

Knight Foundation School of Computing & Information Sciences

Deploying Machine Learning Application on Edge Devices, a Study of Challenges and Solutions

Fall 2022 Capstone 2

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PROBLEM

Edge devices don't all follow the same design philosophies and each device imposes its own limitations. Factors such as memory space, network connection, and processing power are all constraints unique to each edge device. Tools and frameworks are needed in order to help reduce machine learning model and data size on edge devices.

REQUIREMENTS

- Develop strategies in order to allow for machine learning on resource limited edge devices.
- Incorporate methods without fully relying on cloud computing due to potential latency issues.
- Formulate a foundation in order to facilitate application development in the future.

IMPLEMENTATION

- Edge2Train allows for local and offline training of models with resource constraints with the help of micro-controller units.
- Federated learning offers increased accuracy by having models train themselves locally and offer data to the cloud for further accuracy when connection is available.
- Spatiotemporal data compression can cluster data in order to reduce the size of large amounts of data.

EXAMPLE FRAMEWORK DIAGRAMS

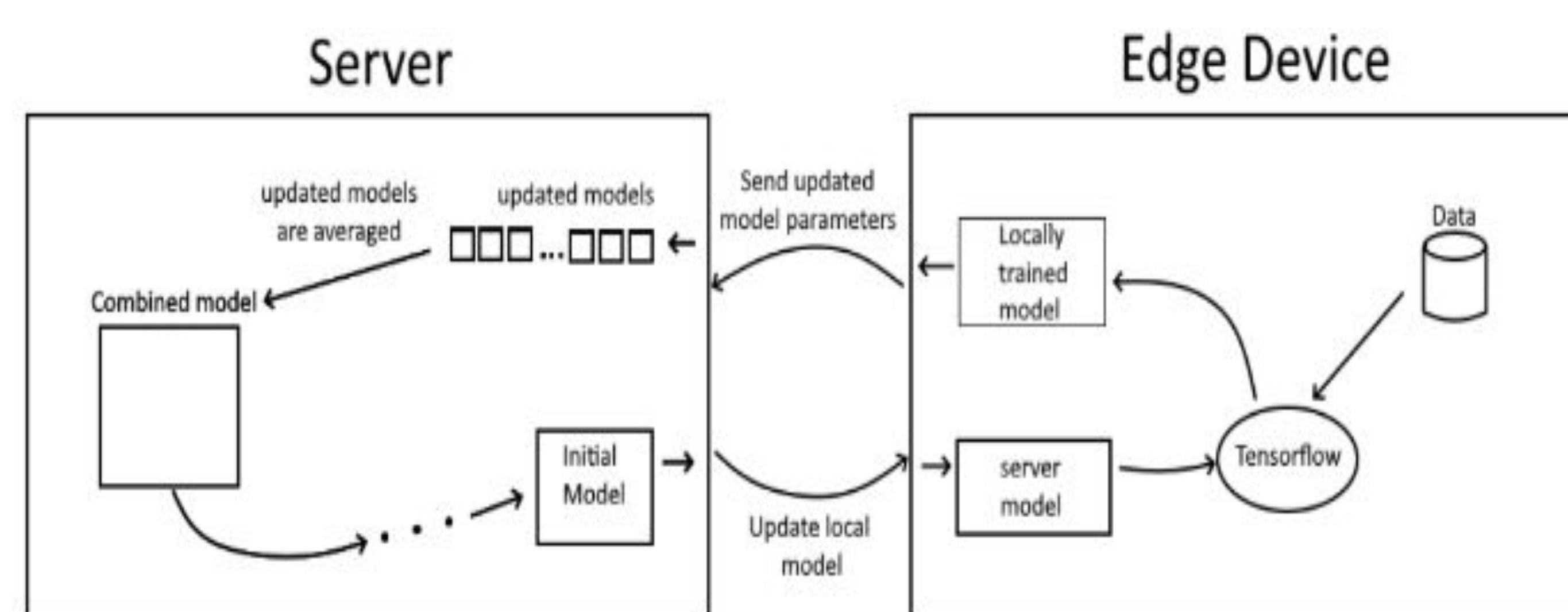


Figure 1: Diagram of Federated Learning

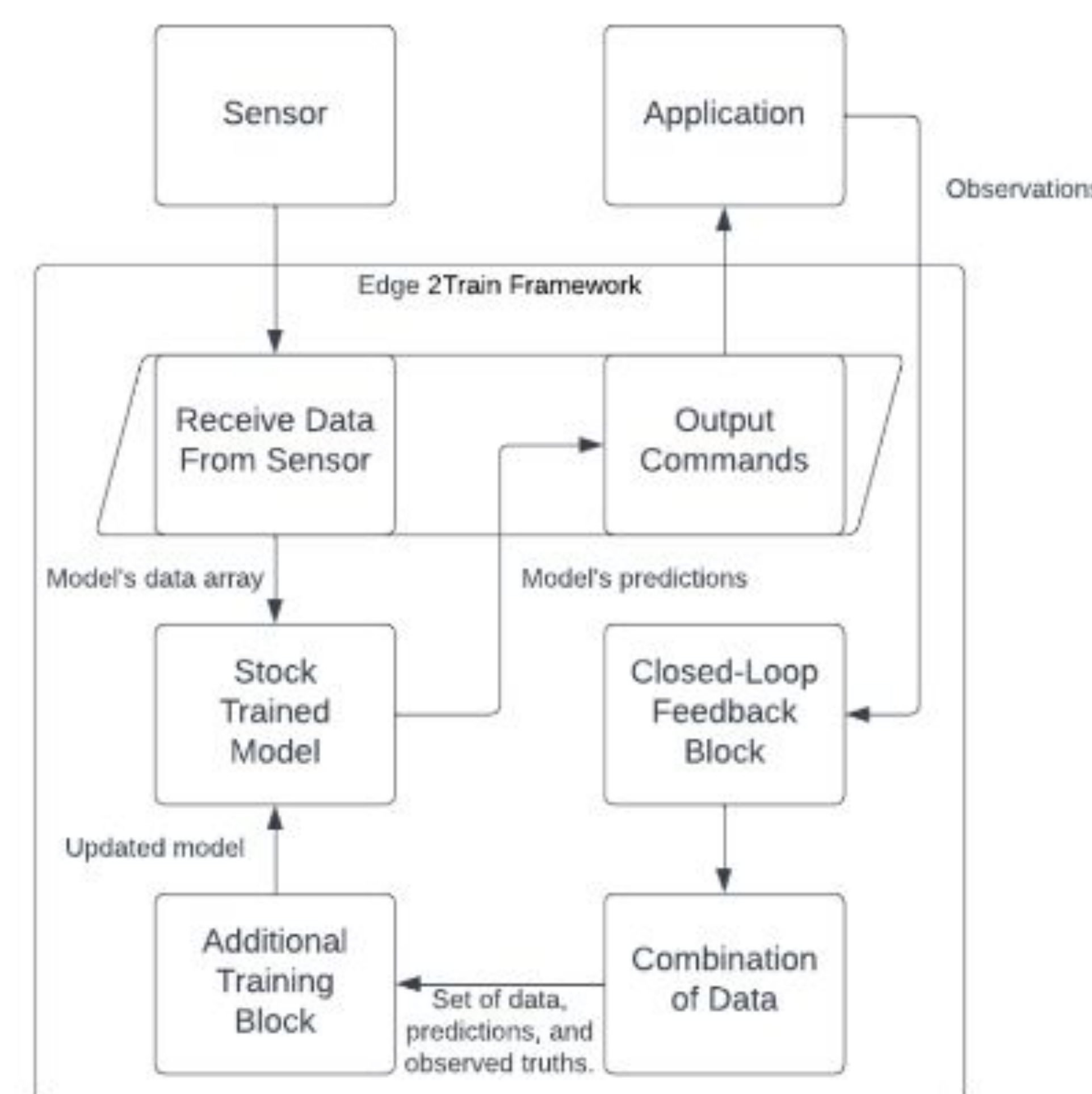


Figure 2: Diagram of Edge2Train

SUMMARY

In order to develop machine learning for edge devices, it is important to understand what your device offers and what it will be used for. In cases where latency isn't an issue, cloud computing provides a way to avoid the edge device's resource and processing limitations. Otherwise, frameworks and tools such as Edge2Train, Federated Learning, and Spatiotemporal Data Compression allow for machines to run on models with resource constraint without losing accuracy, efficiency, or data quality. With these methods in mind, a foothold is now available to begin product development next semester.

ACKNOWLEDGEMENT

The material presented in this poster is based upon the work supported by Luis Robaina with MITRE. We thank Luis Robaina and MITRE for their assistance and mentorship that we received throughout the senior design project.