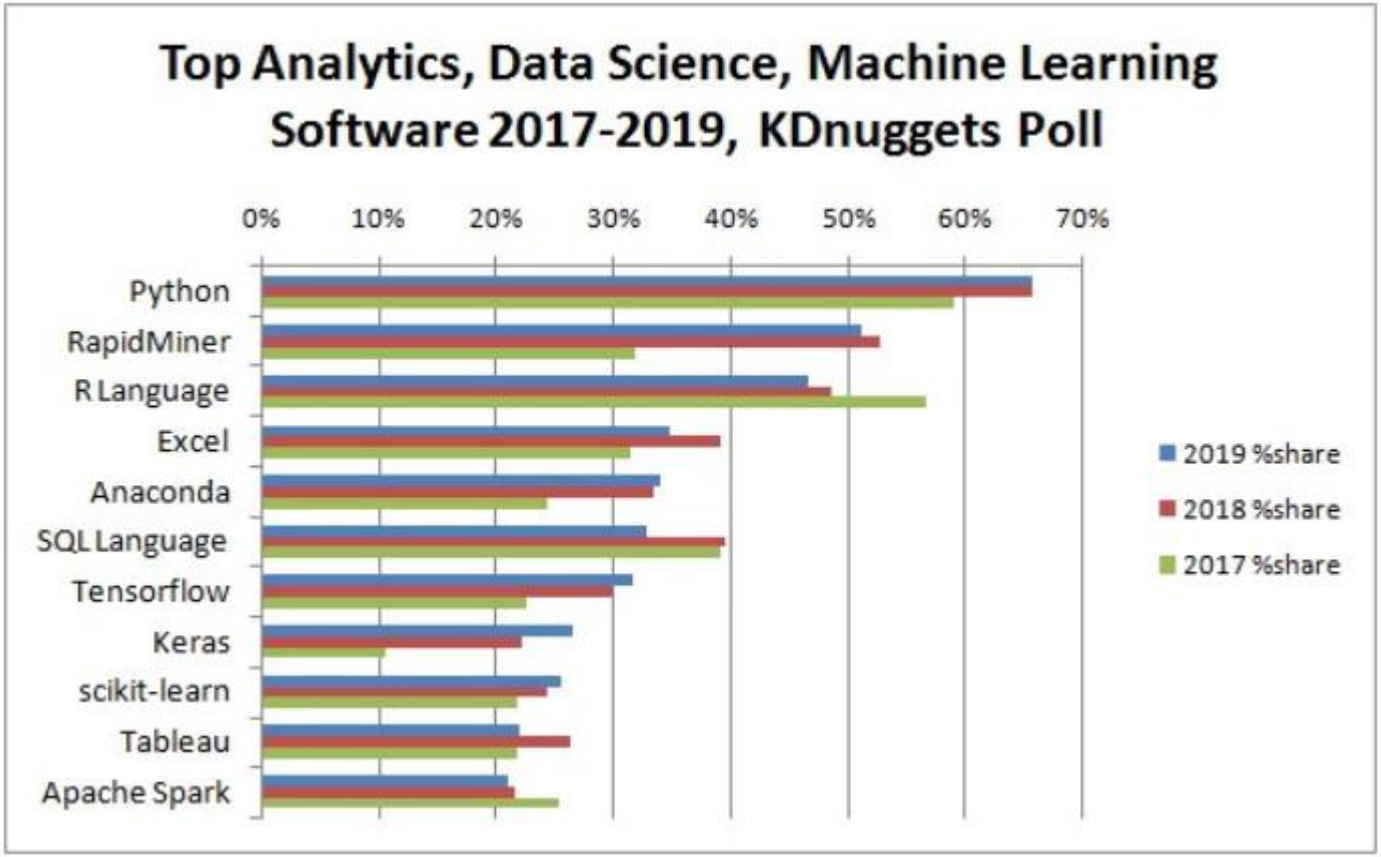
UNIVERSITY OF MANNHEIM

Introduction to RapidMiner

RapidMiner

- A very comprehensive open-source data mining tool
  - The data mining process is visually modeled as an operator chain
  - RapidMiner has over 400 build in data mining operators
  - RapidMiner provides broad collection of charts for visualizing data
- Project started in 2001 by Ralf Klinkenberg, Ingo Mierswa, and Simon Fischer at University of Dortmund, Germany
- Today: Maintained by commercial company plus open-source developers
- RapidMiner Editions
  - RapidMiner Education: Free
  - Enterprise Edition: Commercial

KDnuggets Poll: Which Software is used?

