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Edge-Cloud Collaborative Intelligence

Our world is at the beginning of the technological revolution that promises to transform the way we work, travel, learn, and live, through Artificial Intelligence (AI). While AI models have been making tremendous progress in research labs and overtaking scientific literature in many fields, efforts are now being made to take these models out of the lab and create products around them, which could compete with established technologies in terms of cost, reliability, and user trust, as well as enable new, previously unimagined applications. Foremost among these efforts involves bringing AI "to the edge" by pairing it with the multitude of sensors that is about to cover our world as part of the Internet of Things (IoT) and 5th generation (5G) communication network initiatives.

This research is about edge-cloud Collaborative Intelligence (CI). This is a framework in which AI models are distributed between the edge devices and the cloud. CI has been shown to have the potential for energy and latency savings compared to the more typical cloud-based or fully edge-based AI model deployment, but it also introduces new challenges, which require new science and engineering principles to be developed in order to achieve optimal designs. This collection of USRA projects is meant to investigate the use of deep neural networks in CI. Multiple positions are available, and there is some flexibility to select the type of project that best fits student's interests and background. Previous students in the program have often gone to publish and present the results from their USRA projects at international conferences.

Example projects include:

- **Multi-task collaborative intelligence**
  Distributed deep models that perform multiple tasks at once

- **Deep feature compression**
  Find efficient ways to represent and encode features within a deep model

- **Privacy in collaborative intelligence**
  Create deep models that are able to guarantee some level of privacy during inference

- **Federated learning in collaborative intelligence**
  Efficient, privacy-friendly learning strategies for distributed deep models

These projects are intended for current SFU Engineering Science undergraduate students with strong background in mathematics, signals and systems, probability and statistics, and at least two of these programming environments: Python, C/C++, MATLAB. Experience with Linux and some exposure to machine/deep learning would be an asset. The successful applicant will initially work with a team of graduate students and will be exposed to the state of the art in their particular topic. Subsequently, the student is expected to work more independently on their research project. Examples of our research can be found here: http://www.sfu.ca/~ibajic/#research