EAI 320

Practical Assignment 5

6 April 2016

Compiled by Dr. Joel Dabrowski

Problem

In this assignment, you are required to implement and test a decision tree building algorithm. In particular, the Iterative Dichotomiser 3 (ID3) decision tree building algorithm is considered[1]. For more information on the ID3 algorithm, consider the following sources [1, 2, 3, 4]. Instructions for the practical are as follows:

- Implement the Iterative Dichotomiser 3 (ID3) decision tree building algorithm in Python. As usual, you must implement a generic algorithm. That is, your function should be able to handle any dataset presented to it in a particular format.

- Test your ID3 algorithm on the restaurant dataset presented in the prescribed book. This dataset is presented in Figure 18.3 and is reproduced as follows:

Example	Input Attributes										Goal
	Alt	*Bar*	*Fri*	*Hun*	*Pat*	*Price*	*Rain*	*Res*	*Type*	*Est*	*WillWait*
x_1	Yes	No	No	Yes	Some	\$\$\$	No	Yes	French	0–10	$y_1 = Yes$
x_2	Yes	No	No	Yes	Full	\$	No	No	Thai	30–60	$y_2 = No$
x_3	No	Yes	No	No	Some	\$	No	No	Burger	0–10	$y_3 = Yes$
x_4	Yes	No	Yes	Yes	Full	\$	Yes	No	Thai	10–30	$y_4 = Yes$
x_5	Yes	No	Yes	No	Full	\$\$\$	No	Yes	French	>60	$y_5 = No$
x_6	No	Yes	No	Yes	Some	\$\$	Yes	Yes	Italian	0–10	$y_6 = Yes$
x_7	No	Yes	No	No	None	\$	Yes	No	Burger	0–10	$y_7 = No$
x_8	No	No	No	Yes	Some	\$\$	Yes	Yes	Thai	0–10	$y_8 = Yes$
x_9	No	Yes	Yes	No	Full	\$	Yes	No	Burger	>60	$y_9 = No$
x_{10}	Yes	Yes	Yes	Yes	Full	\$\$\$	No	Yes	Italian	10–30	$y_{10} = No$
x_{11}	No	No	No	No	None	\$	No	No	Thai	0–10	$y_{11} = No$
x_{12}	Yes	Yes	Yes	Yes	Full	\$	No	No	Burger	30–60	$y_{12} = Yes$

Figure 18.3　　Examples for the restaurant domain.

- Use the decision generated by the ID3 algorithm to make decisions on the following sample two examples. Show the decision path that is followed through the tree.

$X_1 = \{Alt = Yes, Bar = No, Fri = Yes, Hun = Yes, Pat = Full, Price = \$\$, Rain = Yes, Res = NoType = Thai, Est = 10 - 30\}$

$X_2 = \{Alt = No, Bar = No, Fri = Yes, Hun = Yes, Pat = Full, Price = \$\$, Rain = Yes, Res = NoType = Thai, Est = 30 - 60\}.$

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[1]The decision tree learning algorithm in the prescribed book is a variation of the ID3 algorithm

Deliverables

- Write a technical report on your finding for this assignment.

- Include your code in the digital submission as an appendix, but leave it out for the hardcopy submission.

Instructions

- All reports must be in PDF format and be named report.pdf.

- Place the software in a folder called SOFTWARE and the report in a folder called REPORT.

- Add the folders to a zip-archive and name it EAI320_prac1_studnr.zip.

- All reports and simulation software must be e-mailed to *EAI320.UP@gmail.com* no later than 16:00 on 13 April 2016. No late submissions will be accepted.

- Place a hard copy of your report in the box in front of Eng 3 7-25 before the deadline.

- Submit your report online on ClickUP using the TurnItIn link.

Additional Instructions

- Do not copy! The copier and the copyee (of software and/or documentation) will receive zero for both the software and the documentation. Z-e-r-o.

- For any questions of appointments email me at *EAI320.UP@gmail.com*

- Make sure that you discuss the results that are obtained. This is a large part of writing a technical report.

Marking

Your report will be marked as follow:

- 60% will be awarded for the full implementation of the practical and the subsequent results in the report. For partially completed practicals, marks will be awarded as seen fit by the marker.

- 40% will be awarded for the overall report. This includes everything from the report structure, grammar and discussion of results. The discussion will be the bulk of the marks awarded.

1. REFERENCES

[1] T. Mitchell, *Machine Learning*, ser. McGraw-Hill international editions - computer science series. McGraw-Hill Education, 1997, ch. 3. [Online]. Available: http://www.cs.princeton.edu/courses/archive/spr07/cos424/papers/mitchell-dectrees.pdf

[2] J. R. Quinlan, "Induction of decision trees," *Machine learning*, vol. 1, no. 1, pp. 81–106, 1986. [Online]. Available: https://wwwold.cs.umd.edu/class/fall2009/cmsc828r/PAPERS/fulltext_Quilan_Ashwin_Kumar.pdf

[3] J. W. Grzymala-Busse, "Selected algorithms of machine learning from examples," *Fundam. Inform.*, vol. 18, pp. 193–207, 1993. [Online]. Available: http://people.eecs.ku.edu/~jerzy/j24-sel.pdf

[4] Wikipedia, "Id3 algorithm," https://en.wikipedia.org/wiki/ID3_algorithm, accessed: 2016-04-04.