Library Academy

Innovate your education

21-01-2026

Ontdek wat data vertellen: Aan de slag met Machine Learning in JASP

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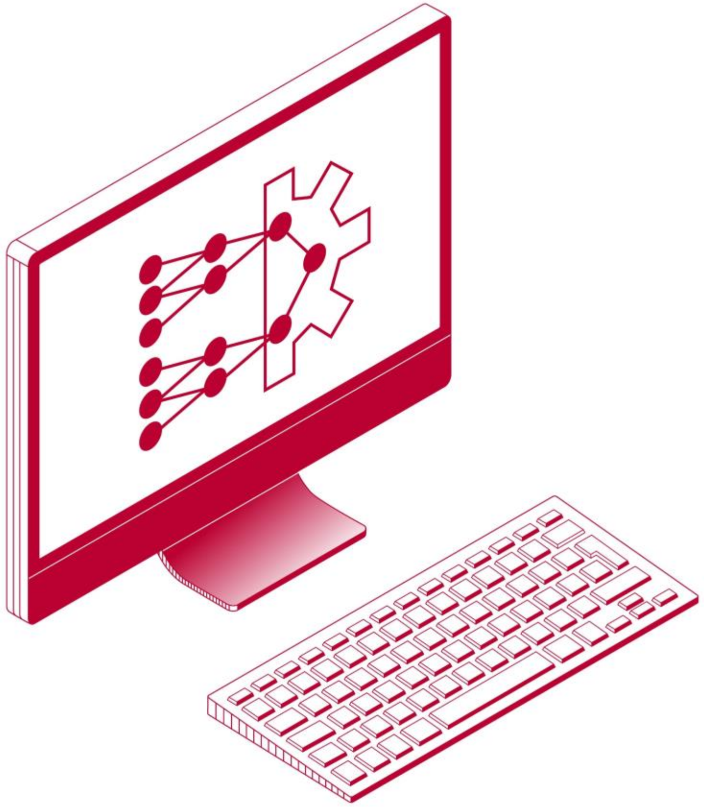
Library Academy 2026



Outline

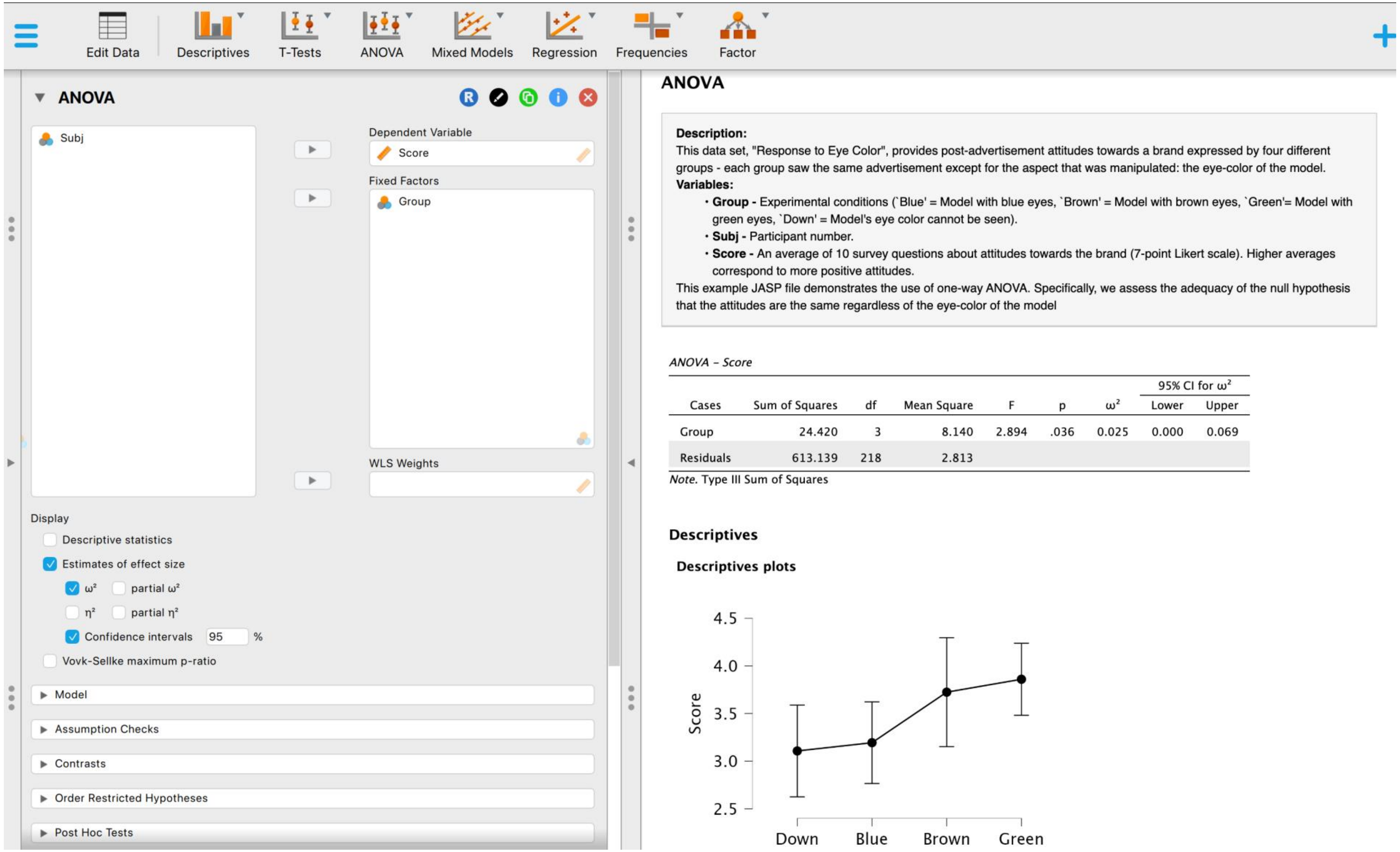
- Basics
  - What is JASP?
  - Regression
- Machine Learning
  - General philosophy
  - K-nearest neighbors
- Exercises

edu.nl/aa8ch

What is JASP?

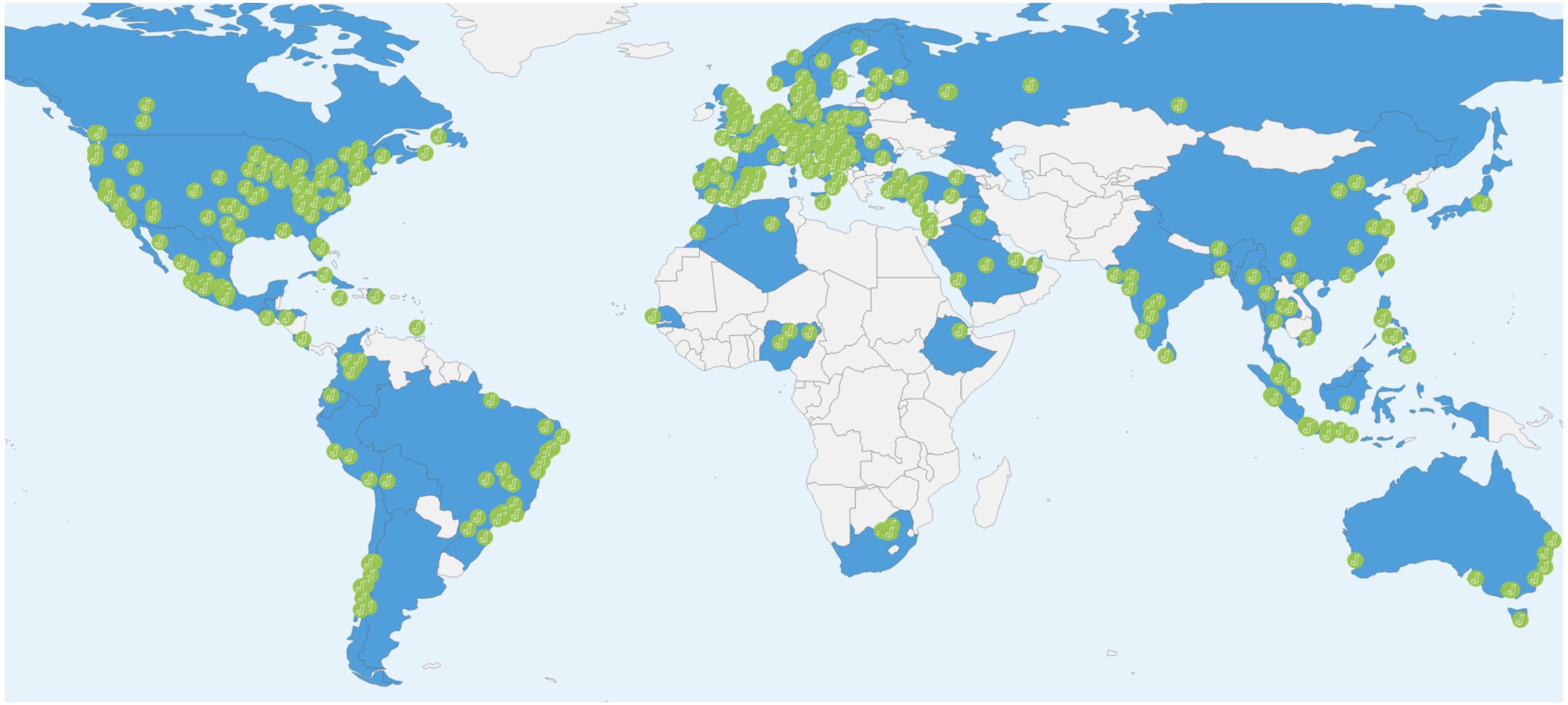
- Developed at UvA over the past 10 years, funded by research grants (NWO/EU)
- Graphical user interface for conducting frequentist and Bayesian statistics
- https://jasp-stats.org/
- Open-source → forever free!

