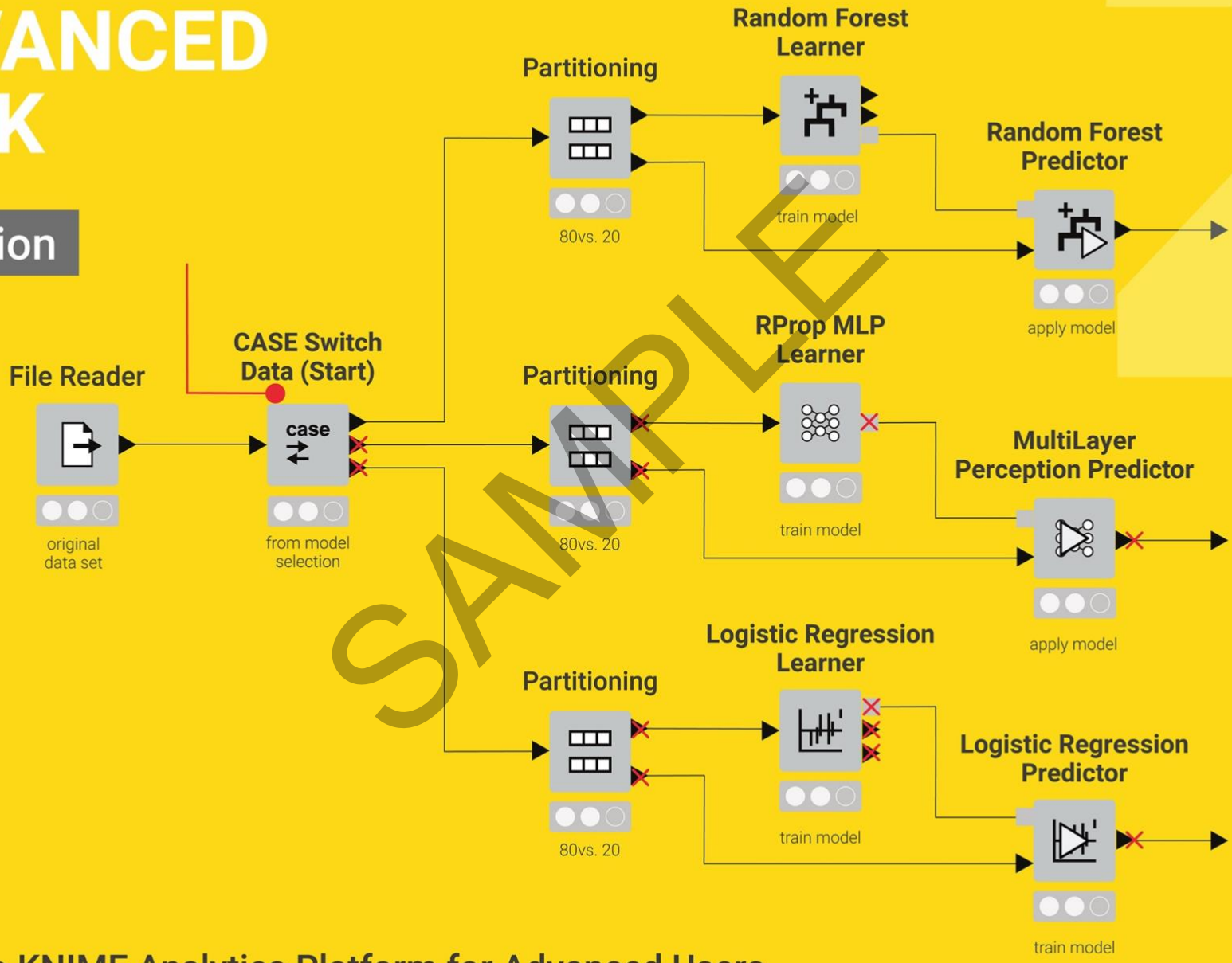
KNIME® ADVANCED LUCK

2nd Edition



A Guide to KNIME Analytics Platform for Advanced Users

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This book has been updated for **KNIME 4.5**.

