# Identifying the learning patterns of the students in Learning Management Systems A. Suthakaran, E. Y. A. Charles Department of computer Science, University of Jaffna,



#### Introduction

The use of technology for teaching and learning in higher education has grown exponentially in the past decade, particularly the use of web-based systems. Learning Management Systems (LMS) are web-based systems allowing instructors and/or students to share materials and interact online. A recent report [1] showed that over 90 % of all responding universities and colleges have established one or more Learning Management Systems (LMS) to allow instructors and students to share instructional materials, make class announcements, submit and return course assignments, and communicate with each other online.

LMSs have tools for producing reports of the student activities. These reports mainly consists of descriptive statistical details such as total or average usage or access. These are not much helpful for the teacher to identify the learning patterns of the students. They are useful only for administrative purposes of each platform. Moreover, the existing e-learning platforms do not offer concrete tools for the assessment of user actions and contents of the educational materials. This research work attempted to analyse LMS log file and tried to identify group of students with similar learning patterns and to find out is there are any correlation between these groups with the final scores.

### Objectives

The aim of this research work is to identify ways to convert log entries into meaningful data such that it can be analyzed using standard data mining techniques. In addition this work concentrated on to identify groups of students having similar learning behaviors or activities and to find the reasons for their learning patterns. Further analysis will be carried out to identify whether any correlation between the group of students with similar learning patterns and their final grade exists.

# Methodology

Our approach involves ...

Collect data.

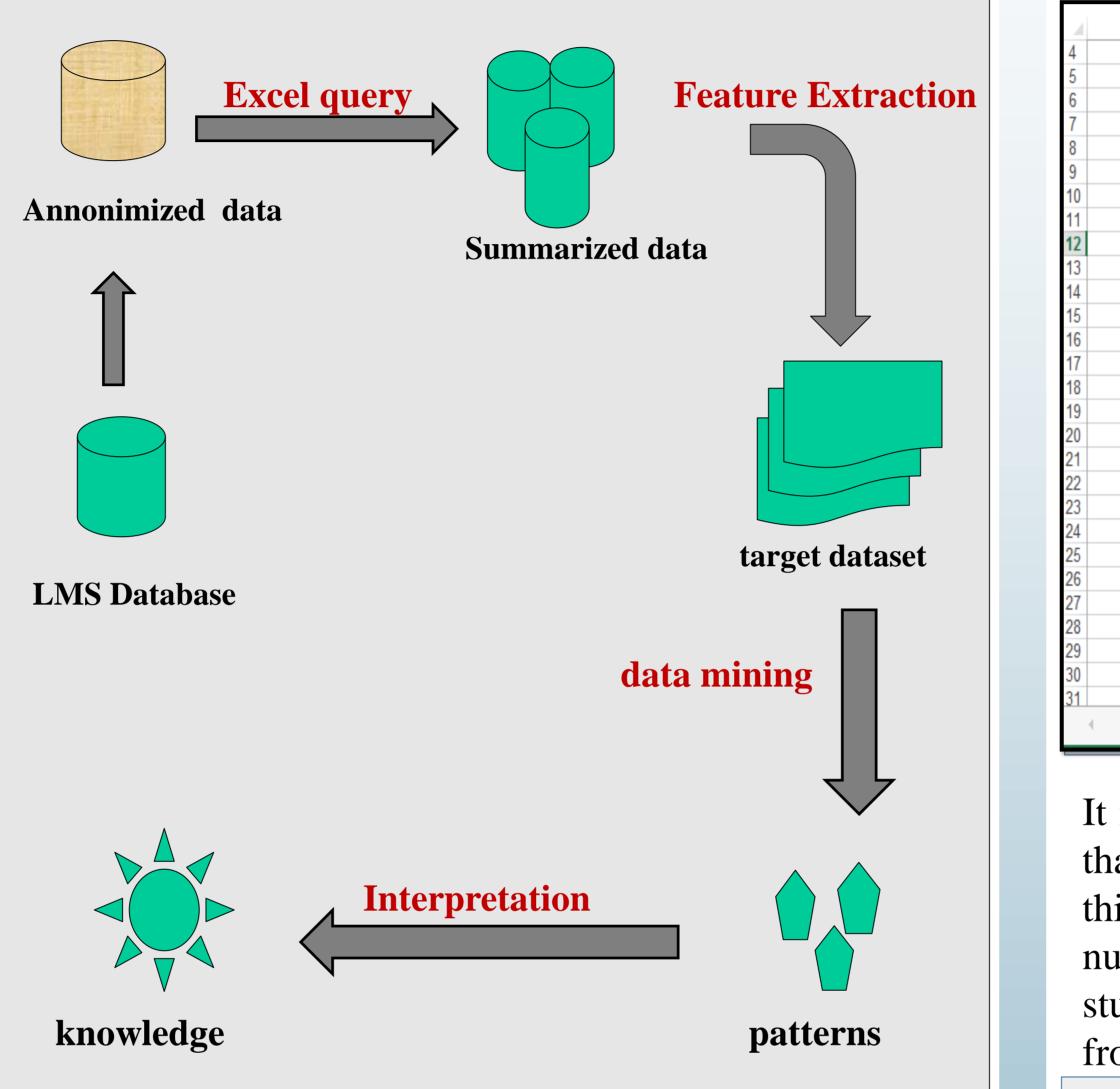
■ Transform the log file into a usable form – The technique used here is to find the frequency of access to a particular material or activity on a monthly basis rather than a complete summary.