What is JASP?


Edit Data
Descriptives
T-Tests
ANOVA
Mixed Models
Regression
Frequencies
Factor
ANOVA
Subj
Dependent Variable
Score
Fixed Factors
Group
WLS Weights
Display
Descriptive statistics
Estimates of effect size
ω²
partial ω²
η²
partial η²
Confidence intervals 95 %
Vovk-Sellke maximum p-ratio
Model
Assumption Checks
Contrasts
Order Restricted Hypotheses
Post Hoc Tests
ANOVA
Description:
This data set, "Response to Eye Color", provides post-advertisement attitudes towards a brand expressed by four different groups - each group saw the same advertisement except for the aspect that was manipulated: the eye-color of the model.
Variables:
• Group - Experimental conditions (`Blue' = Model with blue eyes, `Brown' = Model with brown eyes, `Green'= Model with green eyes, `Down' = Model's eye color cannot be seen).
• Subj - Participant number.
• Score - An average of 10 survey questions about attitudes towards the brand (7-point Likert scale). Higher averages correspond to more positive attitudes.
This example JASP file demonstrates the use of one-way ANOVA. Specifically, we assess the adequacy of the null hypothesis that the attitudes are the same regardless of the eye-color of the model
ANOVA – Score
95% CI for ω²
Cases Sum of Squares df Mean Square F p ω² Lower Upper
Group 24.420 3 8.140 2.894 .036 0.025 0.000 0.069
Residuals 613.139 218 2.813
Note. Type III Sum of Squares
Descriptives
Descriptives plots
Score
4.5
4.0
3.5
3.0
2.5
Down
Blue
Brown
Green

What is JASP?

- Used at 374 universities across 76 countries
- 100,000 monthly downloads



https://jasp-stats.org/teaching-with-jasp/#worldmap

Features

- Website overview
- JASP vs. SPSS feature comparison
- Data formats: .sav, .xls, .txt, .csv, .ods, .tsv, .dta, .por, .sas7bdat, .sas7bcat, and the .jasp format
- APA tables
- OSF integration
- R console
- Compute columns
- Filtering

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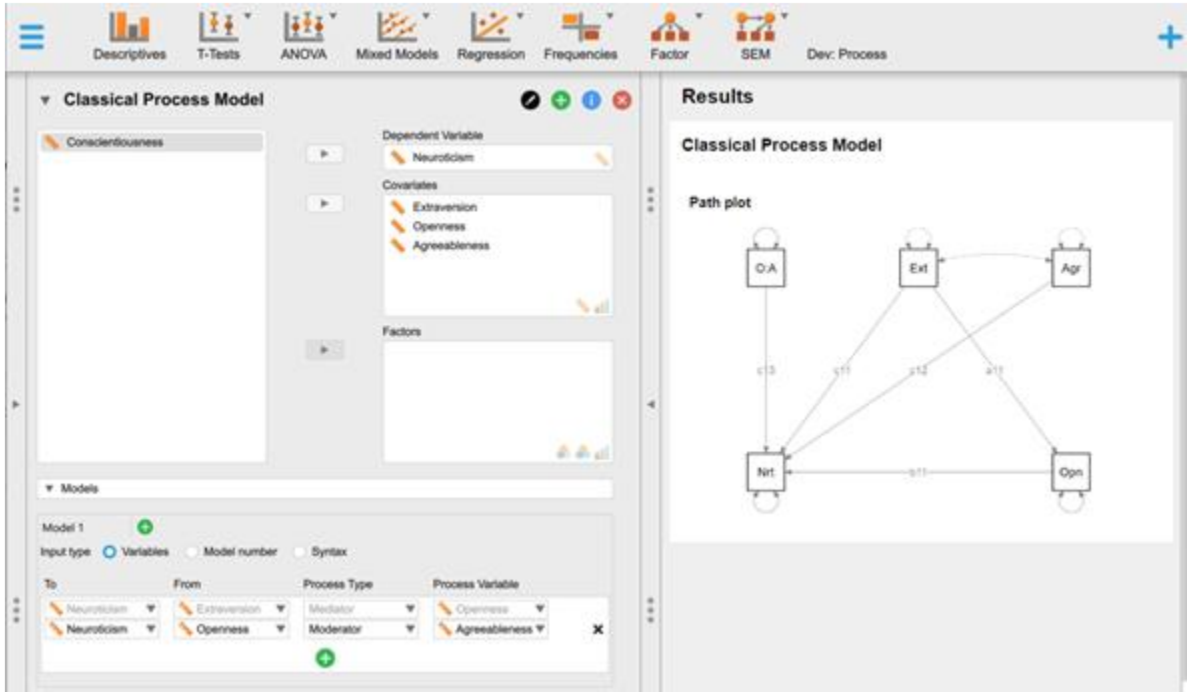
Feature Roadmap

- Full syntax mode ([blog about the first implementation]())
- Better data manipulation
- Select filters



Other Handy Resources

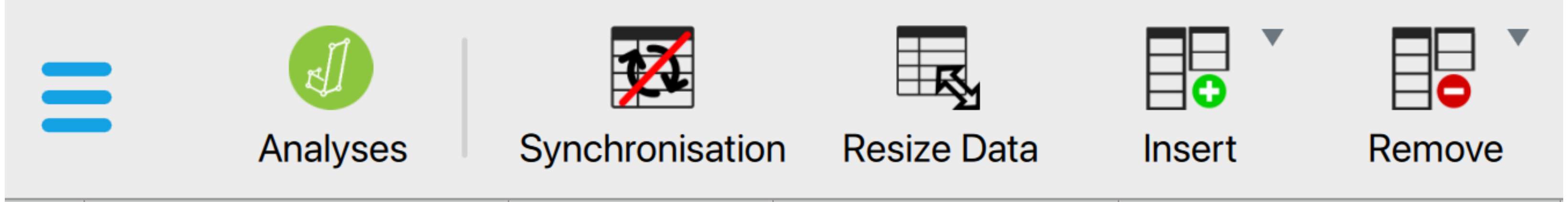
- The JASP Video Library
- How to Use JASP – Inventory of blogs/videos/gifs for frequentist and Bayesian analyses
- JASP YouTube page
- Step By Step Guide: 1. Bayesian One-Way ANOVA and the full playlist
- JASP on Bluesky - https://bsky.app/profile/jaspstats.bsky.social
- JASP forum - https://forum.cogsci.nl/index.php?p=/categories/jasp-bayesfactor
- Found a bug? Please report on Github: https://github.com/jasp-stats/jasp-issues/issues
- JASP Verification Project
- More JASP workshops: https://jasp-stats.org/workshop/

