



Analysis of Latvian higher educational institutions' rating data using clustering

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Introduction

Rating data of Latvian higher educational institutions are published starting from year 2008.

In general cases the rating is made up of indicator values chosen in a definite way that can be multiplied by a significance measure – weight. The obtained numbers are summed and the resulting value defines the position in the rating table.



Introduction (cont.)

In the research an attempt has been made to group state founded higher educational institutions with the help of k-means clustering algorithm and to make sure whether such distribution corresponds to the mathematically calculated position of the institution in the rating table.



Research goal

The following goal has been set – to perform the analysis of Latvian state founded higher educational institutions' rating data for year 2012.

Research tasks are subordinated to the goal set:

- to describe the changes in the number of clusters with respect to the data under analysis
- to evaluate the reliability of clustering results.



Most popular rating systems

International ratings of higher educational institutions are becoming more popular.

Different methodologies exist with respect to determining the rating of higher educational institutions.





Academic *Ranking* of *World Universities*











ARWU is the first *world university ranking*. It ranks the *world's* top 1000 colleges and *universities* based on more than 30 indicators about students, faculty and resources.

(Latvian higher educational institutions are not represented in this rating table)

<http://www.arwu.org/>

Academic *Ranking* of *World Universities*

▶ Academic Ranking of World Universities - 2012

World Rank	Institution*	Country /Region	National Rank	Total Score	Score on Alumni <input type="button" value="▼"/>
1	Harvard University		1	100	100
2	Stanford University		2	72.8	38
3	Massachusetts Institute of Technology (MIT)		3	71.8	69
4	University of California, Berkeley		4	71.6	67.5
5	University of Cambridge		1	69.8	80.3
6	California Institute of Technology		5	64.1	48.5
7	Princeton University		6	62.1	52.3
8	Columbia University		7	60.1	64.2
9	University of Chicago		8	57.2	61.8
10	University of Oxford		2	56.1	51.2



The Times Higher World University Ranking (THE)

THE rating forms the list of 400 world's leading higher educational institutions.

13 indicators grouped in 5 groups are being used: 30% - learning environment, 30% - research activities, 30% - citations, 2.5% - innovations, 7.5% - foreign relations.

(Latvian higher educational institutions are not represented in this rating table)

<http://www.timeshighereducation.co.uk/>



The Times Higher World University Ranking (THE)

World University Rankings 2011-12

World University Rankings 2011-12													
001 - 200		201 - 225		226 - 250		251 - 275		276 - 300		301 - 350		351 - 400	
Rank ▼	Institution	Country / Region	Overall score	change criteria									
1	California Institute of Technology	United States	94.8										
2	Harvard University	United States	93.9										
2	Stanford University	United States	93.9										
4	University of Oxford	United Kingdom	93.6										
5	Princeton University	United States	92.9										
6	University of Cambridge	United Kingdom	92.4										
7	Massachusetts Institute of Technology	United States	92.3										
8	Imperial College London	United Kingdom	90.7										
9	University of Chicago	United States	90.2										
10	University of California, Berkeley	United States	89.8										





SCImago Institutions Rankings

The SCImago Institutions Rankings rating ranks 3042 higher educational institutions in the world and is based on the data about the scientific activities of higher educational institution.

Four indicators include the information about the number of publications (mostly SCOPUS), indicators of scientific cooperation, number of high level publications, etc.

<http://www.scimagoir.com/>



SCImago Institutions Rankings

Eastern Europe

Country	Institutions
Poland	50
Russia	34
Czech Republic	26
Romania	19
Hungary	8
Serbia	8
Croatia	8
Ukraine	7
Bulgaria	5
Lithuania	5
Slovakia	5
Slovenia	5
Estonia	3
Belarus	3
Armenia	2
Georgia	2
Azerbaijan	2
Latvia	2
Moldova	1
Macedonia	1

WR	RR	CR	Organization
1565	81	1	University of Latvia
2794	182	2	Riga Technical University



Webometrics Ranking

Rating Webometrics Ranking ranks more than 20 000 higher educational institutions in the world.

The rating is based only on the information about the institutions available in the Internet.

<http://www.webometrics.info/en/Europe/Latvia>

Webometrics Ranking

Four main indicators are being used:

10% of rank value forms the recognition of the institution in Google search engine,

50% - number of external links to the home page of higher educational institution,

10% - academic and publishing activities in different file formats in Google search engine (.doc, .pdf, .ppt),

30% - number of electronic publications from Google Scholar (2007 – 2011) and data from Scimago SIR (2003-2010).