•Applying data mining techniques and interpret the results.

#### Dalasel

For this research work, the log entries of a computer science course unit (Database Management Systems) followed by 64 second year students at University of Jaffna was selected. Moodle records for each and every activity of the students accessed these resources were collected.

suthakaranniro@gmail.com.



A total of 27228 log entries were collected and analysed. Similar as in other places where logs are maintained, a single log entry might not have much information if considered alone. Hence the log entries are transformed into a form in which standard data mining and machine learning techniques can be applied.

#### Challenges

Collecting the LMS log file from an active course unit that consists more LMS activities.

The way to transform the log file into a usable form.

Choosing the appropriate data mining techniques to identify clusters from the converted data.

#### Results

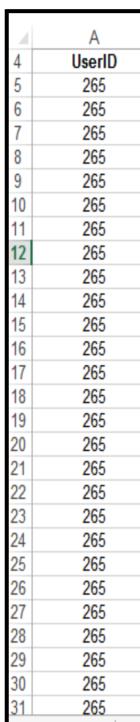
Moodle log file maintains the following details: User id: Name of the LMS user.

Time: Which date and time the user accessed the system.

**IP address:** IP address for the user's computer.

Actions with information: Actions or activities of student and the URL of corresponding task or resource.

A sample of log entries are shown in the following figure:



It is necessary to transform the log entries into a format such that data mining methods for clustering can be applied. For this purpose each distinct activities were identified and the number of times this activity was performed by a particular student in each month is counted[7]. The output obtained from this transformation is shown listed below:

A4	• (0	$X \checkmark f_x$	userld													
Α	В	С	D	Е	F	G	Н		J	К	L	М	N	0	Р	Q
			course view						Resource vi	ew					Assign view	
	21/04/2014	19/05/2014	16/06/2014	14/07/2014	11/08/2014	08/09/2014	21/04/2014	19/05/2014	16/06/2014	14/07/2014	11/08/2014	08/09/2014	21/04/2014	19/05/2014	16/06/2014	14/07/201
	19/05/2014	16/06/2014	14/07/2014	11/08/2014	08/09/2014	06/10/2014	19/05/2014	16/06/2014	14/07/2014	11/08/2014	08/09/2014	06/10/2014	19/05/2014	16/06/2014	14/07/2014	11/08/201
erld																
	month1	month2				month6					month5	month6	month1	month2	month3	month4
265	18	30		8		0	12	11	15	2	0	0	1	9	11	
266	14	13	-	8	3	0	5	7	3	3	0	0	0	2	1	1
267	24	31		0	3	22	9	17		0	0	20	2	5	4	
268	27	22		10		0	9	10	-	6	3	0	3	6	11	
270	12			14	10	0	3	15	_	3	2	0	2	20	-	
271	21	17		6	6	0	11	8	12	0	0	0	3	10	11	
272	18	16			5	0	5	4	1	0	1	0	0	11	4	
273	42	59			33	0	6	20	-	0	2	0	4	23		
275	37	69				0	29	42	28	10	0	0	4	20	21	
276	-	10		14		1	0	1	3	6	0	0	0	4	0	
277	27	30				8	9	3	8	24	5	3	0	10	16	
278	25	35		1	19	0	11	13	0	0	0	0	8	1	2	
279	29	36		8	1	2	5	8	8	0	0	0	2	14	1	
280	16	15		5	43	0	1	1	10	0	28	0	2	4	2	
281	9	7	14	4	3	0	6	0		0	0	0	0	6	5	
282	44	43		25		0	14	7	13	1	21	0	6			
283	35	23				4	15	8	3	1	0	0	3		17	
284	16	15			7	0	3	1	4	0	0	0	1	14		
285	4	4	19		3	0	1	1	4	0	0	0	0	1	13	
286	15	11				0	3	16		4	1	0	3	2	15	
287	9	17				0	2	6		0	2	0	0		8	
288	43	46	39	18	17	6	14		9	3	0	0	4	26	26	1
N suma	ny / week	y_action_tot	al / cours	e_view / R	esource_view	Anonimi	sed Full_(	data 🖉	/							