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Chapter 1. Introduction

1.1. Purpose and Structure of this Book

KNIME Analytics Platform is a powerful tool for data analytics and data visualization. It provides a complete environment for data analysis which is fairly simple and intuitive to use. This, coupled with the fact that KNIME Analytics Platform is open source, has led a large number of professionals to use it. In addition, third-party software vendors develop KNIME extensions in order to integrate their tools into it. KNIME nodes are now available that reach beyond customer relationship management and business intelligence, extending into the field of finance, life sciences, biotechnology, pharmaceutical, and chemical industries. Thus, the archetypal KNIME user is no longer necessarily a data science expert, although his/her goal is still the same: to understand data and to extract useful information.

This book was written with the intention of building upon the reader's first experience with KNIME software. It expands on the topics that were covered in the first KNIME user guide ("KNIME Beginner´s Luck" [1]) and introduces more advanced functionalities. In the first guide [1], we described the basic principles of KNIME Analytics Platform and showed how to use it. We demonstrated how to build a basic workflow to manipulate, visualize, and model data, and how to build reports. Here, we complete these descriptions by introducing the reader to more advanced concepts. A summary of the chapters provides you with a short overview of the contents to follow.

Chapter 2 describes the nodes needed to connect to a database, import data, build an appropriate SQL query to select a subset of the data or for some required processing, and finally to write data back into the database. Accessing a database, importing data, and building SQL queries are the basic operations necessary for any, even very simple, data warehousing strategy.

Of course, the largest source of data is nowadays the Internet. Chapter 3 is dedicated to alternative ways of getting data besides files and databases, i.e. web data sources. Chapter 3 starts with the connectors to Google Sheets and continues with access to REST services. Those are definitely powerful tools to search for data elsewhere.

Chapter 4 introduces the Date&Time object and the nodes to turn a String column into a Date&Time column, to format it, to extract a time difference, and in general to perform date/time based operations. The Date&Time object provides the basis for working with time series. The last section of chapter 4 briefly describes a few nodes dedicated to time series analysis.

A very important concept for the KNIME workflows is the concept of "flow variables". Flow variables enable external parameters to be introduced into a workflow to control its execution. Chapter 5 describes what a flow variable is, how to create it, and how to edit it inside

the workflow, if needed. Capitalizing on the concept of flow variables, we introduce the components and explain how to make them configurable via Configuration nodes and Widget nodes.

Widget nodes especially can be helpful in the creation of dashboards, reports, and data apps. Chapter 6 shows how to build a rich dashboard through the composite view of an advanced component.

Most data operations in KNIME Analytics Platform are executed on a data matrix, named data table. This means that an operation is executed on all data rows. This is a big advantage in terms of speed and programming compactness. However, from time to time, a workflow also needs to run its rows, one after the other, through an operation. That is, sometimes it needs a real loop. Chapter 7 introduces a few nodes that implement loops: from a simple “for” cycle to more complex loops, such as looping on a list of values or feeding the current iteration results into the next iteration.

Chapter 8 illustrates the use of logical switches to change the workflow path upon compliance with some predefined condition.

In this introductory chapter, we list the data and the example workflows that have been built for this book and note the KNIME Extensions required to run some of the example workflows.

