Bayesian Neural Networks

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A Brief History

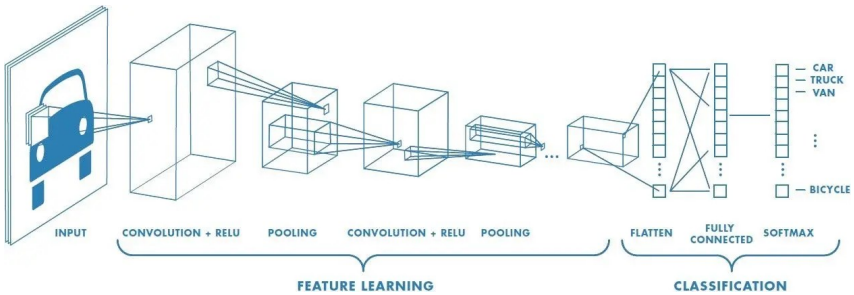
1979 The patent a 'Method of providing digital signatures' is filed by Ralph C. Merkle [**merkle-patent**].

1999 The original patent expires.

2009 Bitcoin uses Merkle Trees for 'block header commitment.' [**friedenb**

2023 Twenty students taking a cryptography class .

Applications



What are .

Figure: Relevant XKCD needed...

Neural Networks (NN)

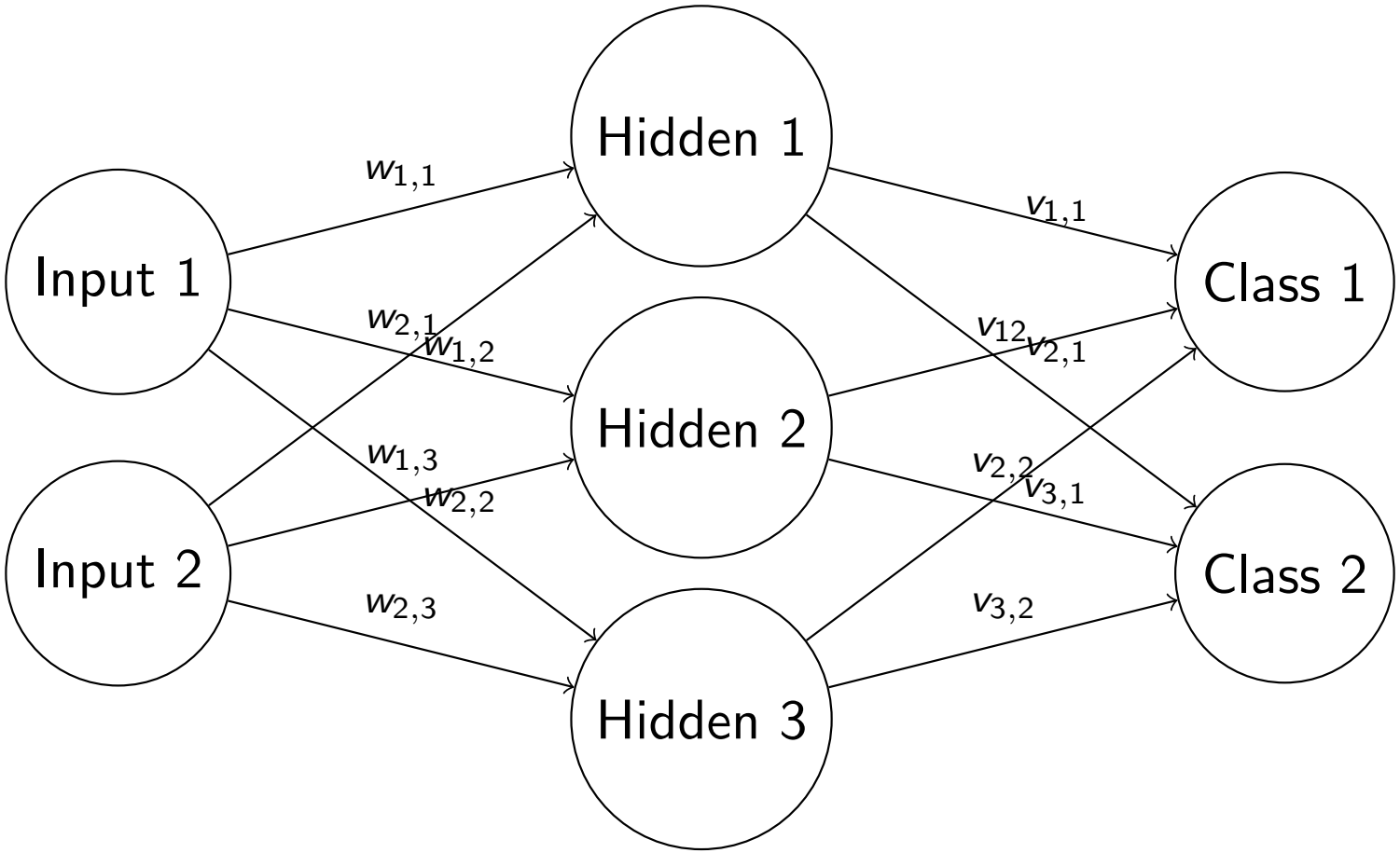


Figure: Example neural network

Issues with Neural Networks

Figure: XKCD: "*Machine Learning*" [3]

- Stir data and pray
-

Convolutional Neural Networks (CNN)

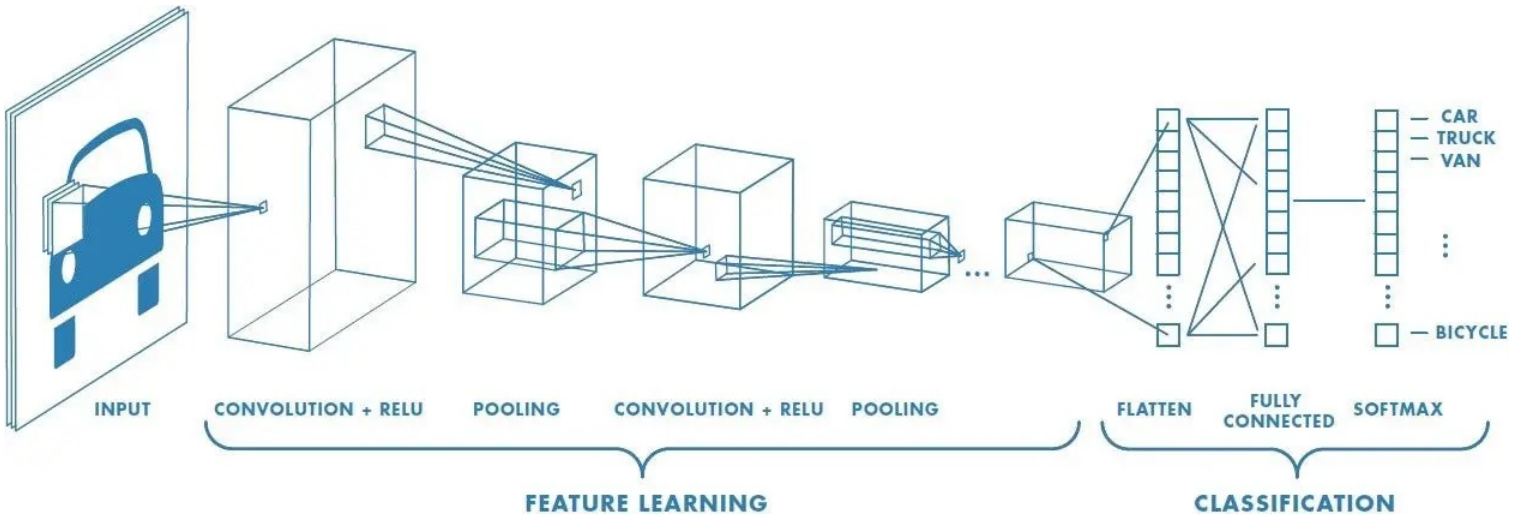


Figure: CNN pipeline [5]