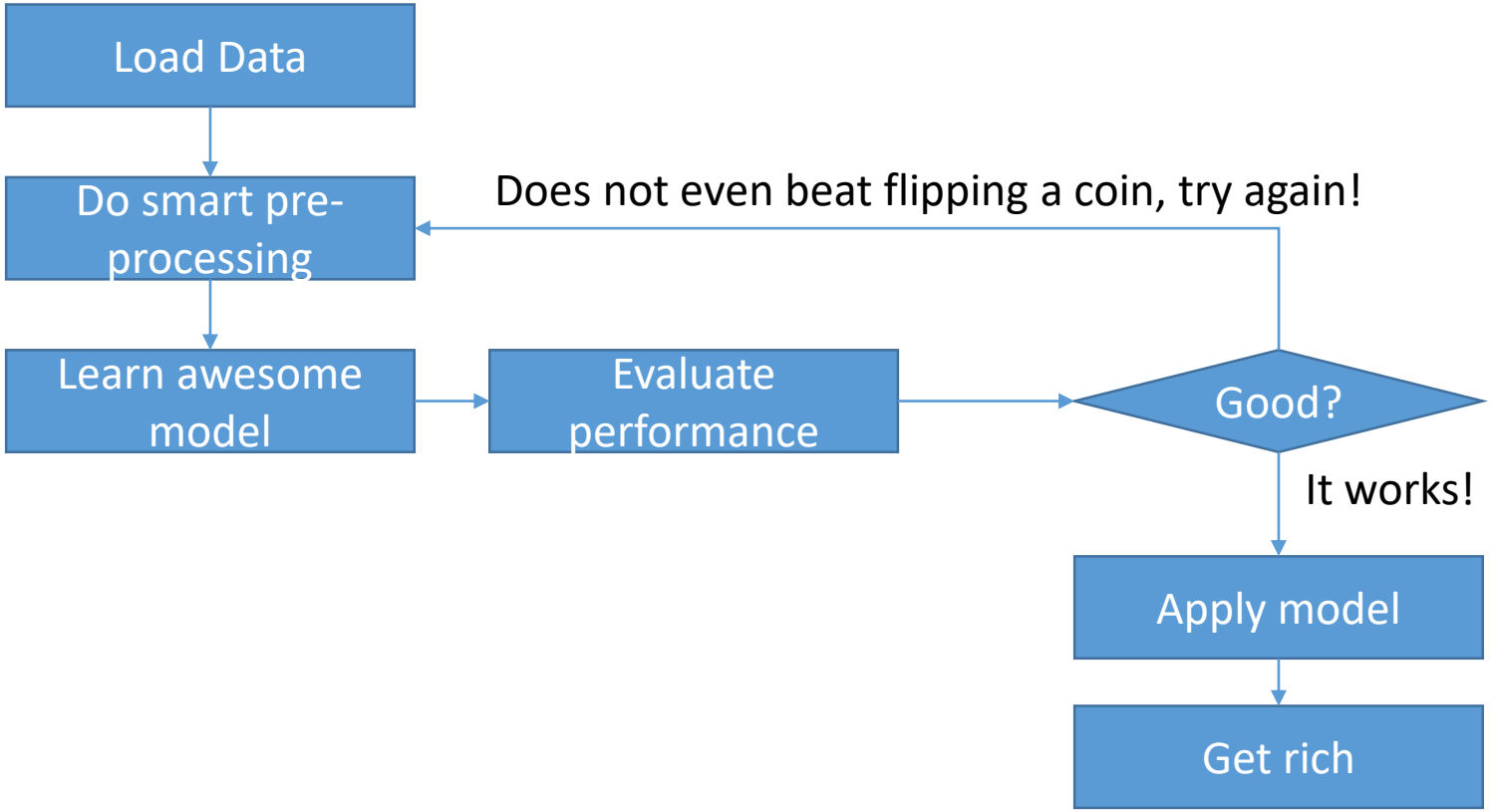


source: https://www.kdnuggets.com/2019/05/poll-top-data-science-machine-learning-platforms.html (accessed on 04.02.2020)

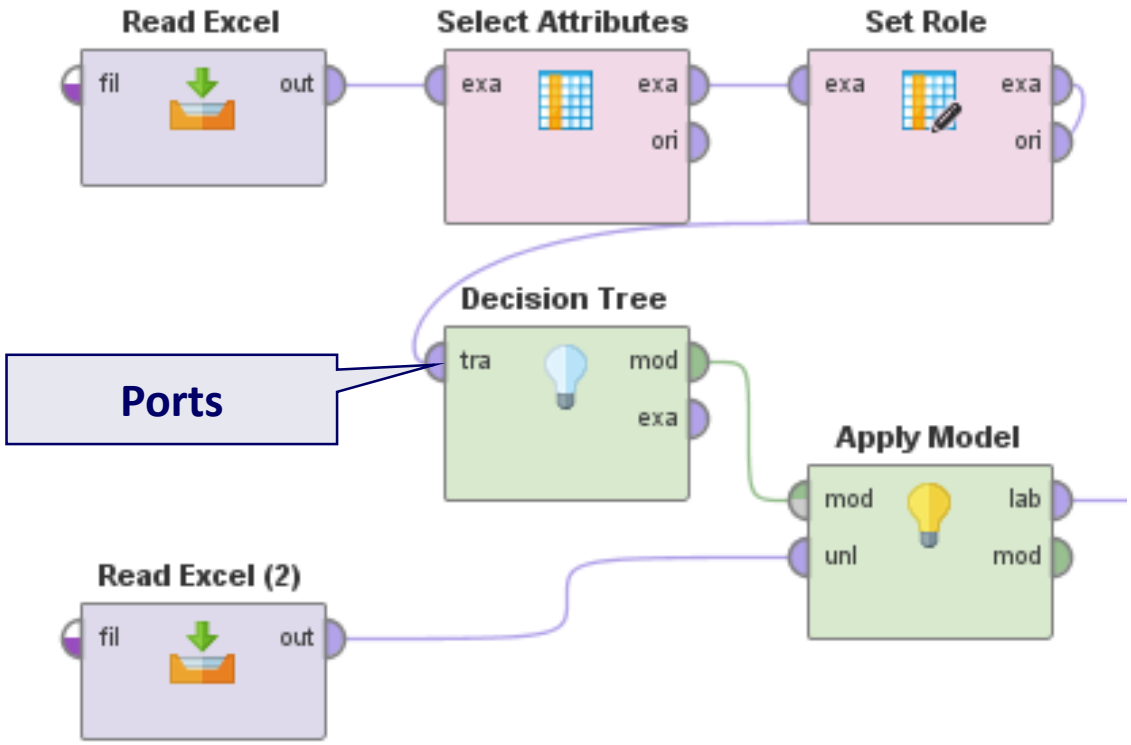
Let's have a look at RapidMiner

How does it work?