JASP Literature

- The JASP Data Library
- Discovering Statistics Using JASP
- Learning Statistics with JASP: A Tutorial for Psychology Students and Other Beginners by Danielle J. Navarro, David R. Foxcroft, and Thomas J. Faulkenberry
- Statistics of Doom by Erin Buchanan
- Statistical Analysis in JASP. A Guide for Students by Mark Goss-Sampson
- Quantitative Analysis with JASP open-source software by Chris Halter (amazon)

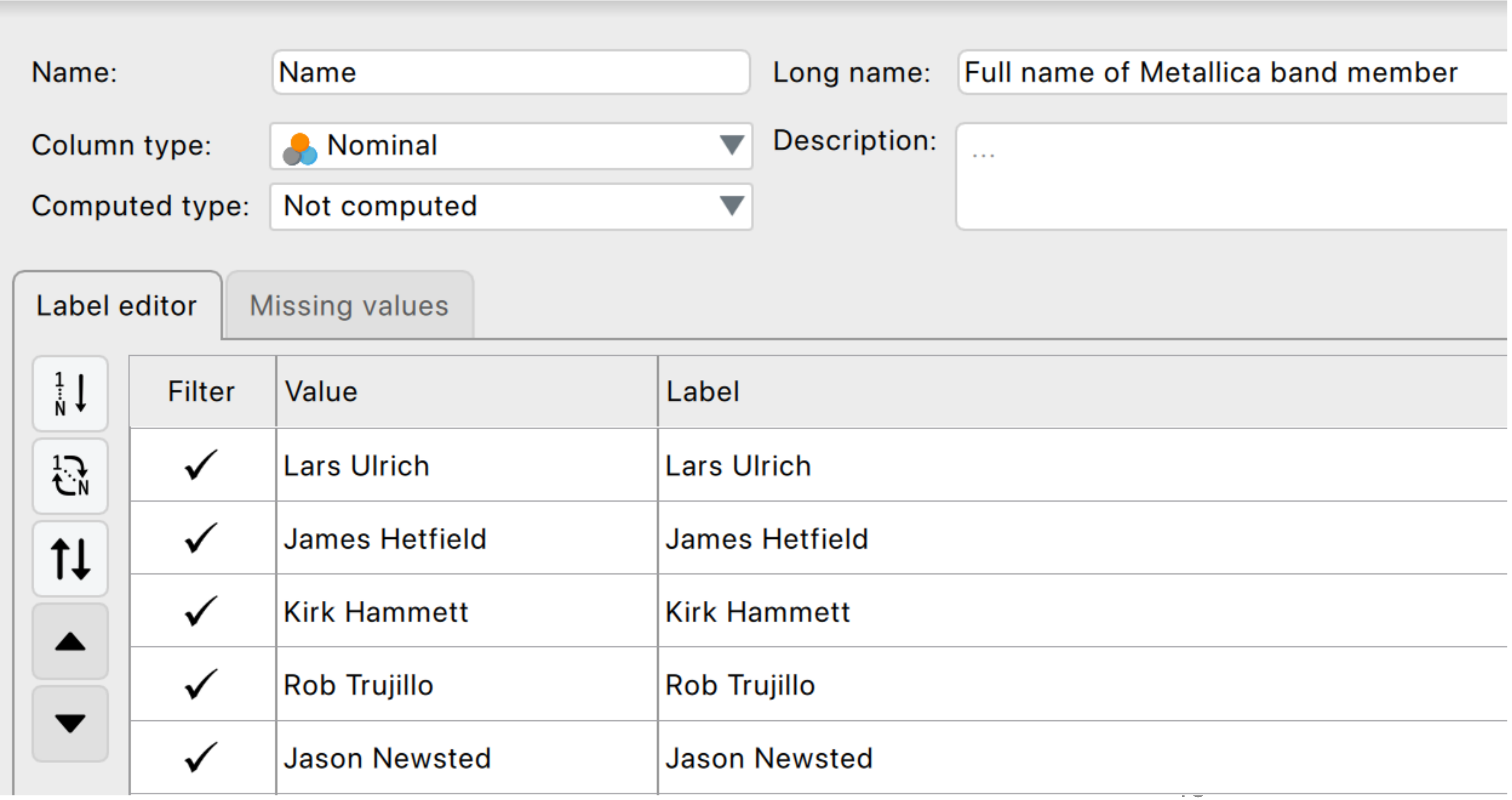
JASP

Data Management



	Name	Instrument	Current member		Headbanging intensity	
1	Lars Ulrich	Drums	Yes	1	Light	1
2	James Hetfield	Guitar	Yes	1	Heavy	3
3	Kirk Hammett	Guitar	Yes	1	Light	1
4	Rob Trujillo	Bass	Yes	1	Moderate	2
5	Jason Newsted	Bass	No	0	Heavy	3