In addition to this the marks for the assignments and quizzes and the overall grade for the selected course unit is also included in the dataset. The data set obtained with the above transformations were clustered with k-mean using Weka and Matlab to find cluster of students with similar learning patterns. Following figure shows the output on identifying clusters using Matlab:

	В	С	D	E	F
	Time	IP address	Action	Information	
	10-18-14 7:01	61.245.163.18	course view	http://lms.jfn.ac.lk/course/view.php	id=121
	8-31-14 10:28	101.2.182.13	course view	http://lms.jfn.ac.lk/course/view.php	id=121
	8-31-14 10:28	101.2.182.13	assign view	http://lms.jfn.ac.lk/mod/assign/view.php	id=2114
	8-31-14 10:27	101.2.182.13	course view	http://lms.jfn.ac.lk/course/view.php	id=121
	8-31-14 10:09	101.2.182.13	course view	http://lms.jfn.ac.lk/course/view.php	id=121
	8-30-14 2:53	10.20.10.6	quiz review	http://lms.jfn.ac.lk/mod/quiz/review.php	attempt=1467
	8-30-14 2:53	10.20.10.6	quiz review	http://lms.jfn.ac.lk/mod/quiz/review.php	attempt=1467
	8-30-14 2:53	10.20.10.6	quiz close attempt	http://lms.jfn.ac.lk/mod/quiz/review.php	attempt=1467
	8-30-14 2:52	10.20.10.6	quiz view summary	http://lms.jfn.ac.lk/mod/quiz/summary.php	attempt=1467
	8-30-14 2:52	10.20.10.6	quiz continue attempt	http://lms.jfn.ac.lk/mod/quiz/review.php	attempt=1467
	8-30-14 2:52	10.20.10.6	quiz continue attempt	http://lms.jfn.ac.lk/mod/quiz/review.php	attempt=1467
	8-30-14 2:52	10.20.10.6	quiz continue attempt	http://lms.jfn.ac.lk/mod/quiz/review.php	attempt=1467
	8-30-14 2:52	10.20.10.6	quiz continue attempt	http://lms.jfn.ac.lk/mod/quiz/review.php	attempt=1467
	8-30-14 2:51	10.20.10.6	quiz continue attempt	http://lms.jfn.ac.lk/mod/quiz/review.php	attempt=1467
	8-30-14 2:51	10.20.10.6	quiz continue attempt	http://lms.jfn.ac.lk/mod/quiz/review.php	attempt=1467
	8-30-14 2:51	10.20.10.6	quiz continue attempt	http://lms.jfn.ac.lk/mod/quiz/review.php	attempt=1467
	8-30-14 2:51	10.20.10.6	quiz continue attempt	http://lms.jfn.ac.lk/mod/quiz/review.php	attempt=1467
	8-30-14 2:50	10.20.10.6	quiz continue attempt	http://lms.jfn.ac.lk/mod/quiz/review.php	attempt=1467
	8-30-14 2:50	10.20.10.6	quiz continue attempt	http://lms.jfn.ac.lk/mod/quiz/review.php	attempt=1467
	8-30-14 2:50	10.20.10.6	quiz continue attempt	http://lms.jfn.ac.lk/mod/quiz/review.php	attempt=1467
	8-30-14 2:50	10.20.10.6	quiz continue attempt	http://lms.jfn.ac.lk/mod/quiz/review.php	attempt=1467
	8-30-14 2:49	10.20.10.6	quiz continue attempt	http://lms.jfn.ac.lk/mod/quiz/review.php	attempt=1467
	8-30-14 2:49	10.20.10.6	quiz continue attempt	http://lms.jfn.ac.lk/mod/quiz/review.php	attempt=1467
	8-30-14 2:48	10.20.10.6	quiz continue attempt	http://lms.jfn.ac.lk/mod/quiz/review.php	attempt=1467
	8-30-14 2:48	10.20.10.6	quiz continue attempt	http://lms.jfn.ac.lk/mod/quiz/review.php	attempt=1467
	8-30-14 2:48	10.20.10.6	quiz continue attempt	http://lms.jfn.ac.lk/mod/quiz/review.php	attempt=1467
	8-30-14 2:46	10.20.10.6	quiz continue attempt	http://lms.ifn.ac.lk/mod/guiz/review.php	attempt=1467
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1x1 clustering.evalu	the second se
	ation.Gaptvaluatio
Property A	Value
abe Distance	'sqEuclidean'
B	100
🔤 ReferenceDistribut	'PCA'
🗄 LogW	[13.8690,13.6463,
ExpectedLogW	[14.6812,14.5106,
+ StdLogW	[0.0442,0.0432,0.0
E SE	[0.0444,0.0434,0.0
🔤 SearchMethod	'GlobalMaxSE'
🕂 OptimalY	57x1 double
X	57x64 double
InspectedK	[2,3,4,5,6,7,8,9,10
CriterionValues	[0.8122,0.8643,0.8
abc CriterionName	'Gap'
🕂 OptimalK	9
20c ClusteringFunction	'kmeans'