- You visually design a data mining process
- A process is like a flow chart for mining operators



Specifying a Process by Chaining Operators

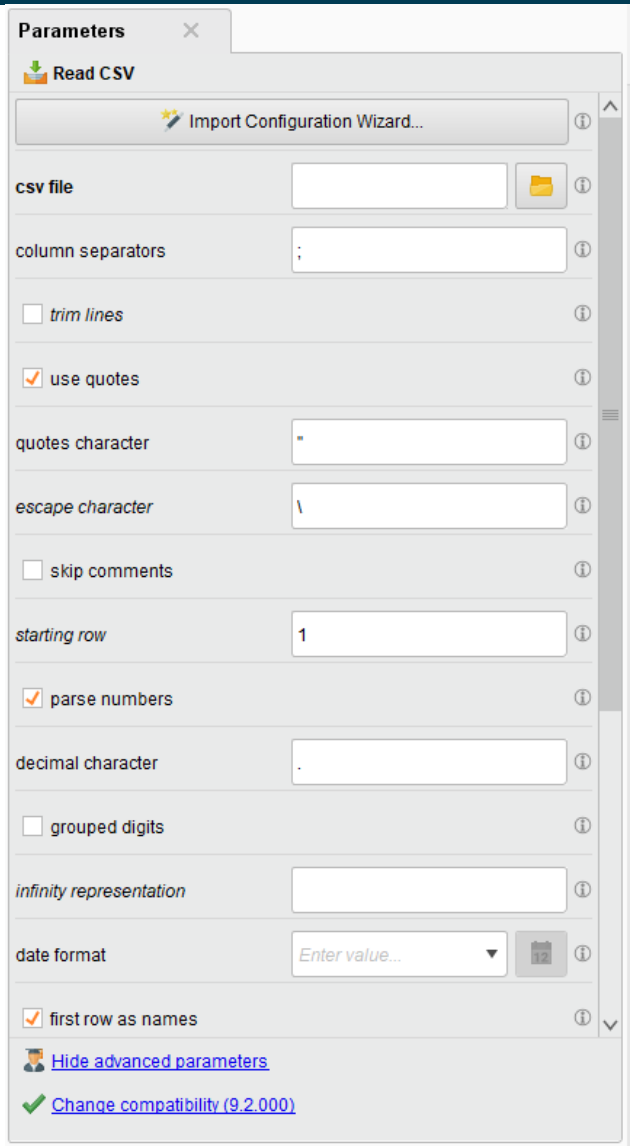


Common Port Names

Name	Meaning
out	Output
exa	Example Set
ori	Original Input
tra	Training Data
mod	Model
unl	Unlabelled Data
lab	Labelled Data
per	Performance

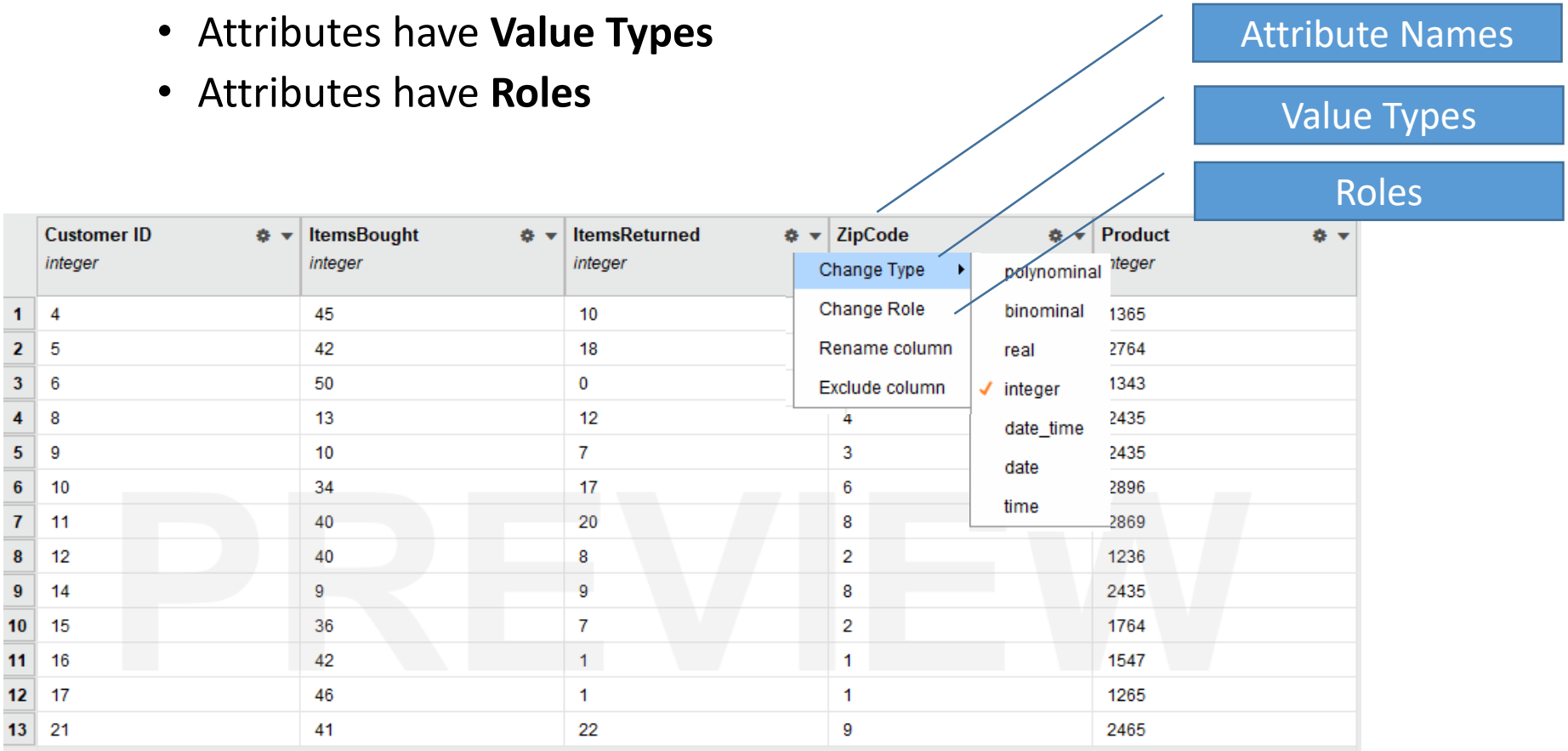
RapidMiner Operators: Loading Data

- Many operators to read data from files
- Output Port labelled “out”
  - Creates an **Example Set**
- An Example Set contains your data!
  - The records are called **Examples**



Data in RapidMiner

- All data that you load will be contained in an example set
- Each example is described by **Attributes** (a.k.a. features)
  - Attributes have **Value Types**
  - Attributes have **Roles**



