Neural layer as a Service Function

Neural layer as a Service Function on cloud–edge environment

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Distributed Deep Neural Network (DNN) Deployment

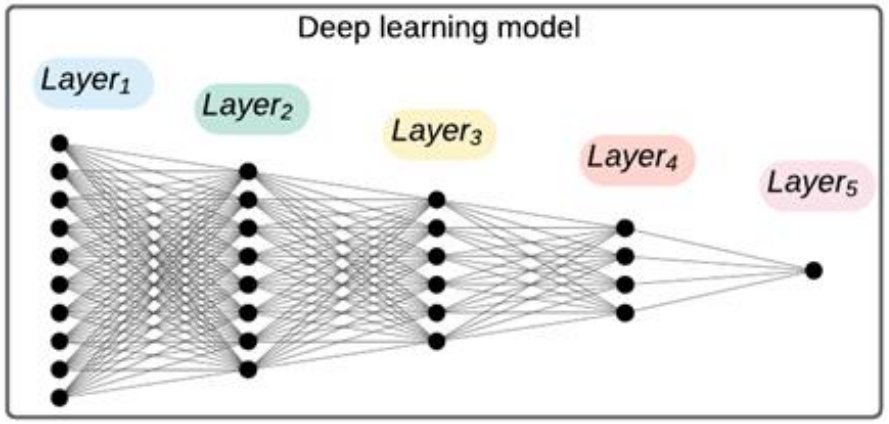
DNN needs computing resources to be executed

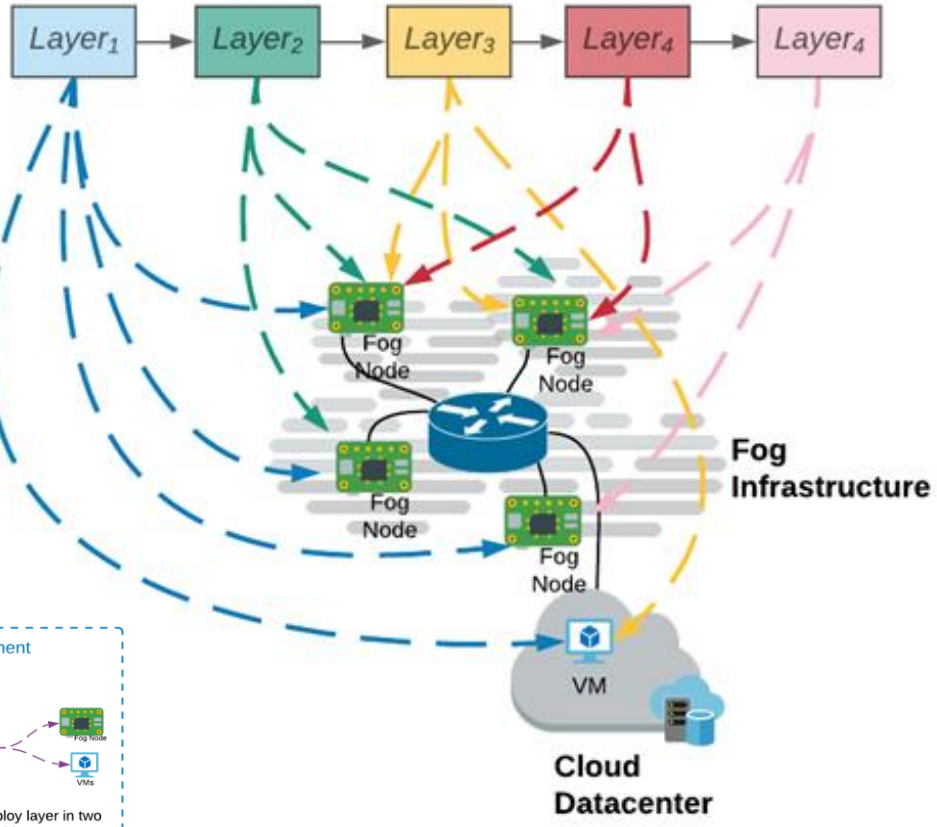
AI Application use Cloud to provide compactional resources

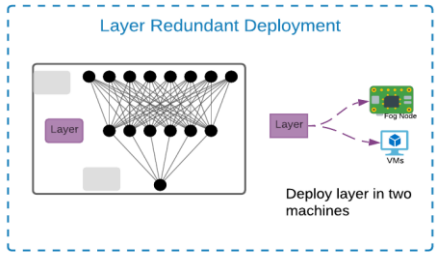
But not latency-sensitive

Data privacy issues

Single-board computer execute part of the DNN in the network's edge.





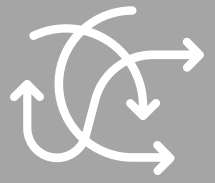


Neural Service Function

- Create layers as functions
  - Create sub-models
  - *Convert DNN to Directed Acyclic Graph (DAG)*
  - *Topological sort*
- *Deploy* layers
  - DNN layer Traversal (DAG Traversal)
  - Placement decision
  - *Deploy a Neural layer as a function*

