Neural Networks

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What is a Deep Neural Network

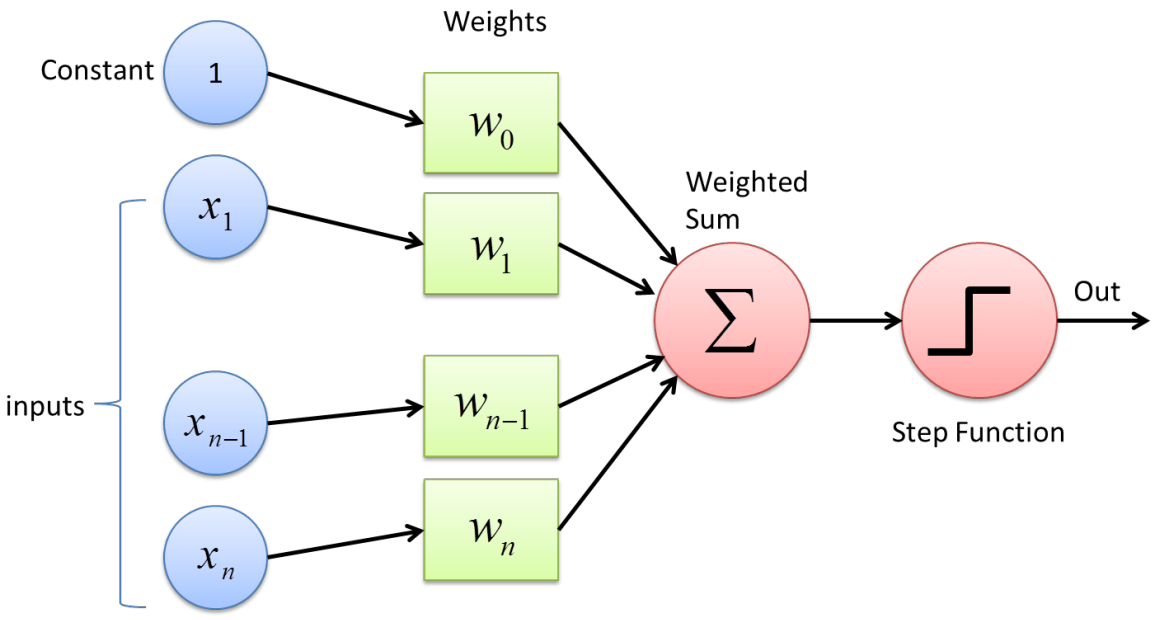
- Computers learn to process data by mimicking the human brain
- Neural networks are made of layered neurons
- Can work with a large volume of data

Examples of the Use of Neural Networks

- Computer Vision
  - Facial Recognition
  - Object Detection
- Speech Recognition
  - Amazon Alexa
  - Voice Transcription
- Natural Language Processing