Data in RapidMiner

- Value types define how data is treated
  - Numeric data has an order (2 is closer to 1 than to 5)
  - Nominal data has no order (red is as different from green as from blue)

Value Type	Description
binominal	Only two different values are permitted
polynominal	More than two different values are permitted
integer	Whole numbers, positive and negative
real	Real numbers, positive and negative
date_time	Date as well as time
date	Only date
time	Only time

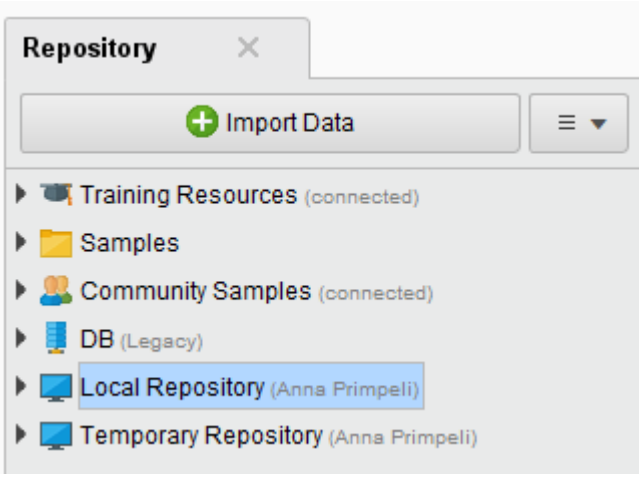
Data in RapidMiner

- Roles define how the attribute is treated by the Operators

Role	Description
Id	A unique identifier, no two examples in an example set can have the same value
Regular (default)	Regular attribute that contains data
Label	The target attribute for classification tasks
Weight	The weight of the Examples with regard to the label
Cluster	Created by RapidMiner as the result of a clustering task
Prediction	Created by RapidMiner as the result of a classification task

The Repository

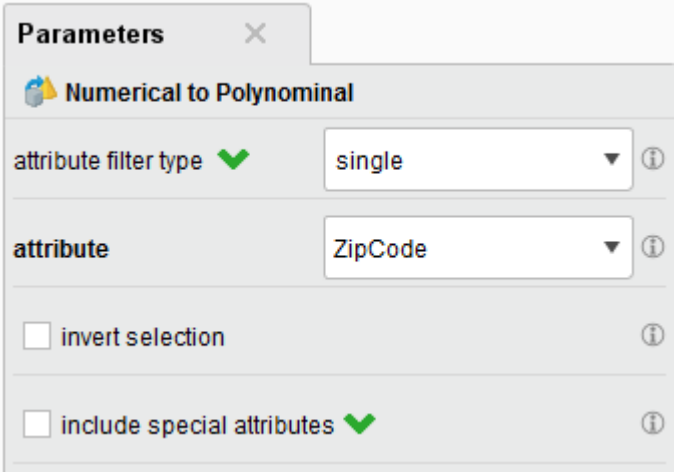
- This is where you store your data and processes
- Stores data and its meta data (!)
  - Only if you load data from the repository, RapidMiner can show you which attributes exist
- Add data via the “Import Data” button or the “Store” operator
- Load data via drag ‘n’ drop or the “Retrieve” operator

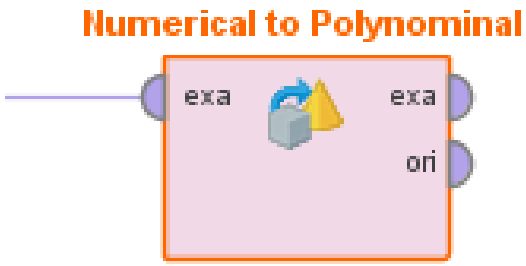


If your have a question starting with
“**Why does RapidMiner not show me …?**”
Then the answer most likely is
“**Because you did not load your data into the Repository!**”

RapidMiner Operators: Pre-Processing

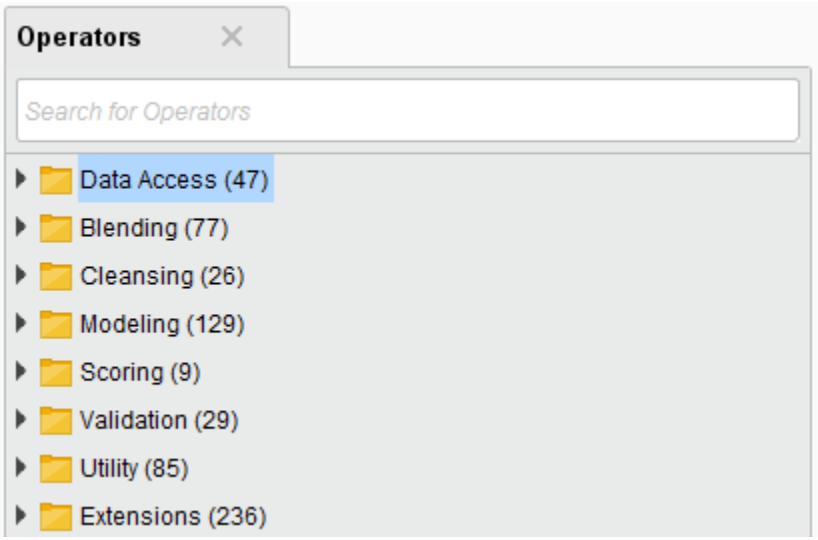
- Type and Role Conversions
  - “TypeA to TypeB”: Change the type
  - “Set Role”: Change the role
- Attribute Set Transformation
  - “Select Attributes”: Remove attributes
  - “Generate Attributes: Create new attributes
- Value Transformation
  - “Normalize”: transform all values to a certain range
- Filtering
  - “Filter examples”: Remove examples
- Aggregation
  - “Aggregate”: SQL-like aggregation (count, sum)





How to find Operators

- The Operators Panel lets you browse all available operators
- You can search for operators by typing in the search bar
- You add operators by double clicking or by dragging them onto the process view