Why we use CNNs

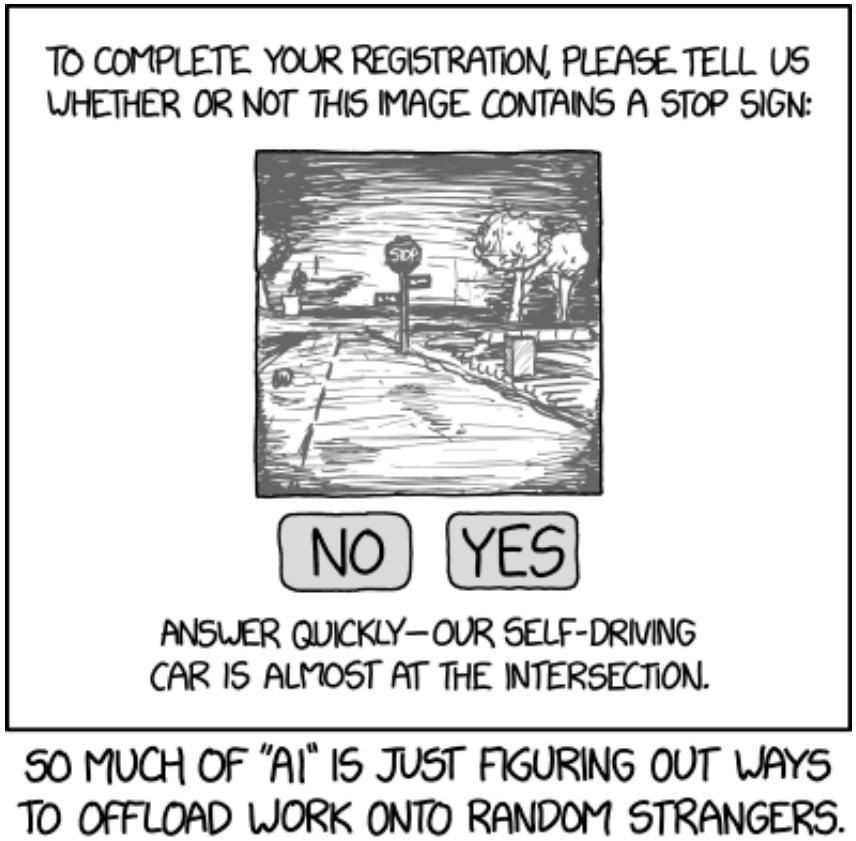


Figure: XKCD: "*Self Driving*" [4]

- They are more efficient for image based tasks
- Channels...

