The Forward-Forward Algorithm: Some Preliminary Investigations [1]

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Method

The Forward-Forward algorithm is an alternative to backpropagation that computes local gradient updates without the need for a backward pass.

Motivations

- Local updates allow for asynchronous layer updates
- Biologically plausible
- Can be run on analog computers
- Can be easily adapted for unsupervised learning

Limitations

- Replace backpropagation outside of low-power environments
- Learns slower than backpropagation
- Lower layers do not receive higher-layer feedback

Findings

Figure 3: Performance of backpropagation vs Forward-Forward.

Figure 4: Hard negative mining improves accuracy.

First Layer Features

Figure 5: Some neurons learn sensible features (top), others do not (bottom).

Reproducibility Issues

- Original code not released
- Hyperparameters not specified
- Found high sensitivity to hyperparameters & specifically optimiser (SGD doesn’t work)
- Achieved 96.8% accuracy vs Hinton’s 99.2%

Future Work

Replicate and explore the recurrent version of FF.

Extensions

- Copies of the same image
- One-hot encodings of image class

References