Frequently Asked Questions – And their surprising answers …

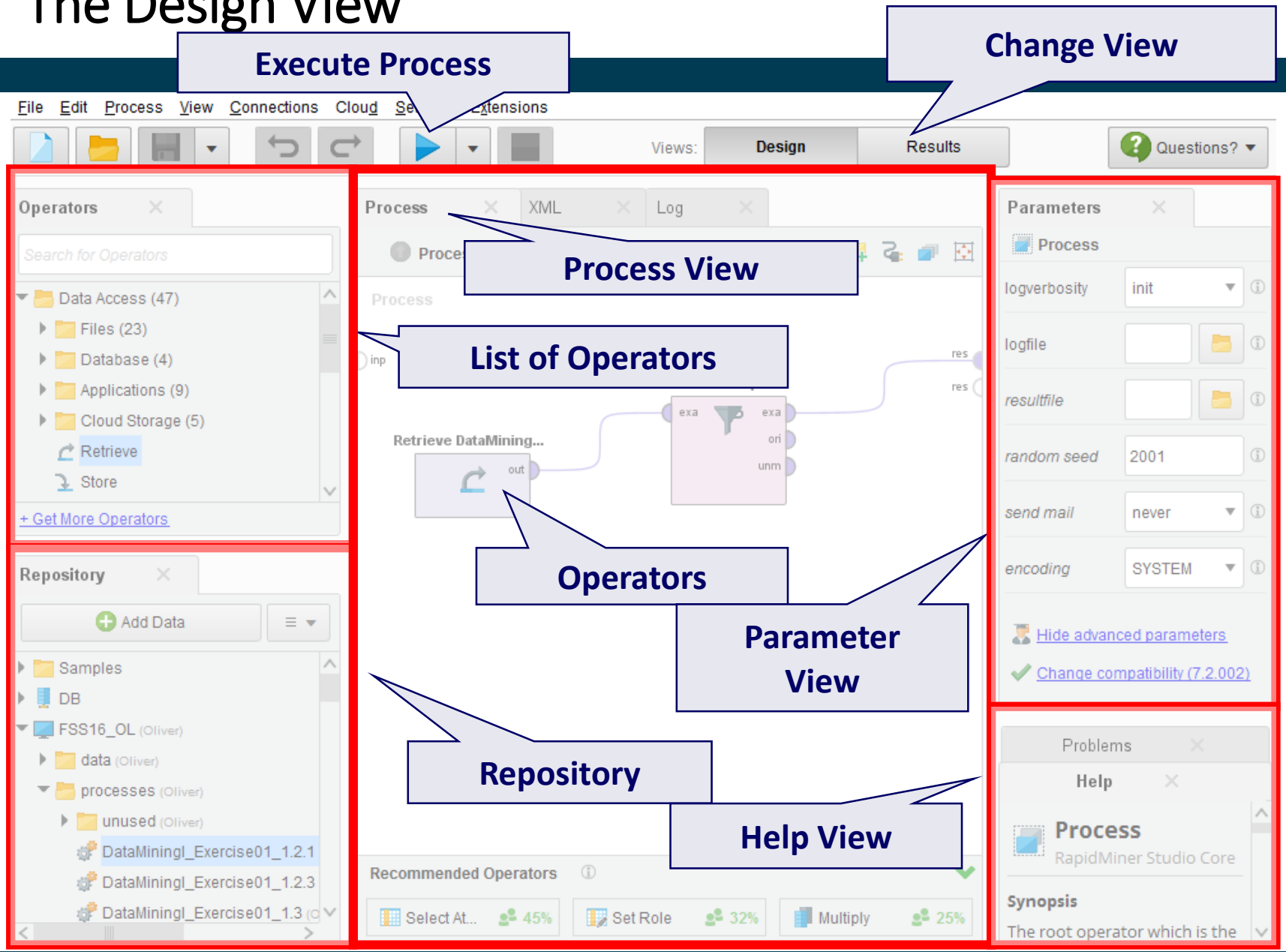
How can I …?	Type … into the search bar!
Select which Attributes to use?	Select Attributes
Filter out examples?	Filter Examples
Read a CSV file	Read CSV
Learn a decision tree	Decision Tree

How to use RapidMiner

- Use the “Design Perspective” to create your Process
  - See your current Process – “Process”
  - Access your data and processes – “Repository”
  - Add operators to the process – “Operators”
  - Configure the operators – “Parameters”
  - Learn about operators – “Help”

- Use the “Results Perspective” to inspect the output
  - The “Data View” shows your example set
  - The “Statistics View” contains meta data and statistics
  - The “Visualizations View” allows you to visualise the data

The Design View



The Results View - Data

Result History | ExampleSet (Read Excel)