How Do Neural Networks Work

1. Input
2. Hidden Layers
3. Output Layer

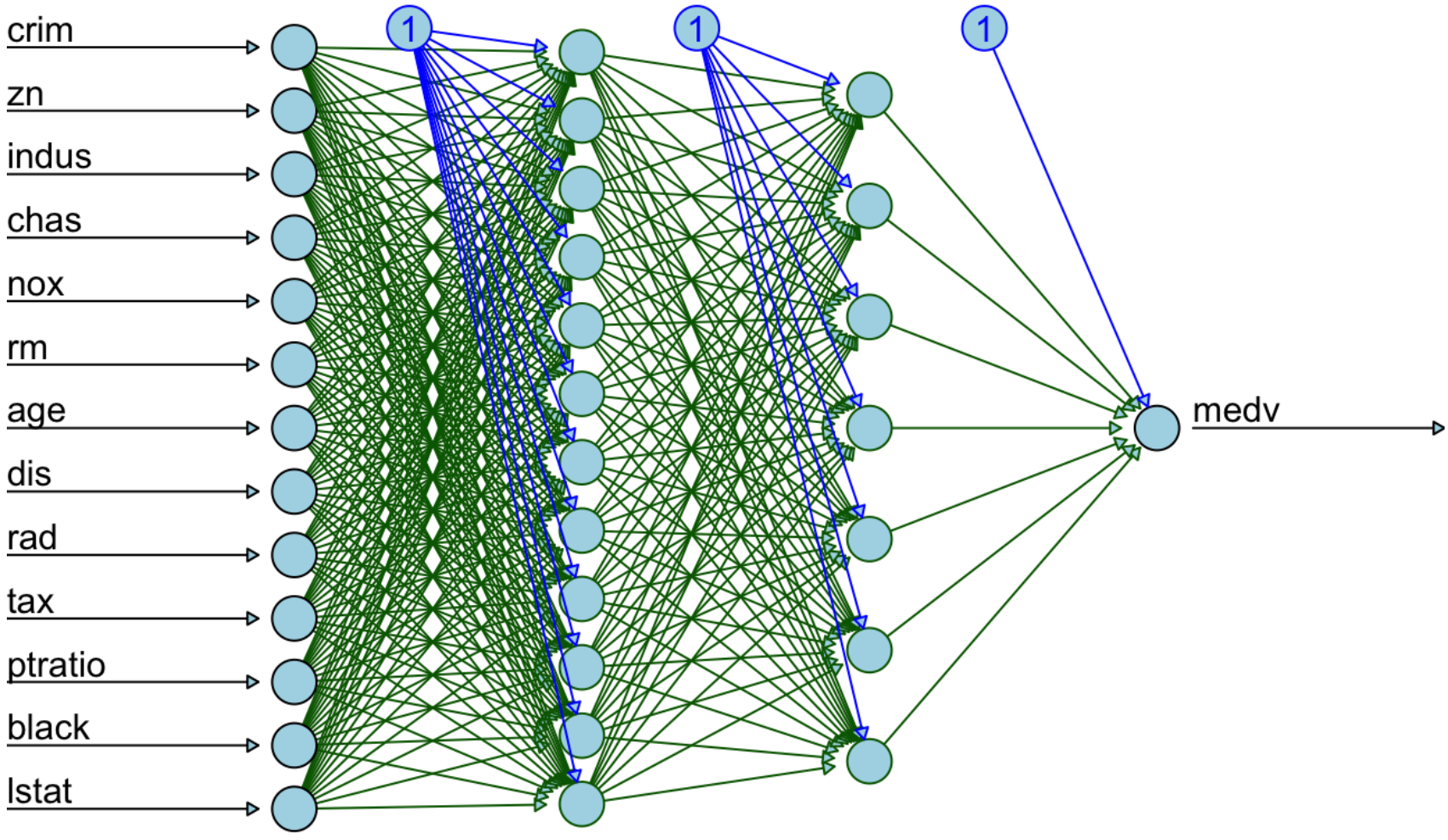


Boston: Predicting Median Value of Owner Occupied Homes

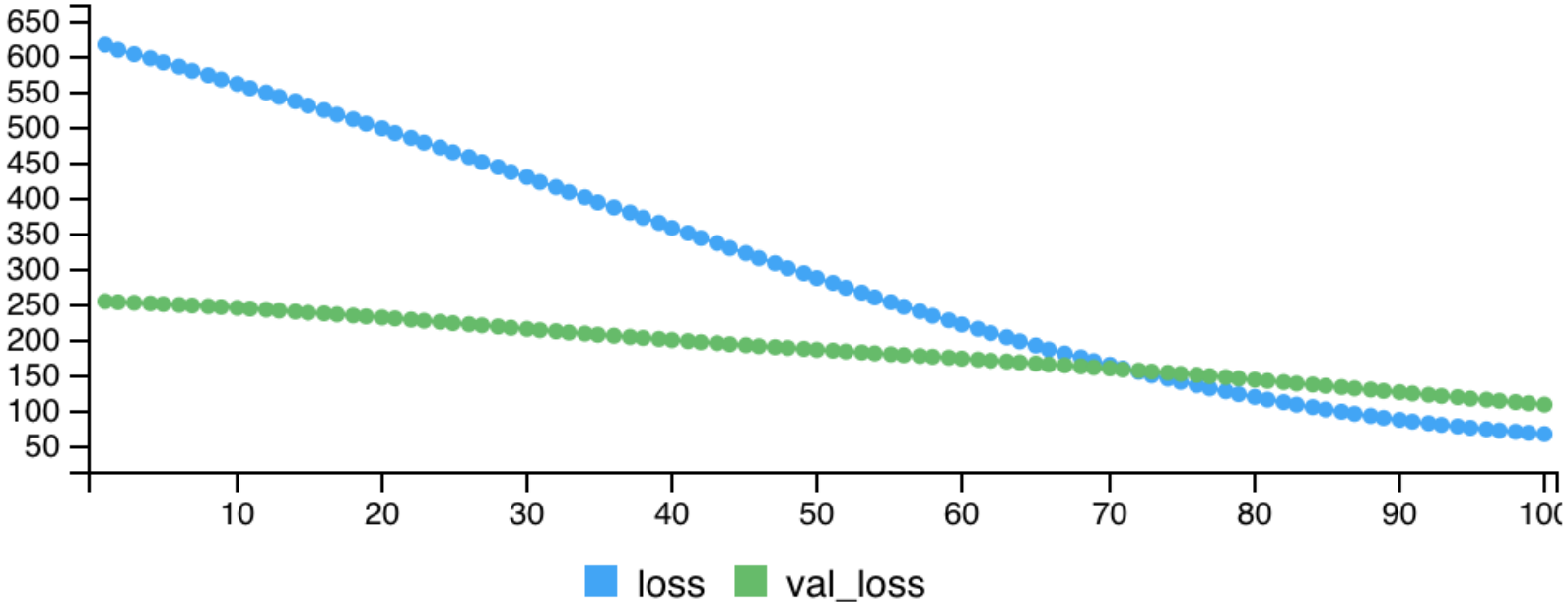
- 14 Features, including the outcome variable
- 506 Rows