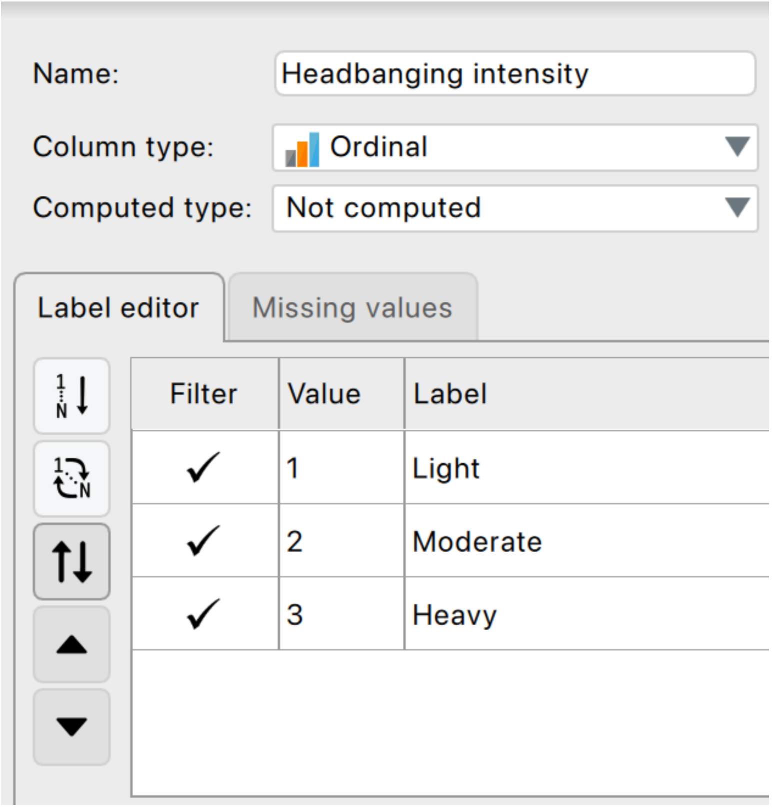
The Variable View



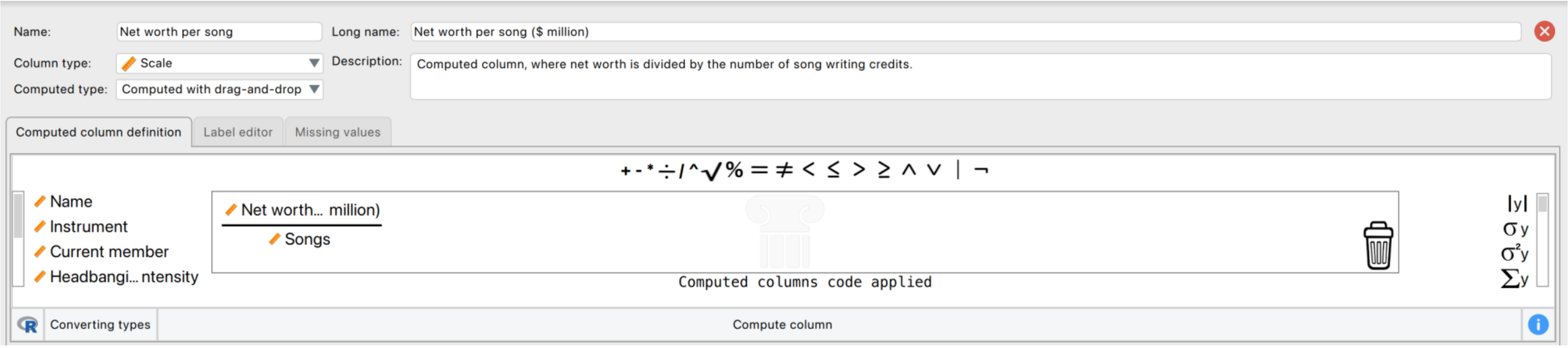
Variable Types

- Scale
  – Numbers (e.g., 7, 0, 120, 8.5)
- Nominal
  – Categories (e.g., ‘Control group’, ‘Experimental group’)
- Ordinal
  – Ordered values (e.g., ‘Dislike’, ‘Neutral’, ‘Like’)

Variable Settings

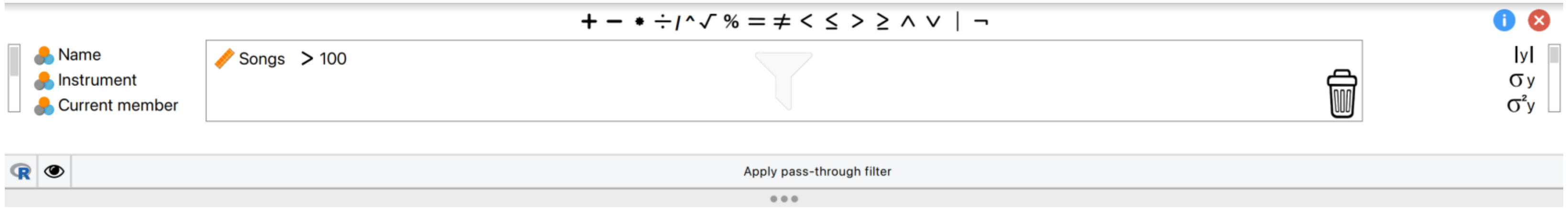


Computing a New Variable

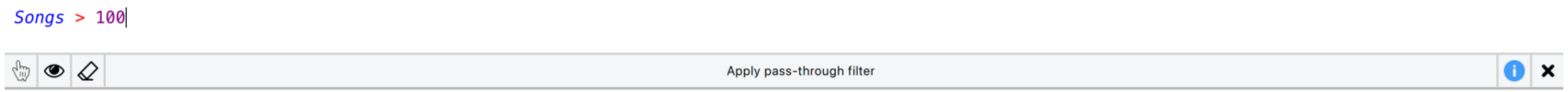


Filtering Data

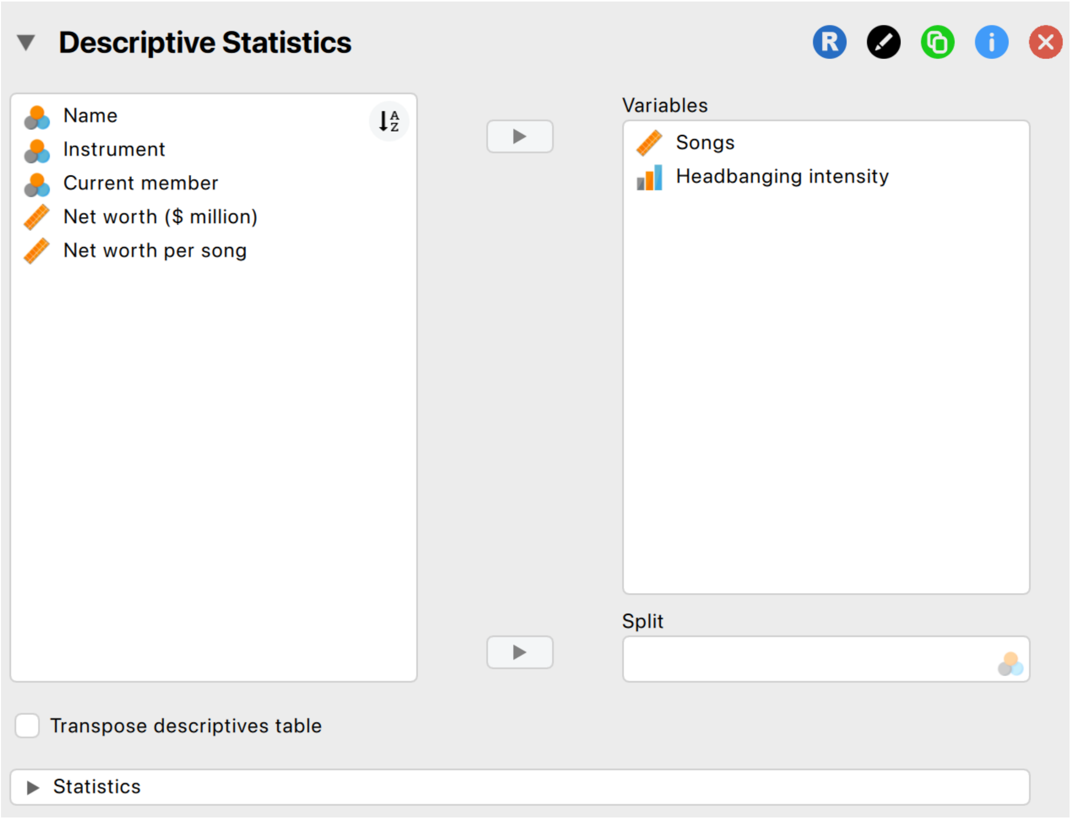
- Using Variable Settings
- Using the Filter functionality
  - Drag and drop



  - R-mode



Descriptives – input window



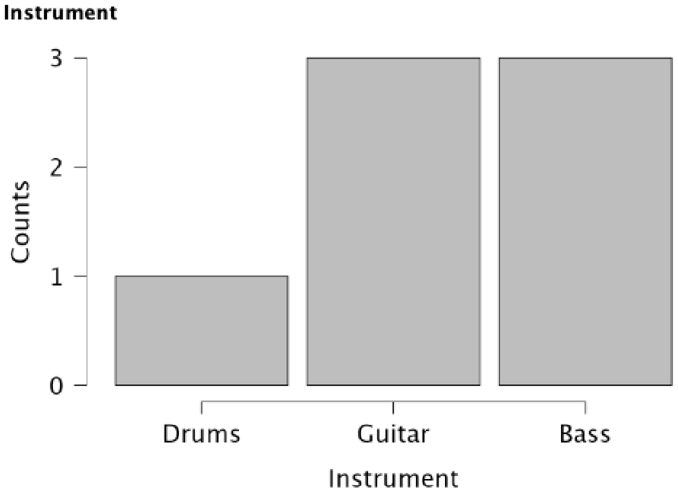
Descriptives – output window

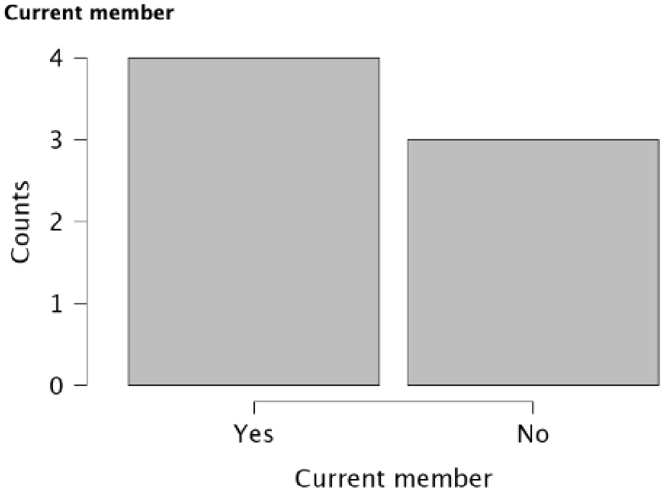
Distribution Plots

B I U Normal Normal

We can have fancy $\LaTeX$ formula's in here, [link cute cat video's](), or insert a drumkit 

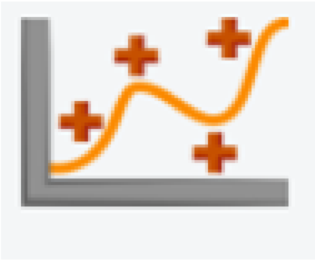
Below are two distribution plots outlining the members of Metallica. On the left, we see the various instruments being played and their frequencies, and on the right we see how many members are still active, and how many left the band.