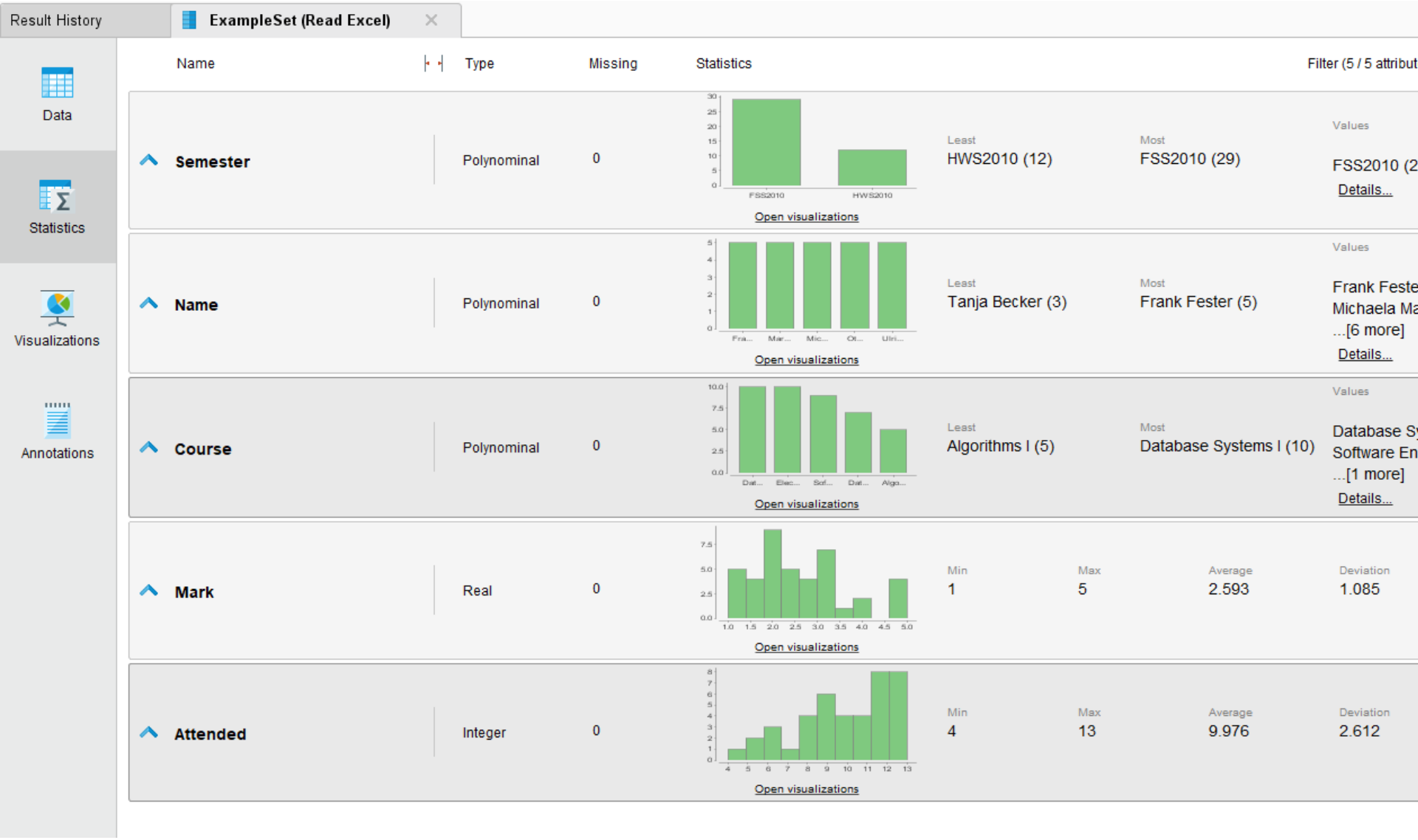
Data | Statistics | Visualizations | Annotations

Open in Turbo Prep | Auto Model | Filter (41 / 41 examples): all

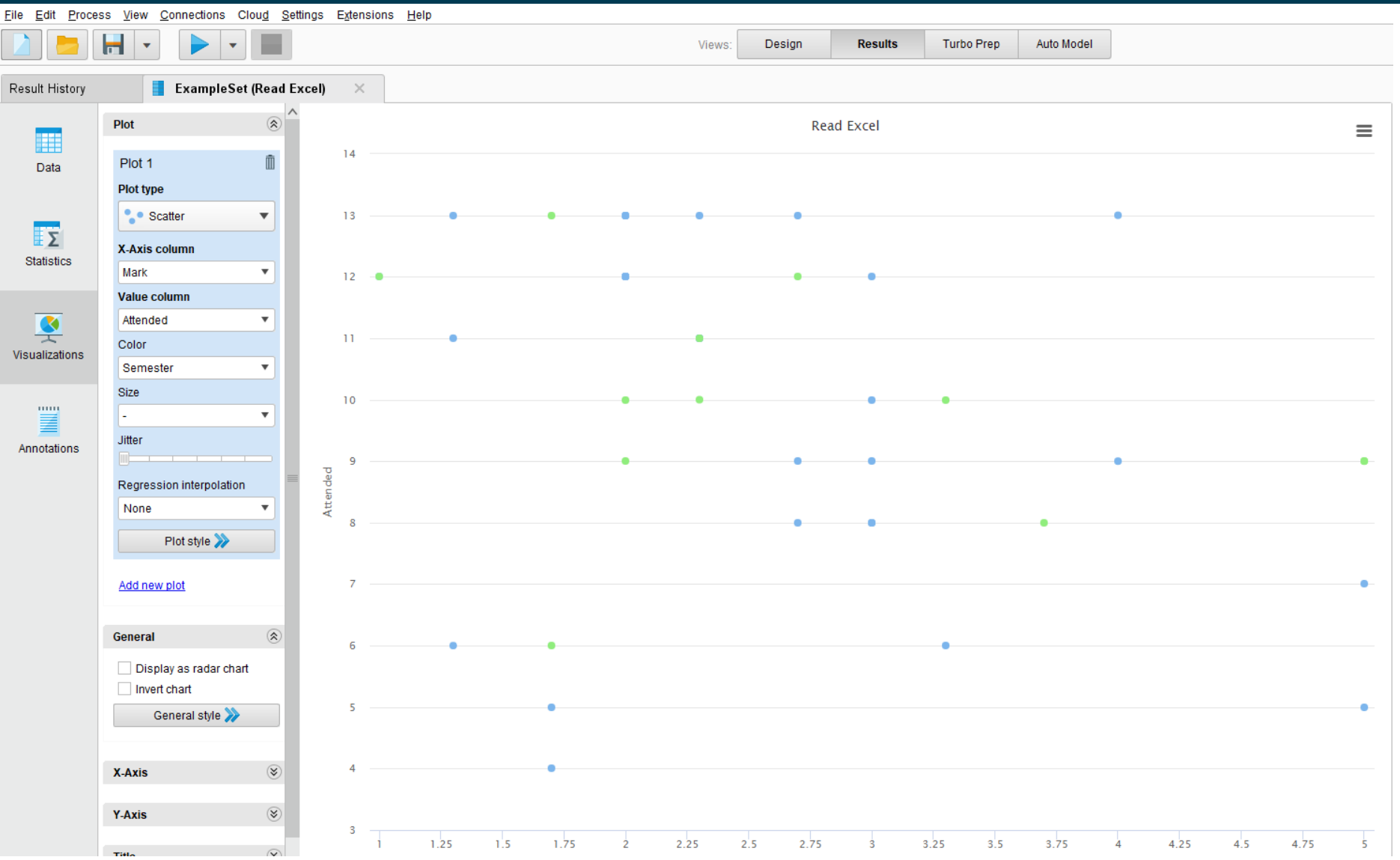
Row No.	Semester	Name	Course	Mark	Attended
1	FSS2010	Alex Krausche	Database Sy...	1.300	13
2	FSS2010	Tanja Becker	Database Sy...	2	12
3	FSS2010	Mariano Selina	Database Sy...	1.700	5
4	FSS2010	Otto Blacher	Database Sy...	2.300	13
5	FSS2010	Frank Fester	Database Sy...	2	13
6	FSS2010	Susanne Müll...	Database Sy...	3	12
7	FSS2010	Avid Morvita	Database Sy...	4	13
8	FSS2010	Steve Queck	Database Sy...	2.700	8
9	FSS2010	Michaela Mart...	Database Sy...	5	5
10	FSS2010	Ulrich Gester	Database Sy...	5	7
11	HWS2010	Alex Krausche	Database Sy...	1	12
12	HWS2010	Tanja Becker	Database Sy...	1.700	13
13	HWS2010	Mariano Selina	Database Sy...	2	10
14	HWS2010	Otto Blacher	Database Sy...	2.300	10
15	HWS2010	Frank Fester	Database Sy...	2	9
16	HWS2010	Michaela Mart...	Database Sy...	3.700	8