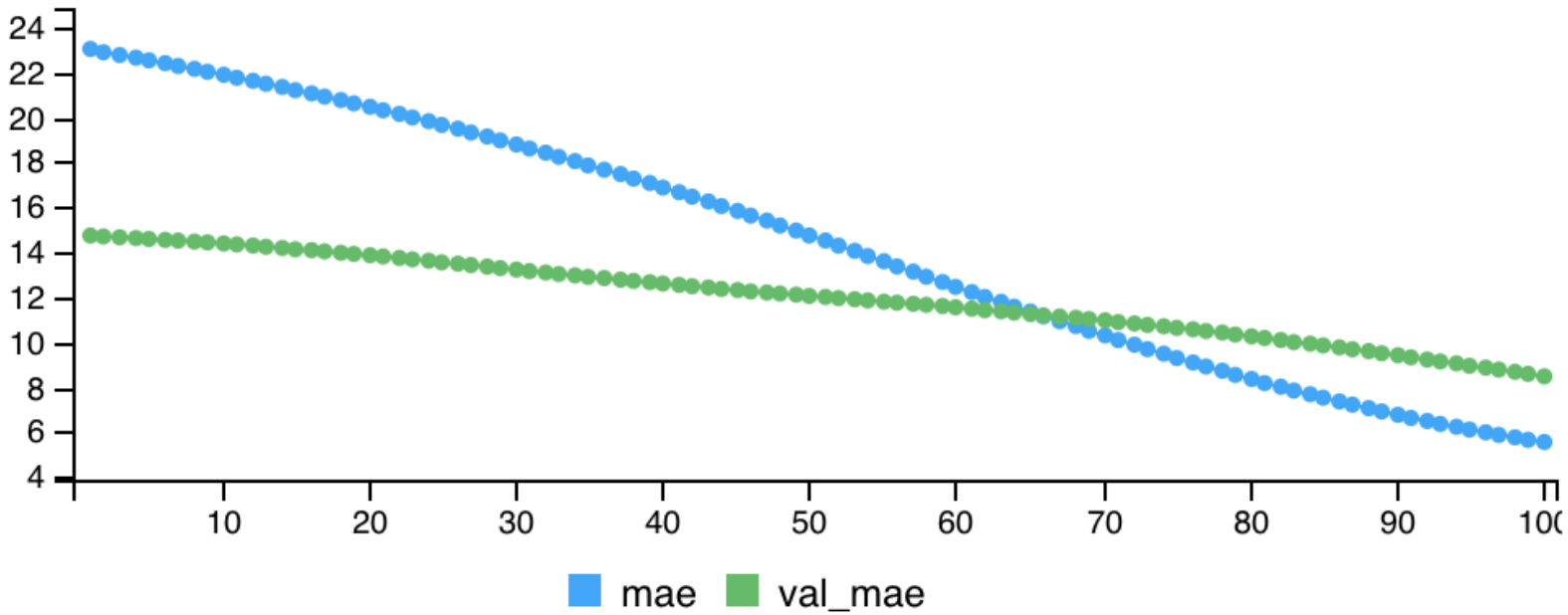
```
model <- keras_model_sequential()
model |>
  layer_dense(units = 5, activation = 'relu', input_shape = c(13)) |>
  layer_dense(units = 1)


model %>% compile(loss = 'mse',
                  optimizer = 'rmsprop',
                  metrics = 'mae')

mymodel <- model |>
fit(training,trainingtarget,
              epochs = 100,
              batch_size = 32,
              validation_split = 0.2)
```

Visual of Neural Network on the Boston Dataset



Training a Neural Network





Test Set Results

```
## [1] "Mean Squared Error:  114.09920161135"
```

Hyperparameter Tuning

- Loss Functions
- Optimization Functions
- Activation Functions
- Other tuneable parameters
  - Training Epochs
  - Batch Size
- Network Architecture
  - Hidden Layers
  - Neuron Connections

Pros and Cons

Pros

- Can be trained on large amounts of data
- Effective at certain tasks
- Less need for feature engineering

Cons

- Less interpretable
- Requires large amount of processing power
- Overfitting
- Potential for introducing biases from the real world

Conclusion

- Many Applications
- More research
  - Capabilities
  - Problems
- Libraries and existing architectures help their development

References

DeepAI. (2019, May 17). Perceptron. DeepAI. Retrieved December 4, 2022, from https://deepai.org/machine-learning-glossary-and-terms/perceptron

Finnstats. (2021, April 10). Deep neural network in R: R-bloggers. R. Retrieved December 4, 2022, from https://www.r-bloggers.com/2021/04/deep-neural-network-in-r/

Joy, A. (2022, April 28). Pros and cons of Deep Learning. Pythonista Planet. Retrieved December 4, 2022, from https://pythonistaplanet.com/pros-and-cons-of-deep-learning/

What is a neural network. Amazon. Retrieved December 4, 2022, from https://aws.amazon.com/what-is/neural-network/