~~EnsembleLUT~~

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AmigoLUT

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AmigoLUT: Scaling up LUT-based Neural Networks with Ensemble Learning

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What is a lookup-table-based NN?

- Lookup-table-based NNs are NNs implemented as a collection of LUTs

- Example: LogicNet

LogicNet

- Each neuron is implemented using LUTs on an FPGA

- Advantage: Only perform lookups instead of multiplications

  → Fast!

- Disadvantage: LUT resources scale up $O(2^n)$ w.r.t. LUT inputs

  → Extremely sparse & quantized NNs hard to scale up in accuracy.

LogicNets are **hard** to scale up!

Solution: Ensemble learning

What is Ensemble Learning?

- Ensemble learning: Train **multiple weak models** to make a decision together
  - Many weak models promotes diversity for better decision making

- Advantages:
  - Easier to find weak models

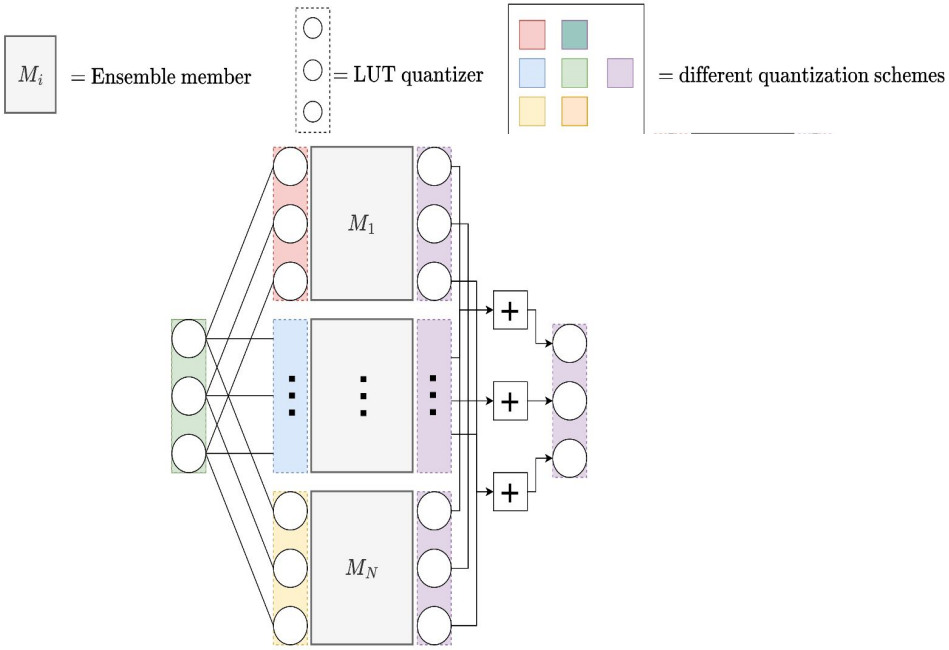
- Disadvantages:
  - Long training times

How does **ensemble learning** address LogicNet's scaling issue?

Ensemble learning scales up **linearly** w.r.t. # models!

AmigoLUT

- A method for mapping ensembles of LUT-based NNs to FPGAs efficiently!



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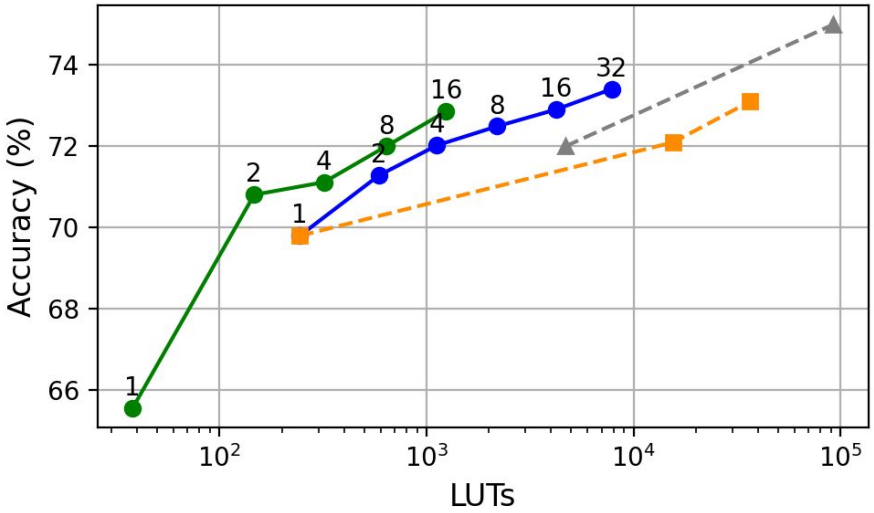
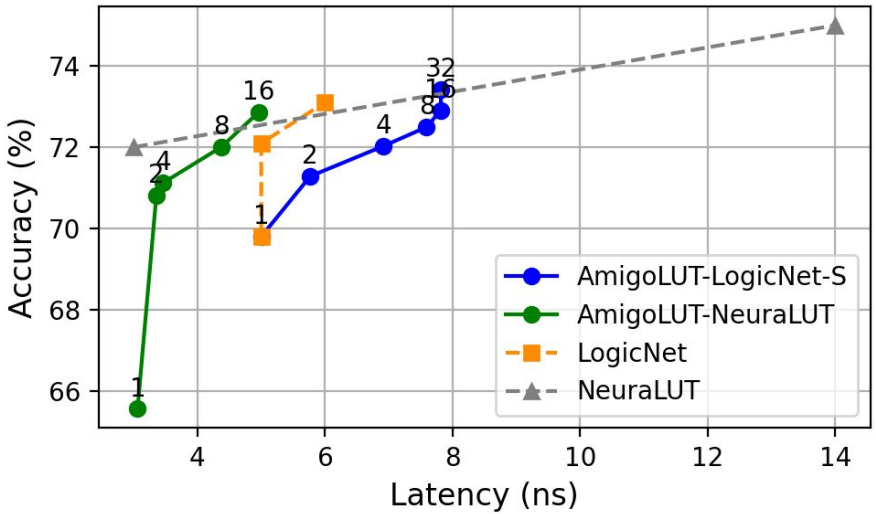
How well does AmigoLUT scale up LUT NNs?

- Jet substructure classification dataset





AmigoLUT

- Scales up LUT-based NN resources **linearly**!

- **Reduces resource overhead** of mapping ensembles to FPGAs.