ExampleSet (41 examples, 0 special attributes, 5 regular attributes)

The Results View - Statistics



The Visualizations View - Charts



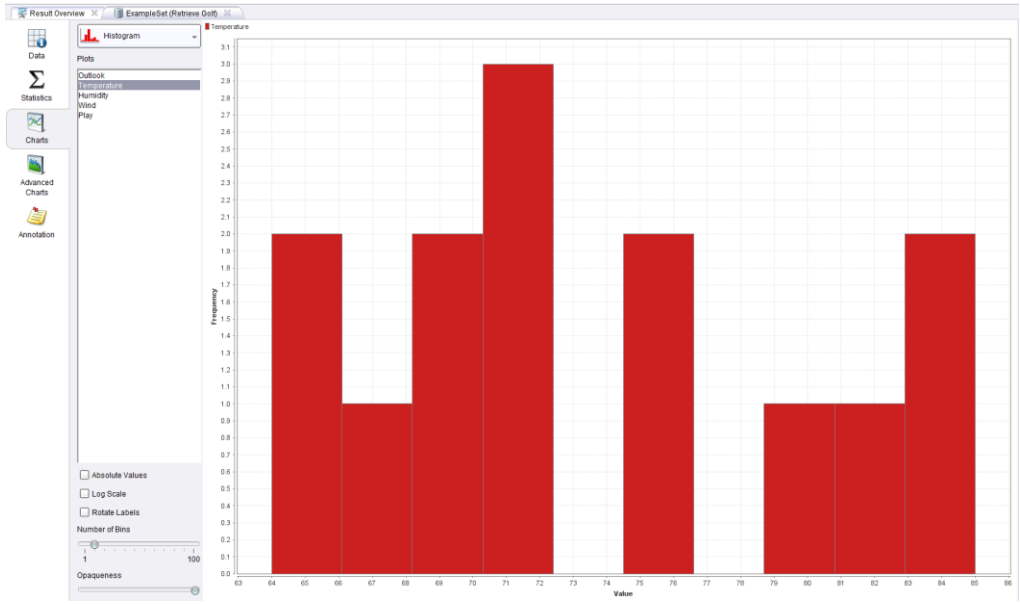
Data Visualisation

- Visualisation of data is one of the most powerful and appealing techniques for data exploration
  - Humans have a well developed ability to analyse large amounts of information that is presented visually
  - Can detect general patterns and trends
  - Can detect outliers and unusual patterns

Visualisation is the conversion of data into a visual format so that the characteristics of the data and the relationships among data items or attributes can be analysed.

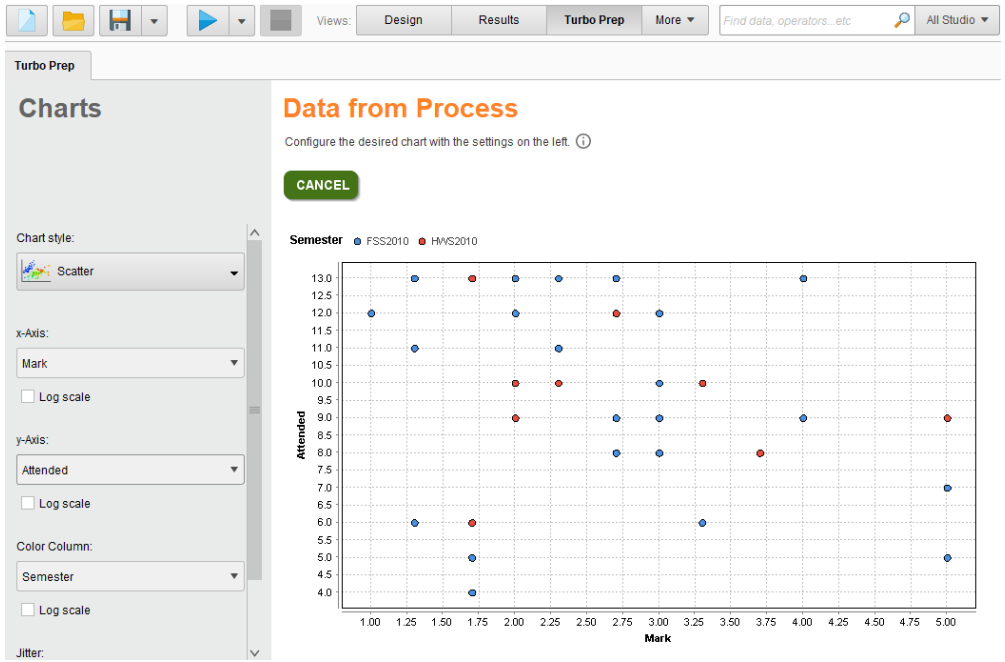
Visualisation Techniques: Histogram

- Usually used to display the distribution of values of a single attribute
  - Divide the values into bins and show a bar plot of the number of objects in each bin
  - The height of each bar indicates the number of objects per bin
  - Shape of histogram depends on the number of bins

