

Knowledge clips for Machine Learning – Tools and applications for policy

This document shows all the knowledge clips that are required for the lectures. There are of course many more out there on many of the topics we have not covered. Prolific contributors that I have found useful are:

- Josh Gardner on the Google Developers' [Youtube channel](#)
- Josh Starmer at [Statquest](#)

1 L1 - Introduction and overview

- None

2 L2 - ML1 – introduction

- How does optimization work? Part 1 (Brandon Rohrer) ([link](#))
- How does optimization work? Part 2 (Brandon Rohrer) ([link](#))
- How does optimization work? Part 3 (Brandon Rohrer) ([link](#))
- How does optimization work? Part 4 (Brandon Rohrer) ([link](#))

3 L3 - ML2 – the basics

- Evaluation: Simple Measures for Classification (CompStat Munich) ([link](#))
Focus on 3.12-6.10 for the explanation on using a **cost function**. The remainder of the clip talks about other cost functions (Brier etc.) – advanced topic.
- Evaluation: Measures for Binary Classification: ROC Measures (CompStat Munich) ([link](#))
Focus on **imbalanced classes** at the start (e.g. defaults) and confusing naming (11.39-13.00)
- Evaluation: Measures for Binary Classification: ROC visualization (CompStat Munich) ([link](#))
If you are interested in deriving ROC/AUC from first principles
- How do Support Vector Machines work? (Brandon Rohrer) ([link](#))
- Decision Boundary (Andrew Ng) ([link](#))
- To discuss in class: [Decision tree animation](#)
- To discuss in class: [Bias Variance](#)

4 L4 - ML3 – dimensionality and assessment

- Principal component analysis – PCA (Statquest) ([link](#))
The key concepts are covered until 12.35.
- RIDGE regressions (Statquest) ([link](#))
This video is a bit slow but does cover RIDGE in detail
- LASSO regressions (Statquest) ([link](#))
If you have just seen RIDGE regression, you can start at 2.40
- Bonus: [Playing around with Eigenvectors](#) (Victor Powell and Lewis Lehe)

5 L5 - ML4 – improving weak learners

- Decision Tree Classifier from Scratch (Josh Gordon) ([link](#))
- ADABOOST clearly explained (Josh Starmer) ([link](#))
- XGBoost from Start to Finish (Josh Starmer) ([link](#))

An extensive webinar where the XGBoost discussion starts at 36:32. The intro is nice to see how to handle data (labeling, missing values, ...)

6 L6 - ML5 – unsupervised learning and explainability

- K-means animation (Andrey Shabalin) ([link](#))
- K-means clustering (StatQuest) ([link](#))

7 L7 - ML6 – Neural Nets

- Neural Networks Demystified (Stephen Welch) ([link](#))

Sets the stage for how to think about neural networks. The remaining videos in this series explain the details of programming a NN. This goes a further than this course but are a great lead into the topic.

- But what is a Neural Network? (3Blue1Brown) ([link](#))

Visualizing a NN is a great way to approach this topic. Watch the video until 13:25. The linear algebra afterwards is not key for the intuition.

- Recurrent Neural Networks (Ava Soleimany) ([link](#))

This advanced video explains RNNs. Focus on the following sections:

2:39	–	Sequence modeling
9:57	–	Recurrent neural networks
14:04	–	RNN intuition
37:36	–	RNN applications

- To discuss in class: visualising neural nets at www.cybercontrols.org ([link](#))

8 L8 - ML7 – Natural Language Processing

- Natural Language Processing (NLP): What Is It and How Does it Work? ([link](#)).

9 L9 - ML8 – generative models

- No clips for this lecture

10 L10 - Summary

- No clips for this lecture