JASP

There are lots of different machine learning algorithms



Regression

- Boosting
- Decision tree
- K-nearest neighbors
- Linear
- Neural network
- Random forest
- Regularized linear
- Support vector machine

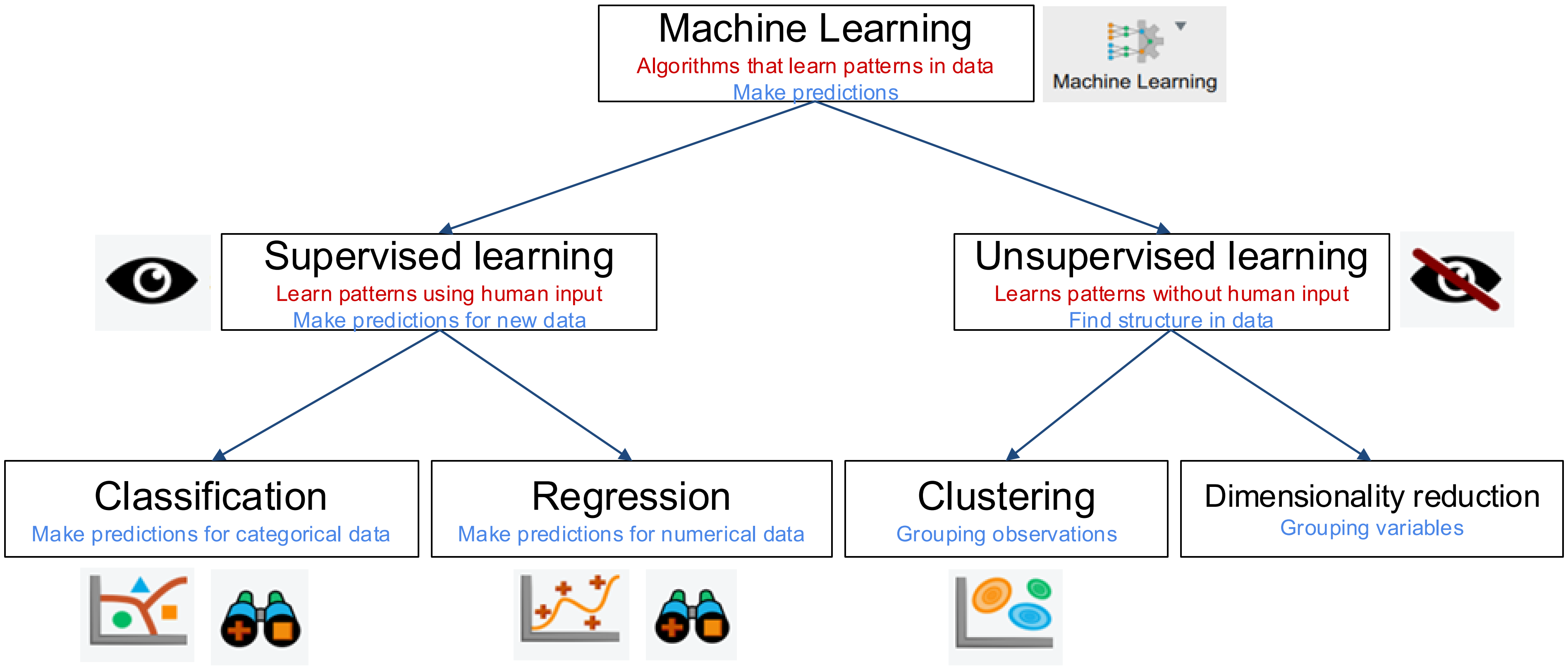
Classification

- Boosting
- Decision tree
- K-nearest neighbors
- Linear discriminant
- Logistic/Multinomial
- Naive Bayes
- Neural network
- Random forest
- Support vector machine

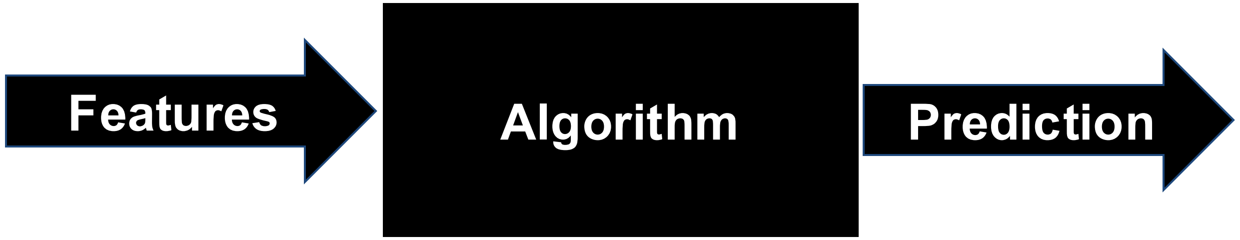
Clustering

- Density-based
- Fuzzy c-means
- Hierarchical
- Model-based
- Neighborhood-based
- Random forest

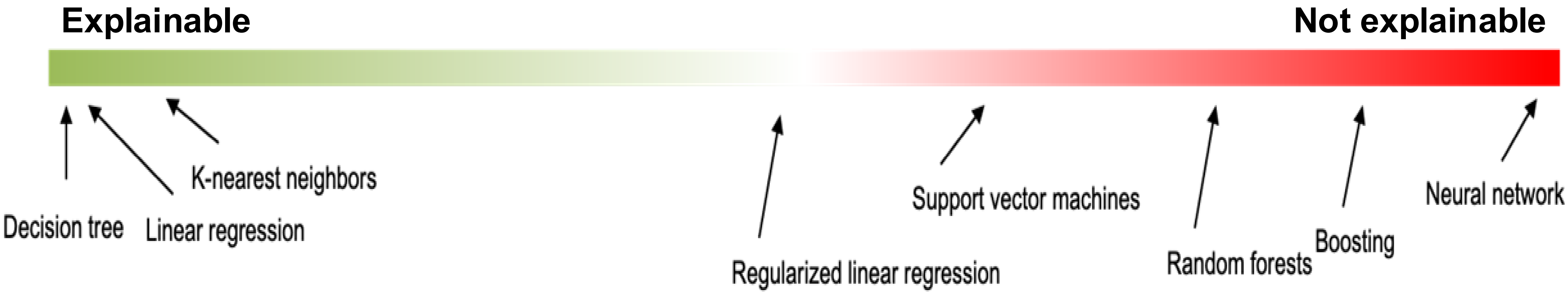
Machine learning is about finding patterns, the goal is making predictions