Bayesian Neural Network

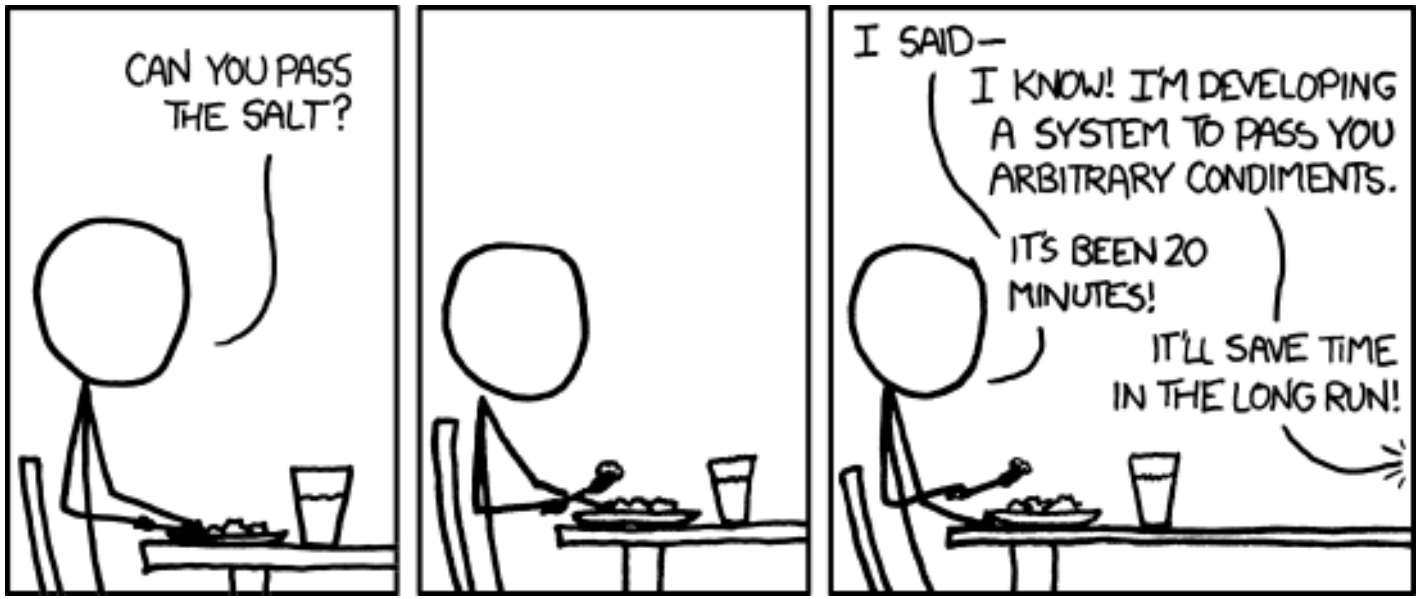


Figure: XKCD: "*The General Problem*" [2]

The relationship between BNNs and BCNNs is the same as NNs and CNNs.

Difference between BNNs and BCNNs

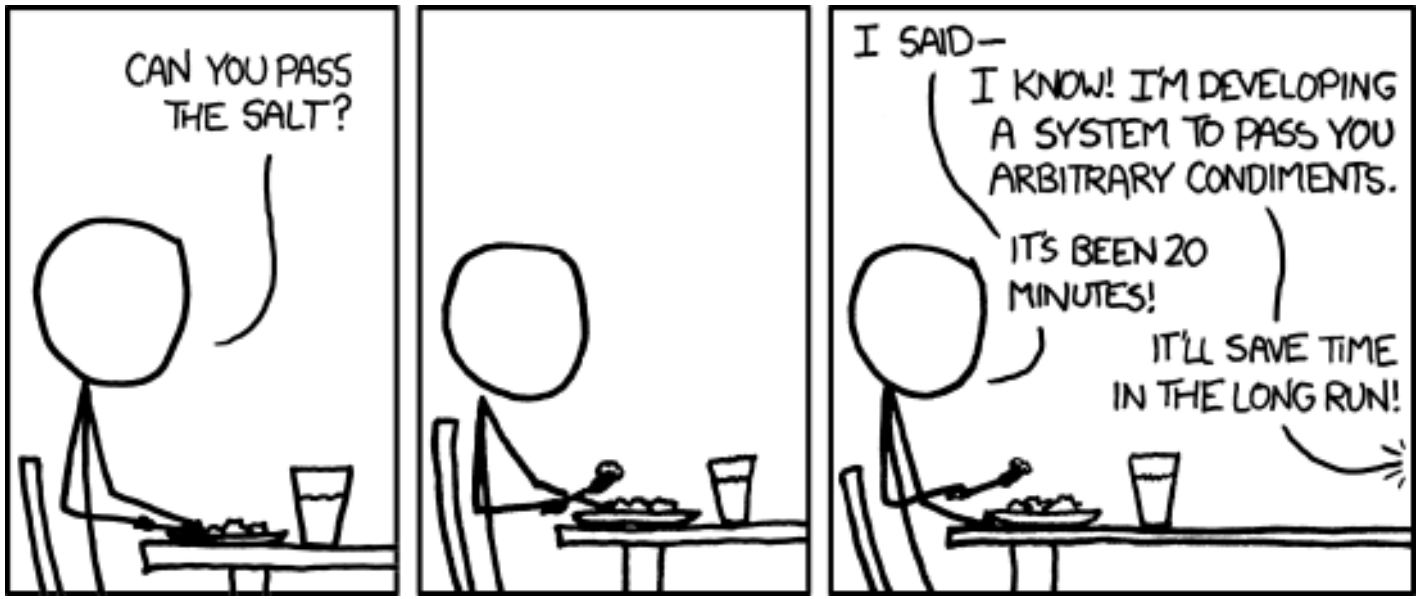


Figure: XKCD: "*The General Problem*" [2]

The relationship between BNNs and BCNNs is the same as NNs and CNNs.