The "gap statistics criterion" [5, 6] is used to find the optimum number of clusters. The analysis identified four clusters of students. Further analysis is need to interpret the clusters.

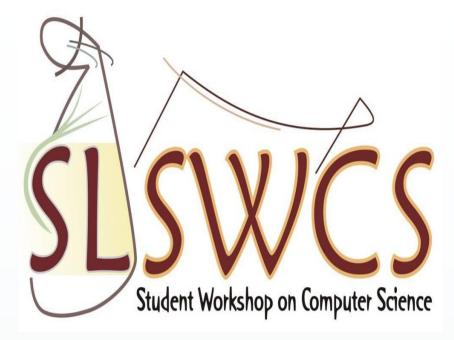
## Discussion & Conclusion

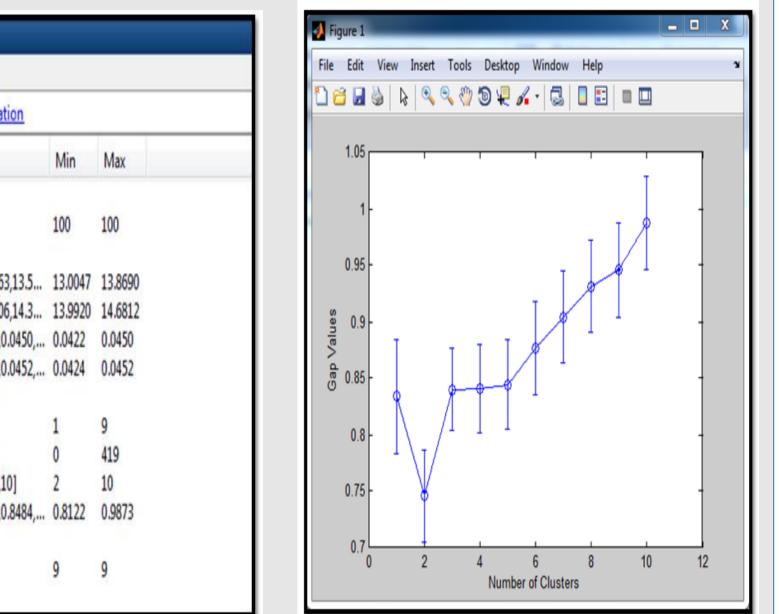
This work proposes a way to transform log records into a form which can be analysed using standard data mining techniques. Kmeans method with gap statistics identified four clusters. This can be viewed as a validation for the proposed transformation. Further analysis have to be carried out to identify whether any correlation between the group of students with similar learning patterns and their final grade exists.

## Reference

- [2]. 154167., 2012. Patterns., 2013. Spaces.







Romero, C., Ventura, S., Garca, E. (2008a)., Data mining in course management systems: Moodle case study and tutorial. Computers Education, 51(1) 368-384.

Valsamidis, S., Kontogiannis, S., Kazanidis, I., Theodosiou, T., Karakos, A. A Clustering Methodology of Web Log Data for Learning Management Systems. Educational Technology Society, 15 (2),

Thomas Haig, Katrina Falkner, Nickolas Falkner, Visualisation of Learn-ing Management System Usage for Detecting Student Behaviour

Luis Talavera and Elena Gaudioso, Mining Student Data To Characterize Similar Behavior Groups In Unstructured Collaboration

Robert Tibshirani, Guenther Walther and Trevor Hastie, Estimating the number of clusters in a data set via the gap statistic, Journal of the Royal Statistical Society: Series B (Statistical Methodology) Volume 63, Issue 2, pages 411–423, 2001

http://in.mathworks.com/help/stats/evalclusters.html#bt0\_87h-1, 2013.

https://www.ablebits.com/office-addins-blog/2014/07/02/ excel-countif-examples/, 2013.