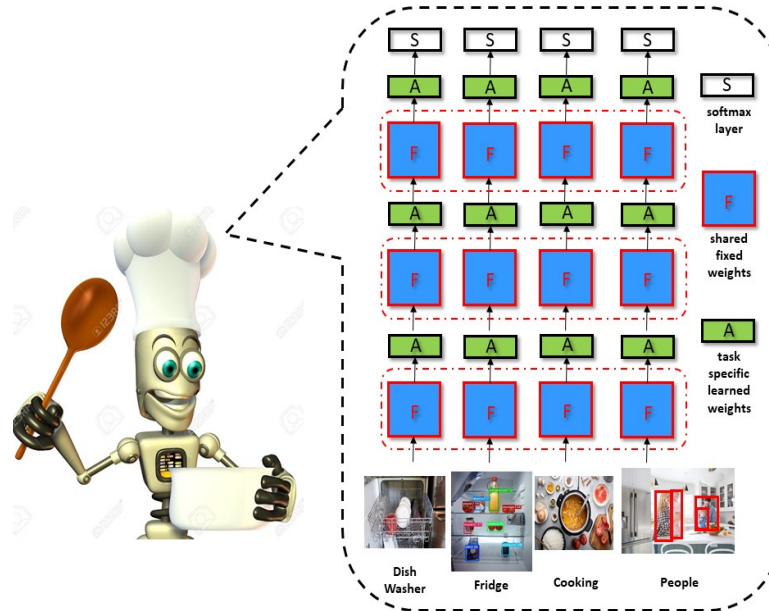
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Challenge

- Robotic vision systems that are fast, scalable in the number of tasks, and aware of their limitations

Solution

- New deep learning architectures combining binary operators, massive parameter sharing, and self-awareness

Scientific Impact

- Broadly applicable to AI methods based on deep learning (NLP, vision, robotics, etc).

Broader Impact

- Better understanding of deep learning

- Many applications in robotics and beyond

- Involvement of undergraduates and high-schoolers in research

Efficient Multi-domain Learning by Covariance Normalization

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Challenge

- How can a deep learning model be reused across many tasks with a minimal set of adaptation parameters per task

Scientific Impact

- Achieves state of the art performance on 10 datasets with the addition of 1-2% adaptation parameters per task

- Solve 50-100 tasks with memory complexity of two networks!

Broader Impact

- Scalable deep learning, e.g. robots that can solve many tasks with a single GPU

- Applicable to many problems of interest to robotics

Solution

- New architecture combining fixed layers (shared and large), residual adaptation layers (task specific and small), and covariance normalization