

Bayesian Neural Networks

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Abstract

Bayesian Neural Networks are...

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1 Introduction

1.1 History

- 1987 • The patent a 'Method of providing digital signatures' is filed by Ralph C. Merkle[merkle-pater
- 1999 • The original patent expires.
- 2009 • Bitcoin uses Merkle Trees for 'block header commitment.'[friedenbach_alm_2017]
- 2009 • BitTorrent uses Merkle Trees for data integrity[bep30].

2 Neural Network

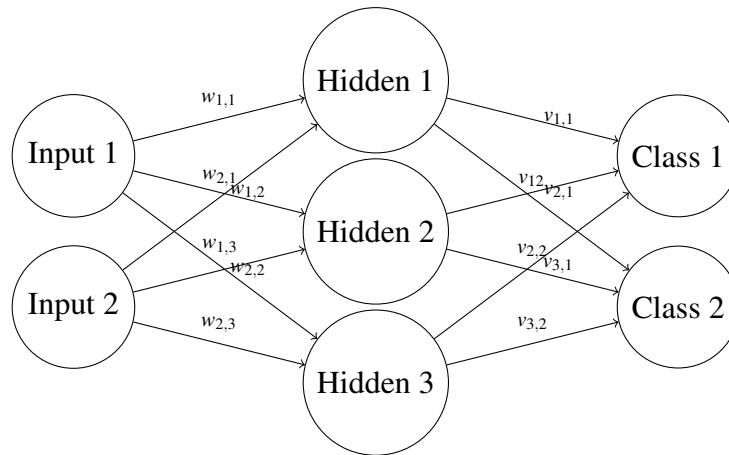


Figure 1: Example neural network

Neural networks....

2.1 Convolutional Neural Networks

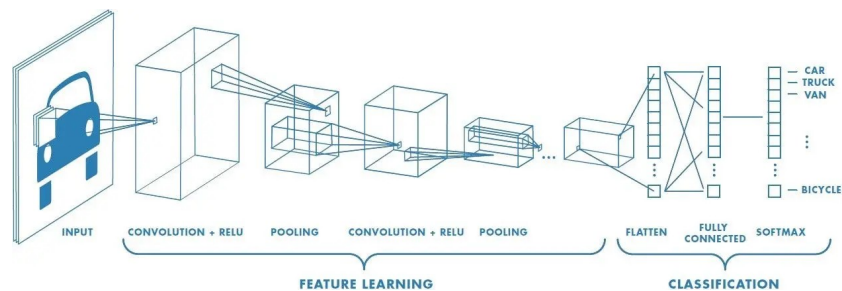


Figure 2: CNN pipeline [2]

Convolutional neural networks (CNN) are a type of neural network that is better suited for image recognition. Instead of reading the entire image a CNN slides over the image...

The result is that the neural network trains faster..

3 Bayesian Neural Networks

Bayesian neural networks take the

3.1 Bayesian Conolutional Neural Networks

Same principle...

4 Simulation

We use a BCNN implementation from [Github](#) based on work from ... [4] [3]

4.1 CIFAR-10

The CIFAR-10 dataset...

4.2 Hyperparamaters

We used the following hyperparamaters for training

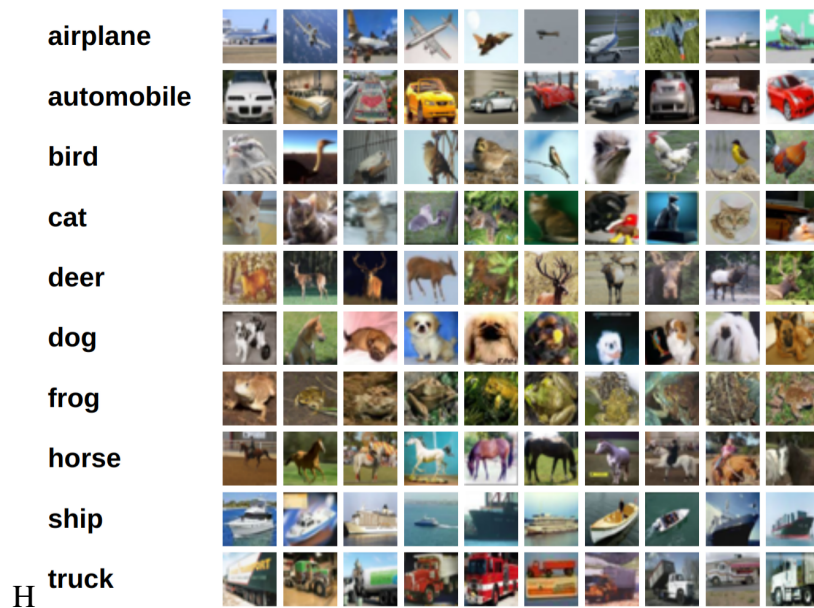


Figure 3: Example CIFAR-10 images [1]

Hyperparameter	CNN	BCNN
Epochs	500	500
Learning Rate	May be higher (0.01 - 0.1) due to simpler structure
Regularization	L1/L2 weight decay or Dropout common to prevent overfitting	Can benefit from Dropout, but weight decay might be less crucial
Optimizer	Adamw	Adamw

4.3 Results

5 Closing

References

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- Saha, S. (2018). A guide to convolutional neural networks — the eli5 way.
- Shridhar, K., Laumann, F., & Liwicki, M. (2018). Uncertainty estimations by softplus normalization in bayesian convolutional neural networks with variational inference. *arXiv preprint arXiv:1806.05978*.
- Shridhar, K., Laumann, F., & Liwicki, M. (2019). A comprehensive guide to bayesian convolutional neural network with variational inference. *arXiv preprint arXiv:1901.02731*.
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