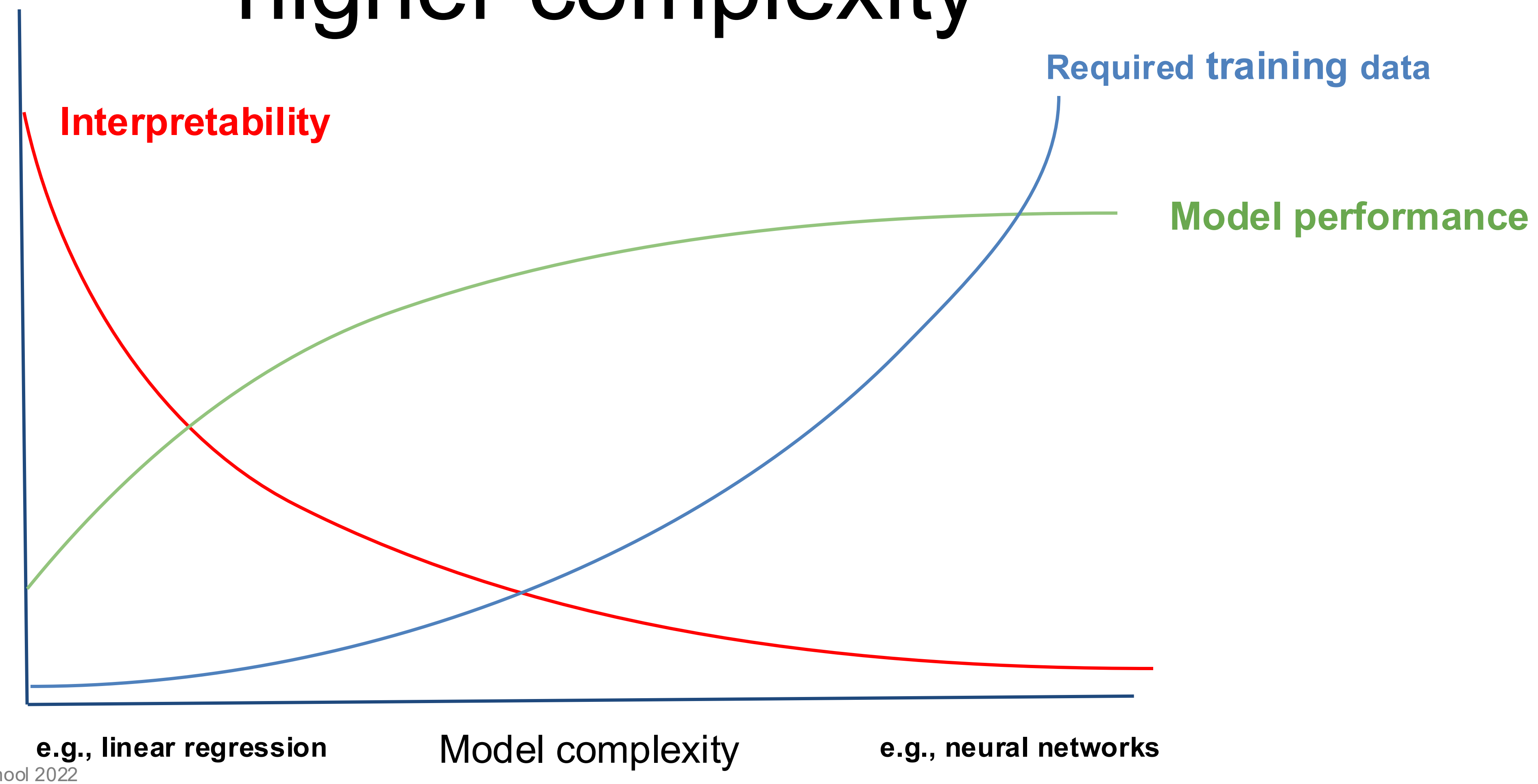
- Some algorithms are ‘black boxes’



- Understanding all algorithms is not the most important, understanding how to evaluate their results is



Better performance (often) comes with higher complexity



Learning objectives for today

- Train machine learning algorithms (regression, classification, clustering) using JASP
- Understand how to evaluate the quality of these algorithms
- Apply these algorithms to predict new data

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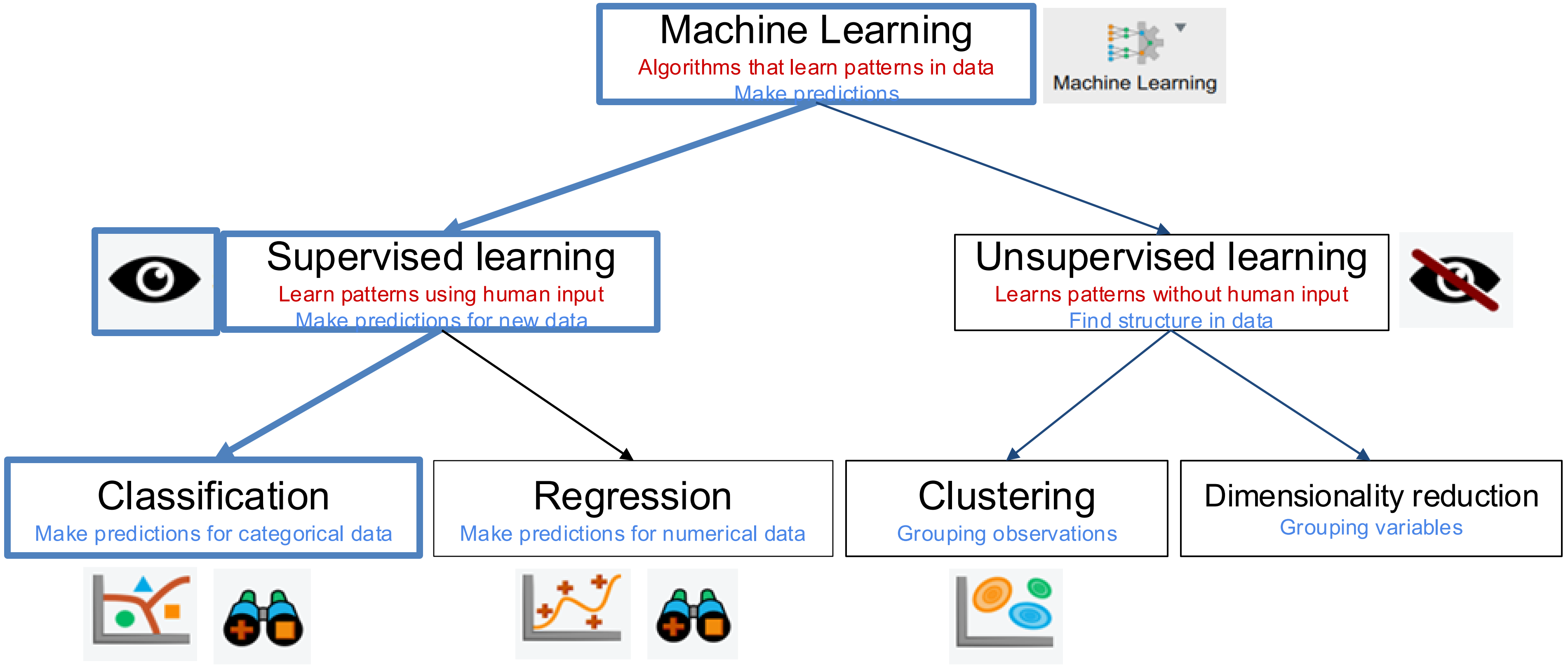
Machine learning is about finding patterns, the goal is making predictions