CIFAR-10

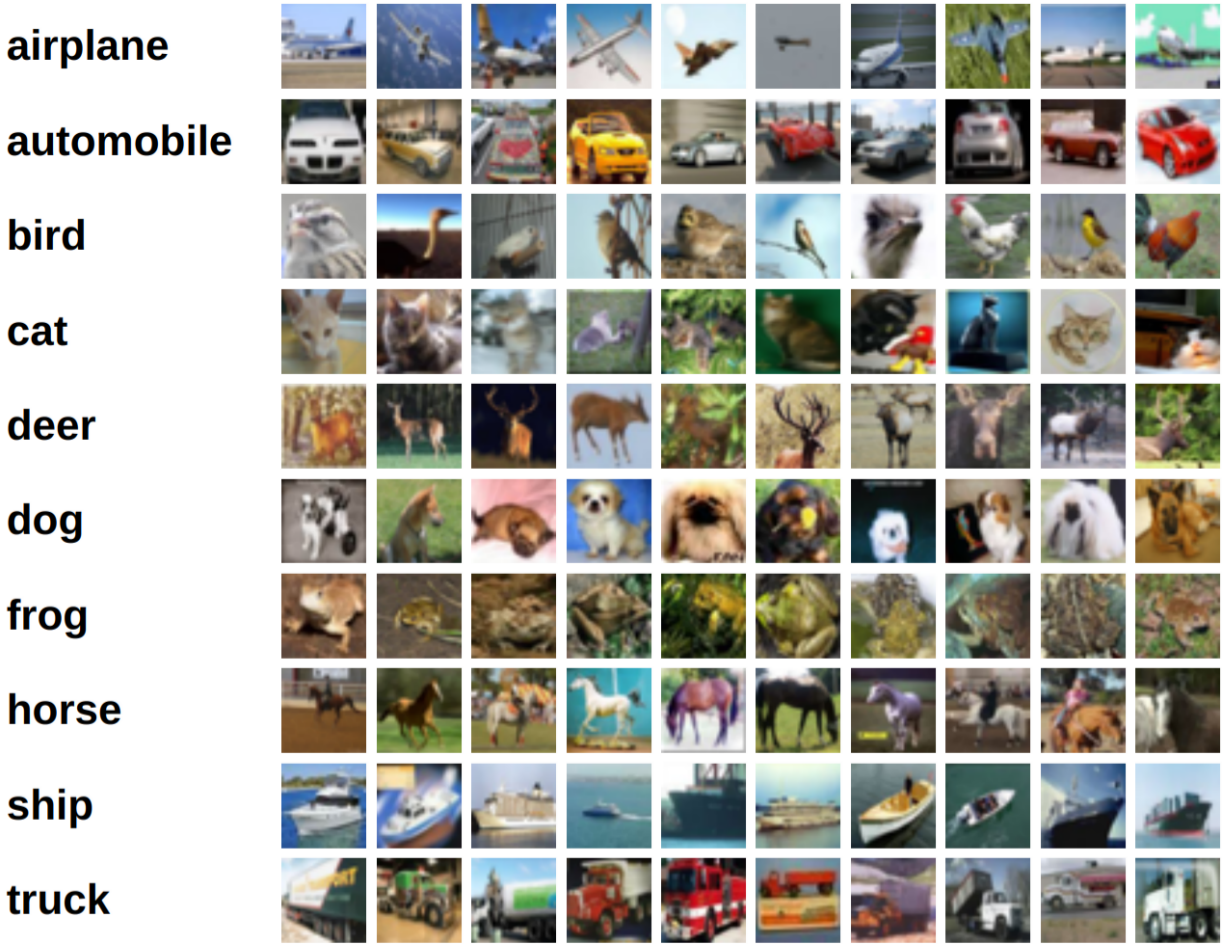


Figure: Example CIFAR-10 images [1]