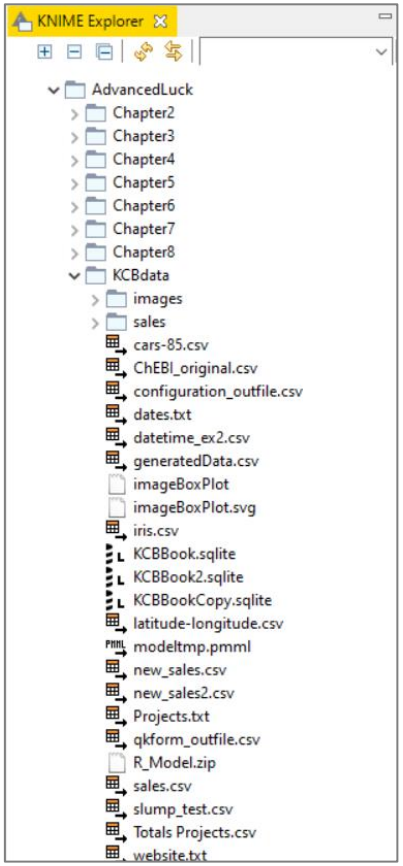
1.2. Data and Workflows for this Book

This book builds a few examples and provides solutions to the exercises. Solutions and exercises are contained in folder “AdvancedLuck” downloadable from the KNIME Hub space of one of the authors of this book. To download material from the KNIME Hub, you need to create a KNIME account, the same as for the KNIME Forum. After entering the KNIME Hub, in order to download the workflows, just click on the cloud icon.

- Download the whole folder “AdvancedLuck” onto your machine, which will result in a .knar file. Then:
- Double click it OR import it into the KNIME Explorer via Select File -> Import KNIME Workflow …

1.25. Workflows and data for this book on the KNIME Hub (hub.knime.com/rs1/spaces/Public/latest/KNIMEPress%2FKNIME_Advanced_Luck_4.5_2022011)

1.1. Workflows and data used in this book, as imported from the "AdvancedLuck" folder on the KNIME Hub



At the end of the import operation, in your "KNIME Explorer" panel you should find a folder named "AdvancedLuck" and containing Chapter2, Chapter3, Chapter4, etc … subfolders, each one with workflows and exercises to be implemented in the corresponding chapters of this book. In addition, under the main folder "Advanced Luck", you should find a KCBdata subfolder containing all necessary data.

The data used for the exercises and for the demonstrative workflows of this book were either generated by the authors or downloaded from the UCI Machine Learning Repository [2], a public data repository (http://archive.ics.uci.edu/ml/datasets). If the data set belongs to the UCI Repository, a full link is provided here to download it. Data generated by the author, that is not public data, are located only in the KCBdata folder.

Data sets from the UCI Machine Learning Repository [2]:

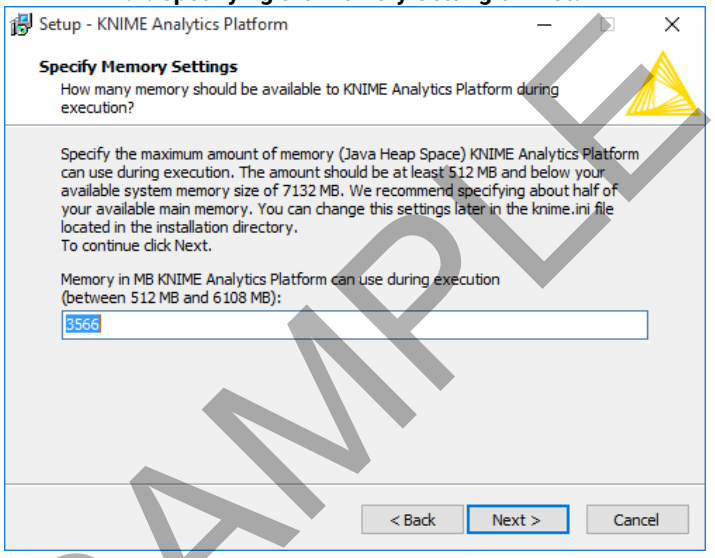
- Automobile: http://archive.ics.uci.edu/ml/datasets/Automobile
- Slump_test: http://archive.ics.uci.edu/ml/datasets/Concrete+Slump+Test

This book is not meant as an exhaustive reference for KNIME Analytics Platform, although many useful workflows and aspects of it are demonstrated through worked examples. This text is intended to give you the confidence to use the advanced functions in KNIME Analytics Platform to manage and analyze your own data.

1.3. Memory Usage in KNIME Analytics Platform

The maximum amount of memory to use is set at installation time, if you install it using the Windows Installer. However, in all other installation procedures, or if you want to change the set number of MB later, you will need to set yourself the maximum amount of memory available to KNIME Analytics Platform.

1.2. Specifying the Memory Setting on Install



The amount of memory available to KNIME Analytics Platform is stored in the knime.ini file. The knime.ini file is located in the directory in which KNIME Analytics Platform has been installed, together with the knime.exe file. The knime.ini file contains a number of required settings.