A typical classification classification**workflow**

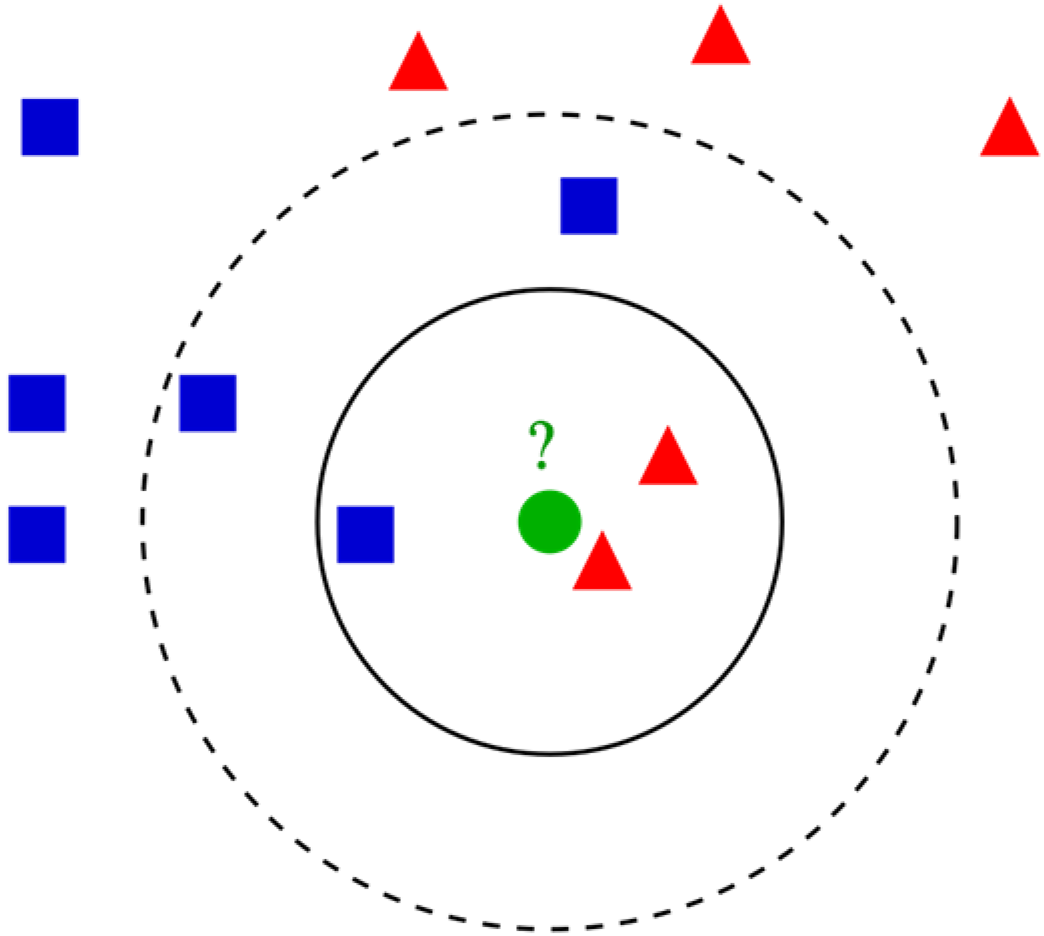
1. Training the classification model
2. Optimizing the model (optional)
3. Evaluating the quality of the predictions of the model
4. Apply the model to new data

You typically split your dataset in 2 or 3 parts

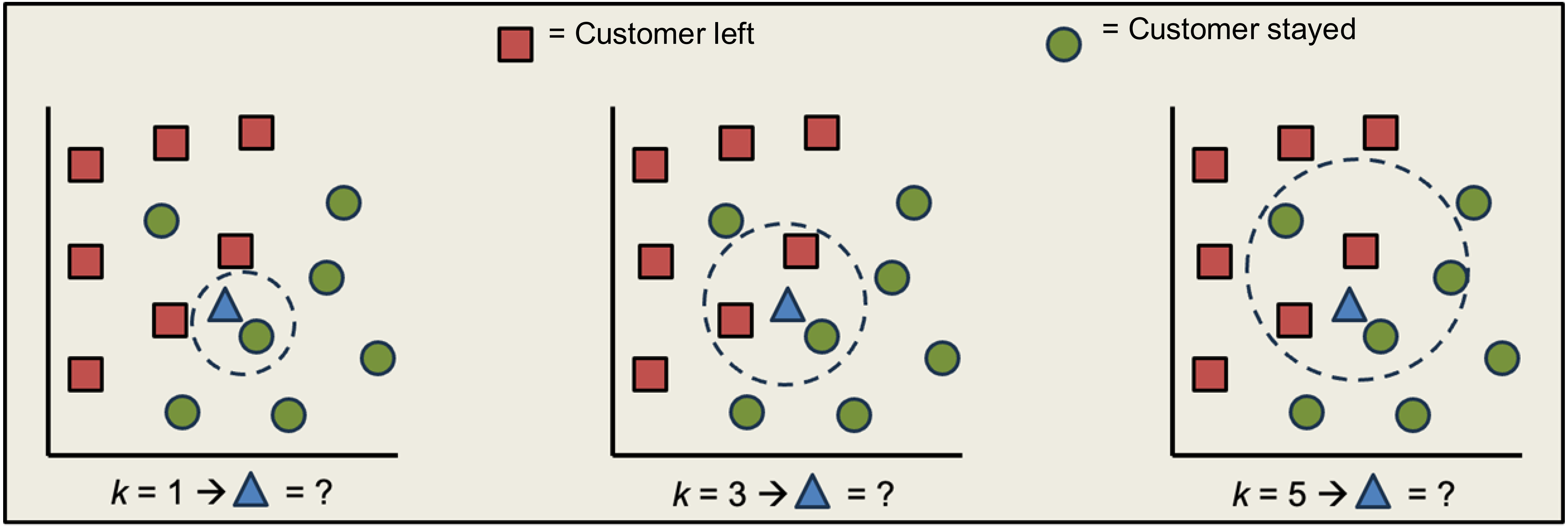
1. Training set (typically 80%): Used for training the model
2. Validation set: Used for optimizing the model (optional)
3. Test set (typically 20%): Used for evaluating the model

Algorithm: K-nearest neighbors

- Finds the *k* most similar observations in the training set and uses this as a basis for prediction.
- For a new observation you find the *k* most similar observations and **take the most occurring category**.



Algorithm: K-nearest neighbors



Exercise: K-nearest neighbors

Using pen and paper, draw up the data as follows:

- Number of products sold on the horizontal axis,
- Number of years as a customer on the vertical axis,
- Use 😳 for a customer who stayed,
- Use 😟 for a customer who left

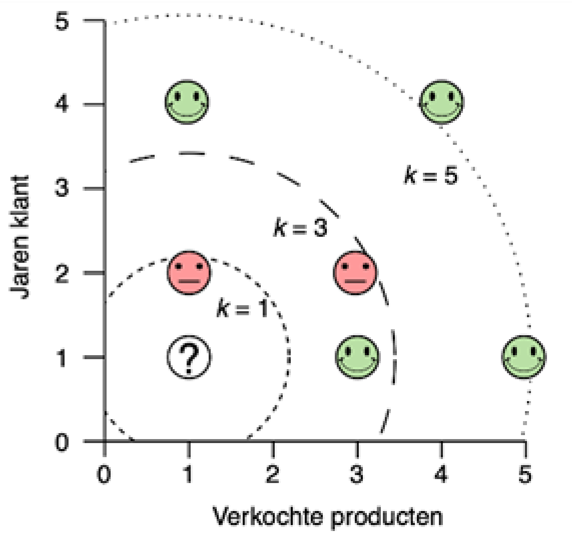
What is your prediction with k = 1, 3 and 5 when products sold = years as customer = 1? 😳 or 😟 ?

What is your prediction with k = 1, 3 and 5 when products sold = 5 and years customer = 3 😳 or 😟 ?