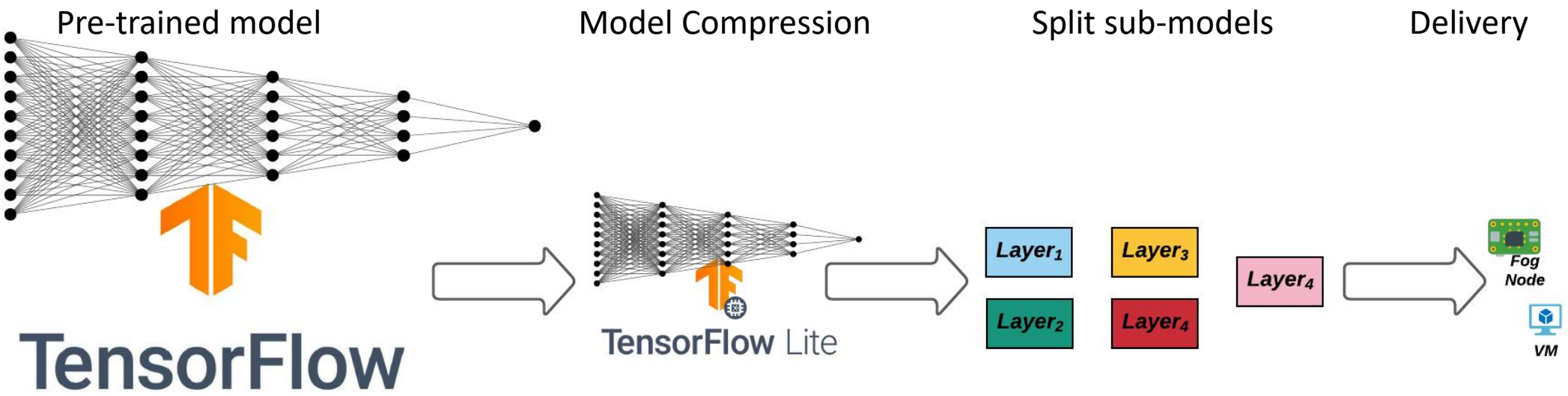
DNN Deployment

Split DNN into layers



Layers Placement

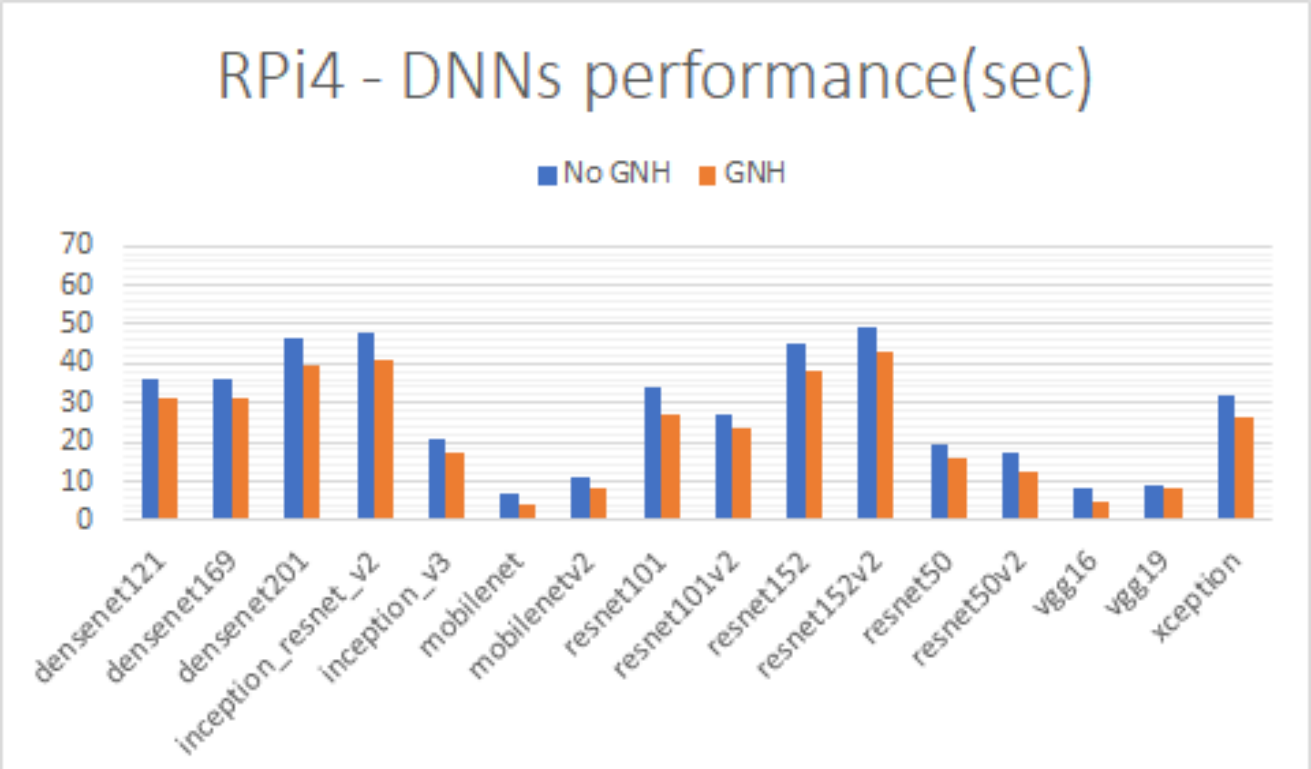
Split DNN into layers



Layers Placement

- Use dynamic programming to traverse over the DAG
- Greedy Nominator Heuristic (GNH)
  - Decide redundant deployment.
  - Uses *Parsl* to speed up the decision-making process
- *Parsl*
  - deploy the replicated layers in the Edge-Cloud resources
  - *TensorFlow Lite inference with in Raspberry Pi 4 Model B (RPi4)*

Experiment



- Deploy redundant Neural layers
  - speed up AI inference by up to 20%.
- Benchmark 16 DNN
  - with Parsl & TensorFlow Lite
  - Raspberry Pi 4 Model B (RPi4)

Thank You

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