Hyperparameters

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

Results

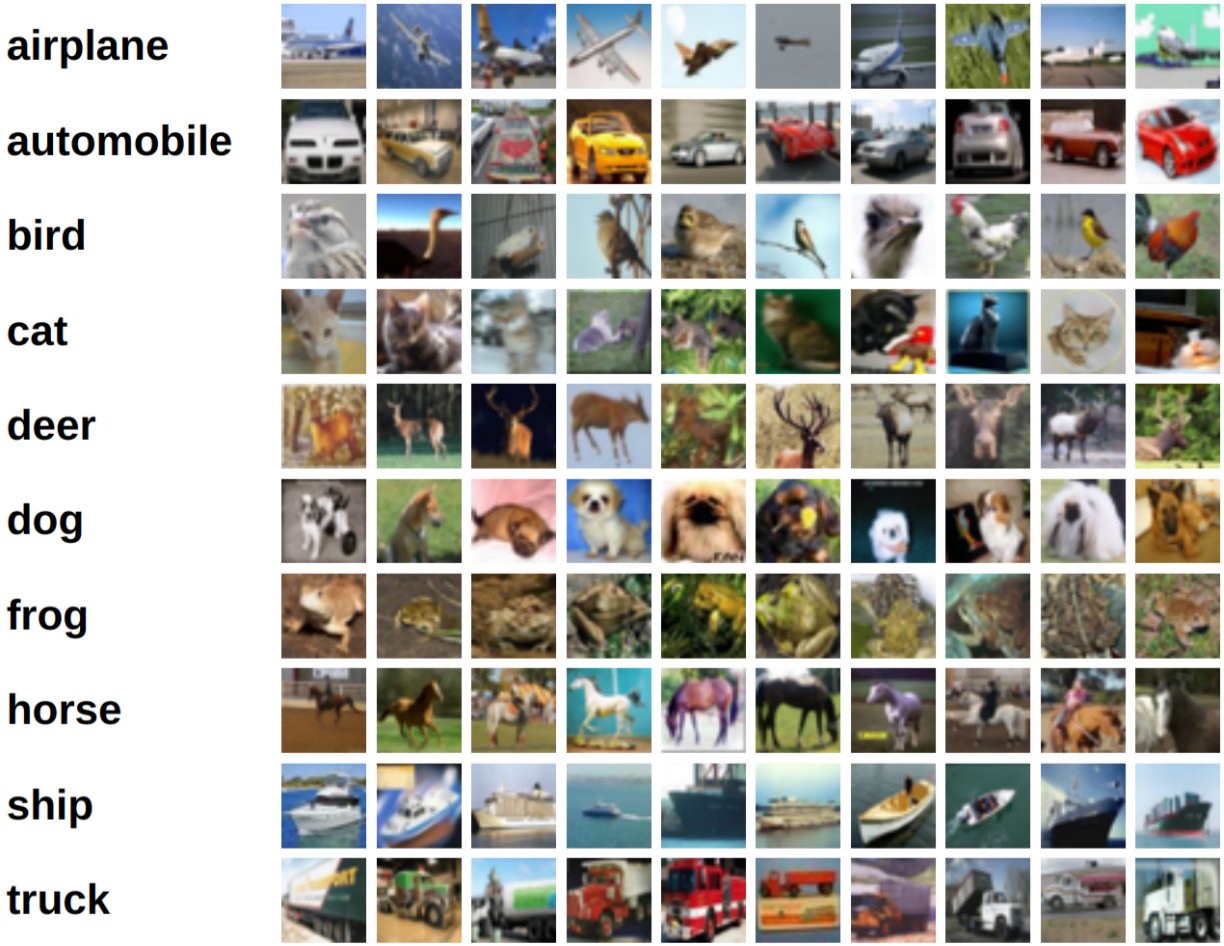


Figure: Example CIFAR-10 images [1]