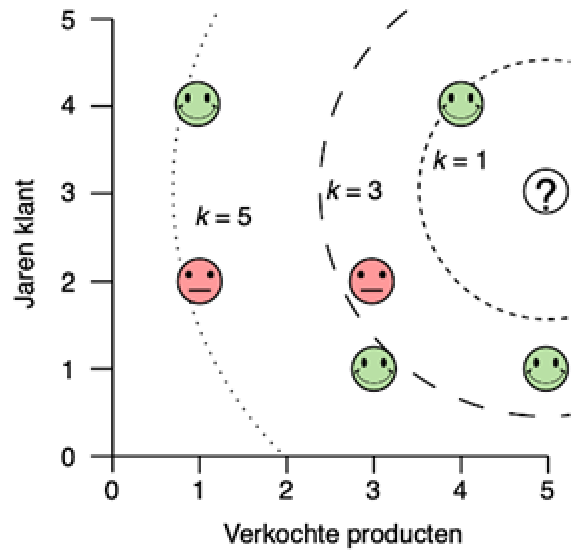
Sold products	Years customer	Outcome
1	4	Stayed
4	4	Stayed
1	2	Left
3	2	Left
3	1	Stayed
5	1	Stayed

Exercise: K-nearest neighbors

- What is your prediction with k = 1, 3 and 5 when products sold = years as customer = 1? 🙂 or 🙁 ?
- What is your prediction with k = 1, 3 and 5 when products sold = 5 and years customer = 3 🙂 or 🙁 ?



k = 1 → 🙁
k = 3 → 🙁
k = 5 → 🙂



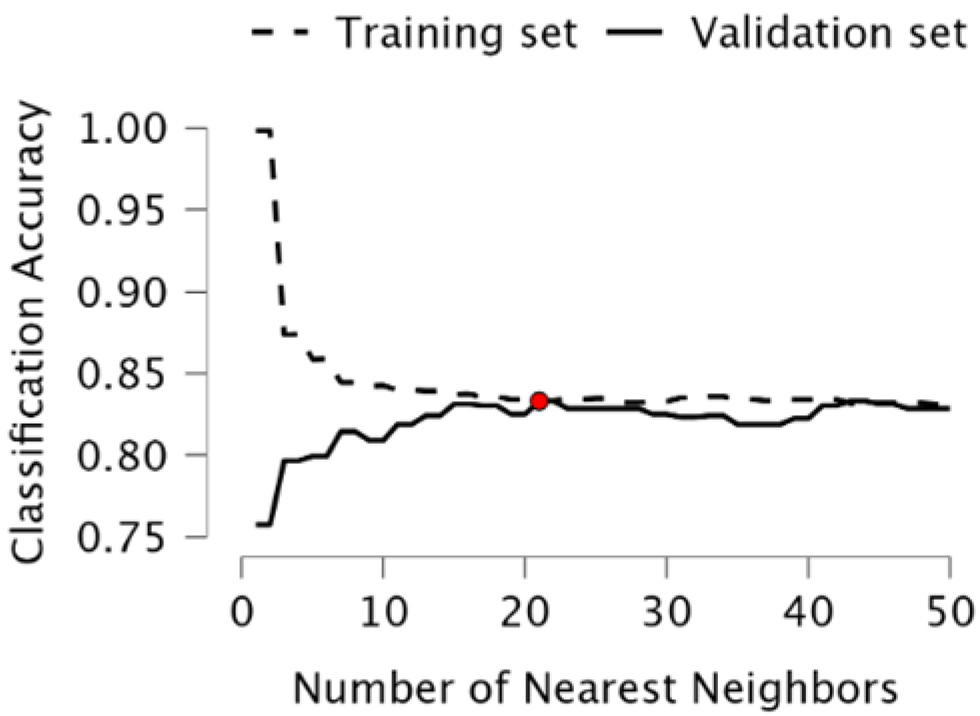
k = 1 → 🙂
k = 3 → 🙂
k = 5 → 🙂

Validation: K-nearest neighbors

- *k* = 1 is a more flexible model, it gives perfect predictions on the training set, but does not generalize well to never before seen data

- *k* = *n* is a more generalized model, it gives poor predictions on the training set but generalizes better to never before seen data.

- Optimal: somewhere in between.



Evaluation: K-nearest neighbors

Accuracy:
Proportion of correctly classified cases

= (TN + TP) / (TN + FP + FN + TP)
= (942 + 183) / (942 + 102 + 179 + 183)
= 0.801

Confusion Matrix

		Predicted	
		No	Yes
Observed	No	942	102
	Yes	179	183

Evaluation: K-nearest neighbors

Precision:
Proportion of correctly classified positive predictions

= TP / (TP + FP)
= 183 / (183 + 102)
= 0.642

Confusion Matrix

		Predicted	
		No	Yes
Observed	No	942	102
	Yes	179	183

Evaluation: K-nearest neighbors

True positive rate (recall):
Proportion of correctly classified positive observations

= TP / (TP + FN)
= 183 / (183 + 179)
= 0.505

Confusion Matrix

		Predicted	
		No	Yes
Observed	No	942	102
	Yes	179	183

And many more...

		Predicted condition			
	Total population $= \mathrm{P} + \mathrm{N}$	**Predicted positive**	**Predicted negative**	Informedness, bookmaker informedness (BM) $= \mathrm{TPR} + \mathrm{TNR} - 1$	Prevalence threshold (PT) $= \frac{\sqrt{\mathrm{TPR} \times \mathrm{FPR}} - \mathrm{FPR}}{\mathrm{TPR} - \mathrm{FPR}}$
Actual condition	**Real Positive (P)** [a]	**True positive** (TP), hit[b]	**False negative** (FN), miss, underestimation	True positive rate (TPR), recall, sensitivity (SEN), probability of detection, hit rate, power $= \frac{\mathrm{TP}}{\mathrm{P}} = 1 - \mathrm{FNR}$	False negative rate (FNR), miss rate type II error [c] $= \frac{\mathrm{FN}}{\mathrm{P}} = 1 - \mathrm{TPR}$
	Real Negative (N) [d]	**False positive** (FP), false alarm, overestimation	**True negative** (TN), correct rejection[e]	False positive rate (FPR), probability of false alarm, fall-out type I error [f] $= \frac{\mathrm{FP}}{\mathrm{N}} = 1 - \mathrm{TNR}$	True negative rate (TNR), specificity (SPC), selectivity $= \frac{\mathrm{TN}}{\mathrm{N}} = 1 - \mathrm{FPR}$
	Prevalence $= \frac{\mathrm{P}}{\mathrm{P} + \mathrm{N}}$	Positive predictive value (PPV), precision $= \frac{\mathrm{TP}}{\mathrm{TP} + \mathrm{FP}} = 1 - \mathrm{FDR}$	False omission rate (FOR) $= \frac{\mathrm{FN}}{\mathrm{TN} + \mathrm{FN}} = 1 - \mathrm{NPV}$	Positive likelihood ratio (LR+) $= \frac{\mathrm{TPR}}{\mathrm{FPR}}$	Negative likelihood ratio (LR−) $= \frac{\mathrm{FNR}}{\mathrm{TNR}}$
	Accuracy (ACC) $= \frac{\mathrm{TP} + \mathrm{TN}}{\mathrm{P} + \mathrm{N}}$	False discovery rate (FDR) $= \frac{\mathrm{FP}}{\mathrm{TP} + \mathrm{FP}} = 1 - \mathrm{PPV}$	Negative predictive value (NPV) $= \frac{\mathrm{TN}}{\mathrm{TN} + \mathrm{FN}} = 1 - \mathrm{FOR}$	Markedness (MK), deltaP (Δp) $= \mathrm{PPV} + \mathrm{NPV} - 1$	Diagnostic odds ratio (DOR) $= \frac{\mathrm{LR+}}{\mathrm{LR-}}$
	Balanced accuracy (BA) $= \frac{\mathrm{TPR} + \mathrm{TNR}}{2}$	F_1 score $= \frac{2\,\mathrm{PPV} \times \mathrm{TPR}}{\mathrm{PPV} + \mathrm{TPR}} = \frac{2\,\mathrm{TP}}{2\,\mathrm{TP} + \mathrm{FP} + \mathrm{FN}}$	Fowlkes–Mallows index (FM) $= \sqrt{\mathrm{PPV} \times \mathrm{TPR}}$	*phi* or Matthews correlation coefficient (MCC) $= \sqrt{\mathrm{TPR} \times \mathrm{TNR} \times \mathrm{PPV} \times \mathrm{NPV}} - \sqrt{\mathrm{FNR} \times \mathrm{FPR} \times \mathrm{FOR} \times \mathrm{FDR}}$	Threat score (TS), critical success index (CSI), Jaccard index $= \frac{\mathrm{TP}}{\mathrm{TP} + \mathrm{FN} + \mathrm{FP}}$

JASP

Exercises!

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Thank you for your attention!

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