-Xmx<size> is the setting that defines the maximum heap size available to run workflows. You can define this value by editing the knime.ini file or at installation time. If you run into memory problems, you probably need to manually increase the heap space (-Xmx option) directly in the knime.ini file to a size compatible with the memory you have on your machine (like 4G for 4 Gigabytes).

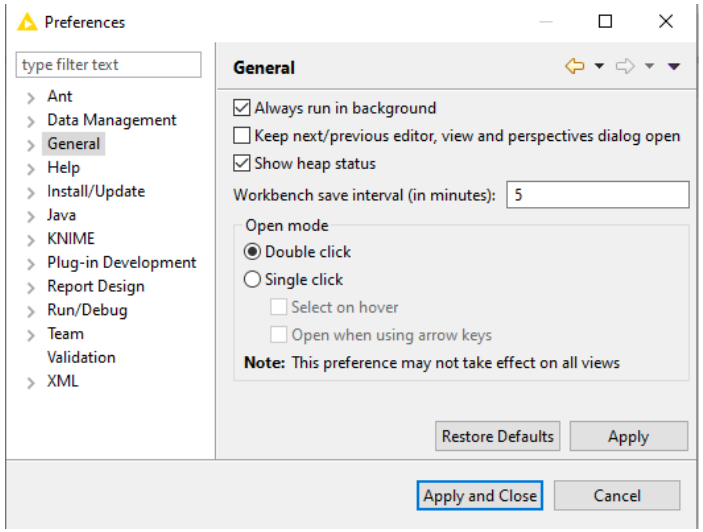
1.3. The "knime.ini" file

```
-startup
plugins/org.eclipse.equinox.launcher_1.3.100.v20150511-1540.jar
--launcher.library
plugins/org.eclipse.equinox.launcher.win32.win32.x86_64_1.1.300.v20150602-1417
-vmargs
-server
-Dsun.java2d.d3d=false
-Dosgi.classloader.lock=classname
-XX:+UnlockDiagnosticVMOptions
-XX:+UnsyncloadClass
-Dknime.enable.fastload=true
-XX:CompileCommand=exclude,javax/swing/text/GlyphView,getBreakSpot
-Xmx3566m
-Dorg.eclipse.swt.browser.IEVersion=10001
-Dsun.awt.noerasebackground=true
```

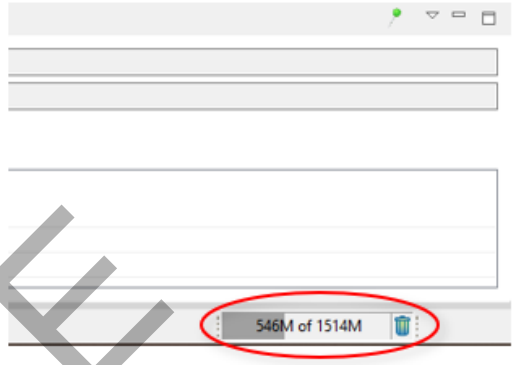
There is also an easy way to monitor how much heap space is being used by a workflow and if this reaches the maximum limit assigned by the –Xmx option. In the Top Menu in the KNIME workbench:

- Click “File”
- Select “Preferences”
- “Preferences” window opens
- In “Preferences” window
    - Select “General”
    - In the frame on the right named “General”, enable the option “Show heap status”
    - Click “OK”
    - Now, in the lower right corner you can see a small number showing the heap status.

1.4. The "Preferences" window with the "Show heap status" option



1.5. The bottom right corner shows the heap status



To run the example workflows and the exercises provided in this book, you will need to install the whole “KNIME & Extensions” group.

In order to install a KNIME Extension:

- In the top menu of the KNIME workbench, select “File” -> “Install KNIME Extensions …”
- In the “Install” window:
  - Open the group containing your extension, like for example “KNIME & Extensions” group
  - If you do not know where your extension package is located, just run a search by inserting a few related keywords in the top textbox
  - Select your extension
  - Click “Next” and follow installation instructions