Confusion Matrix

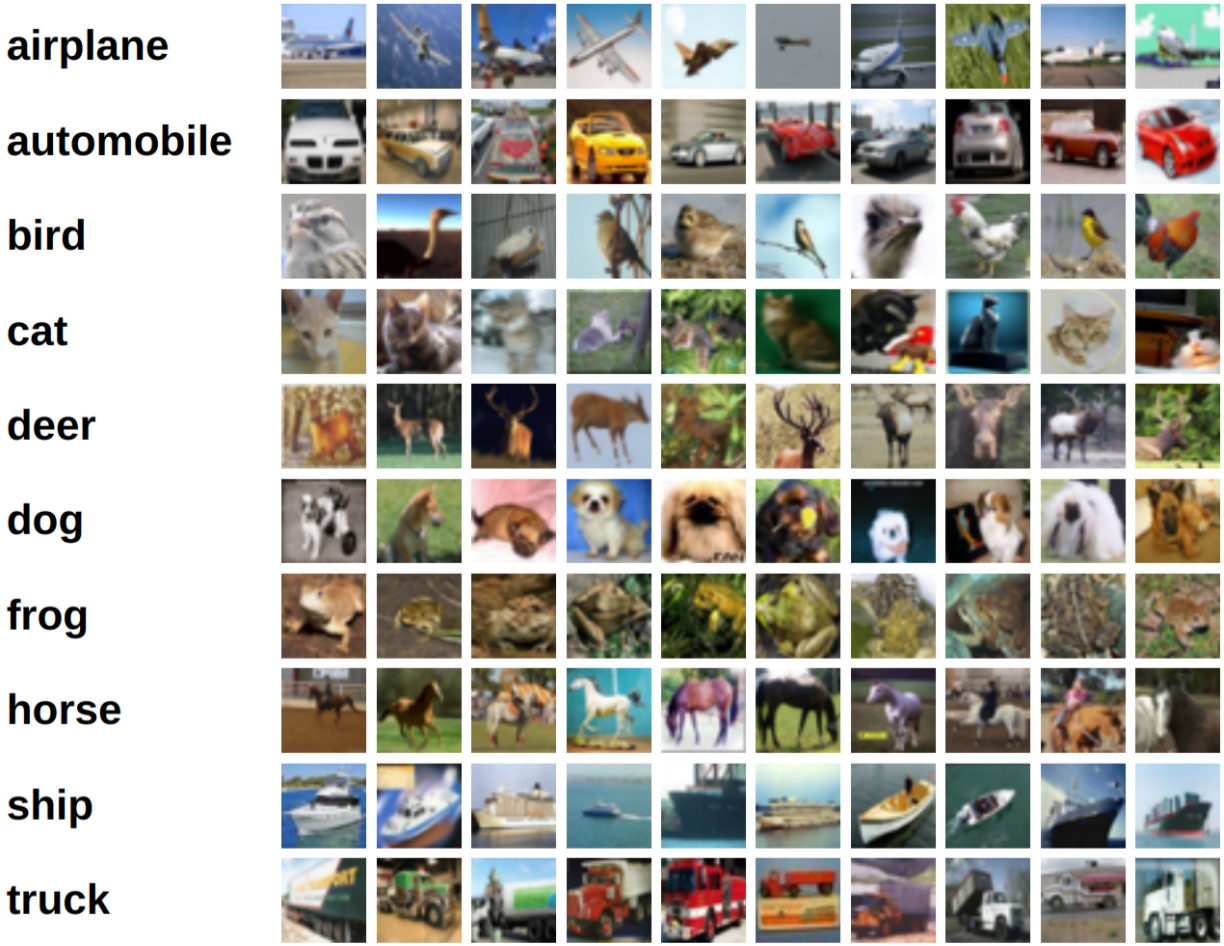


Figure: Example CIFAR-10 images [1]

References I

- Krizhevsky, A., Nair, V., & Hinton, G. (n.d.).Cifar-10 (canadian institute for advanced research). http://www.cs.toronto.edu/~kriz/cifar.html
- Monroe, R. (2011, November). Xkcd: The general problem.
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- Saha, S. (2018).A guide to convolutional neural networks — the eli5 way.