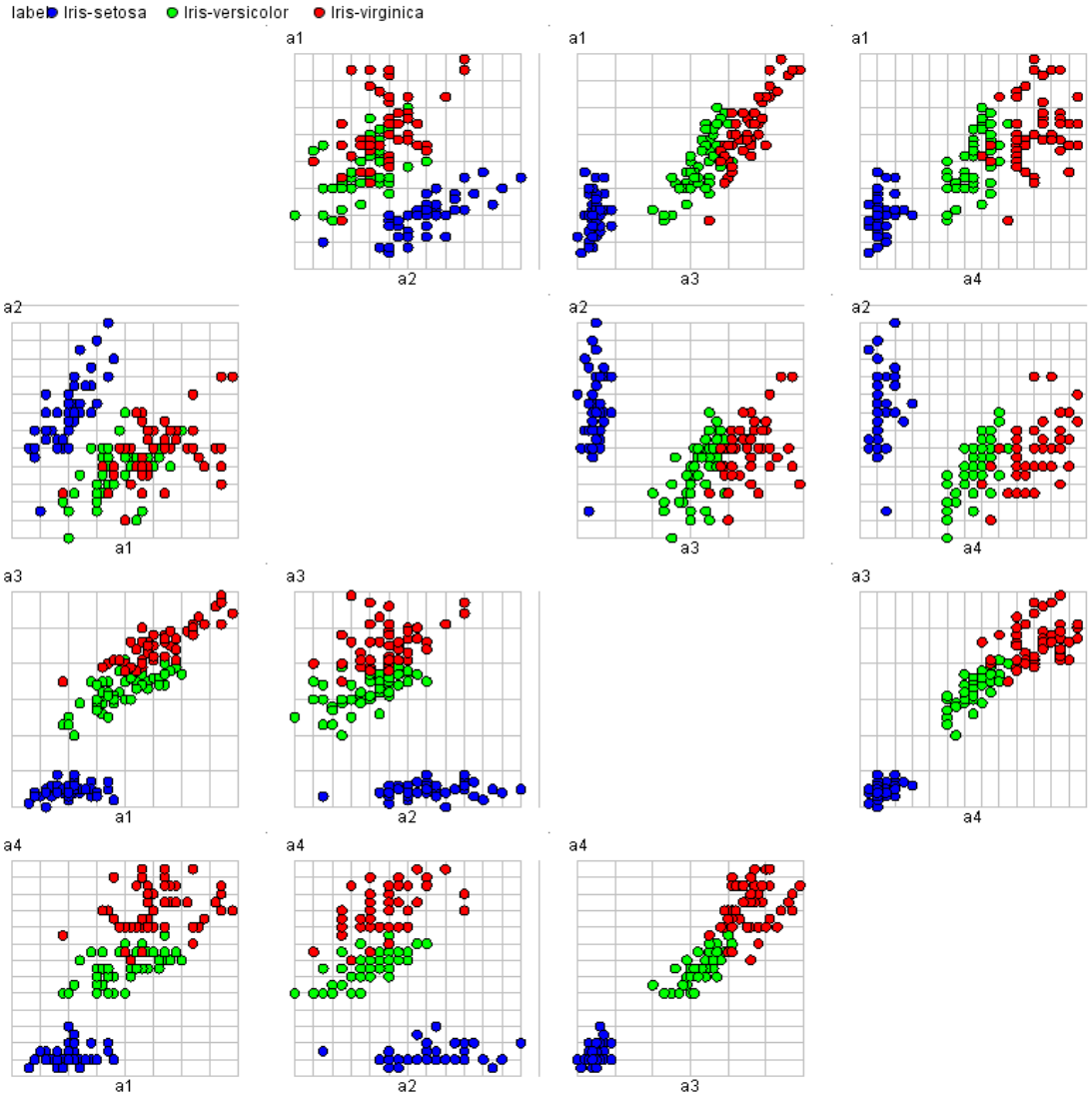


Visualisation Techniques: Scatter Charts

- Two-dimensional scatter charts are most commonly used
- Often additional attributes/dimensions are displayed by using the size, shape, and color of the markers that represent the objects
- It is useful to have arrays of scatter charts that can compactly summarise the relationships of several pairs of attributes
- RapidMiner Scatter Charts
  - Scatter (single chart)
  - Scatter Multiple
  - Scatter Matrix
  - Scatter 3D



RapidMiner Chart: Scatter Matrix



RapidMiner Resources

- RapidMiner Education License Program:
  - https://rapidminer.com/educational-program/
- Rapidminer User Manuals: http://rapidminer.com/documentation/
- Open Access Book covering RapidMiner
  - Matthew North: Data Mining For The Masses: https://docs.rapidminer.com/downloads/DataMiningForTheMasses.pdf
- Operator Documentation: https://docs.rapidminer.com/latest/studio/operators/
- RapidMiner Forum and Discussion Groups: https://community.rapidminer.com/
- Video Tutorials
  - by Rapid-I: https://www.youtube.com/user/RapidIVideos
  - by Neutral Market Trends: http://www.neuralmarkettrends.com/tutorials/
- MyExperiment: process repository: http://www.myexperiment.org/

Hands-on!

- Now start RapidMiner
- Load your first dataset
- Start exploring the data!

Examples for Data Profiling

- Students Data Set

Course	Taught in	# Students	Grade Range	Max. Attend
Algorithms I	HWS2010	5	1.7 – 5.0	12
Database Systems I	FSS2010	10	1.3 – 5.0	13
Database Systems II	HWS2010	7	1.0 – 5.0	13
Electronic Markets	FSS2010	10	1.0 – 3.0	13
Software Engineering	FSS2010	9	1.3 – 4.0	13

- Scatter Chart
  - Y-Axis: Course
  - X-Axis: try!