Webometrics

ranking	<u>World Rank</u> ▲	<u>University</u>	<u>Det.</u>	<u>Presence Rank*</u>	<u>Impact Rank*</u>	<u>Openness Rank*</u>	<u>Excellence Rank*</u>
1	796	University of Latvia / Latvijas Universitāte Rīga	»	681	1654	495	1340
2	1403	Rīga Technical University / Rīgas Tehniskā universitāte	»	3347	1579	1029	2630
3	2599	Latvia University of Agriculture / Latvijas Lauksaimniecības universitāte	»	3070	5850	638	3993
4	3447	Transport and Telecommunications Institute Rīga / Transporta un sakaru institūts	»	2784	7130	911	5230
5	3909	Rezekne Higher School / Rēzeknes Augstskola	»	6494	4992	2220	5230
6	4477	Daugavpils University / Daugavpils Universitāte	»	3356	9060	2037	4606
7	5371	Liepāja University (Liepāja Pedagogical Higher School) / Liepājas Universitāte	»	342	7823	6754	5230
8	5509	School of Business Administration Turība / Biznesa augstskola Turība	»	5531	4020	7601	5230
9	5563	Vidzeme University College / Vidzemes Augstskola	»	4376	6803	4954	5230
10	5739	(1) Baltic International Academy / Baltijas Starptautiskā akadēmija	»	3799	4449	8345	5230

Situation in Latvia



ARHĪVS



Pirmais visu Latvijas augstskolu reitings

02.06.2008 LA.lv

 Drukāt
 Ieteikt

"Latvijas Avīze" sadarbībā ar Latvijas Universitāti sagatavojuši pirmo Latvijas augstskolu reitingu. Augstākās izglītības piedāvājums Eiropas Savienībā un visā pasaulē ir kļuvis daudz atvērtāks un konkurētspējīgāks, pieaug pieprasījums pēc informācijas par augstskolu kvalitāti un to darbības efektivitāti. Daudzas Eiropas universitātes, sekojot ASV piemēram, jau šodien sacenšas par savu vietu globālajā augstākās izglītības vidē.

Arī Latvijā jau gadiem tiek runāts par nepieciešamību veidot nacionālo augstskolu reitingu, bet lielākā Latvijas augstākā mācību iestāde – Latvijas Universitāte – kā vienu no saviem stratēģiskajiem mērķiem tuvākajiem desmit gadiem ir izvirzījusi iekļūšanu Eiropas labāko 100 universitāšu saimē. Beidzot tas ir noticis, pavasarī – laikā, kad daudziem jauniešiem jāizšķiras, kur tālāk studēt. "Latvijas Avīze" saviem lasītājiem ir sagatavojuši pirmo augstskolu reitingu, kas tapis sadarbībā ar Latvijas Universitāti un kurā iekļautas visas Latvijas augstākās mācību iestādes. Reitinga izveidei izmantota pasaulē aprobēta metodoloģija un publiski pieejamie dati par augstākajām mācību iestādēm valstī. Darbu koordinēja Latvijas Universitātes [Ekonomikas](#) un vadības fakultātes absolvente Evija Rūsīte, kura ir uzrakstījusi maģistra darbu "Indikatoru sistēmas izstrāde universitāšu darbības izvērtēšanai".



Situation in Latvia (cont.)

In the formation of Latvian higher educational institutions' rating the evaluation criteria or indicators are the following:



Situation in Latvia (cont.)

- **I1** – the ratio of the number of students and academic personnel (**weight=1**);
- **I2** – the proportion of the graduates (**weight=0.5**);
- **I3** – the proportion of academic personnel in the basic work possessing Dr. degree (among all higher educational institutions) (**weight=1.5**);
- **I4** - the proportion of academic personnel in the basic work possessing Dr. degree (in a definite higher educational institution) (**weight=1**);
- **I5** – the proportion of academic personnel in the basic work (**weight=0.5**);

Situation in Latvia (cont.)

- **I6** – age structure of academic personnel (proportion of 30 – 50 years' old) (**weight=1**);
- **I7** – proportion of foreign students (**weight=0.5**);
- **I8** – number of publications per one unit of academic personnel (**weight=2**);
- **I9** – quality of education (excellent and good) (**weight=2**);
- **I10** – the popularity/ recognition of the higher educational institution (**weight=1**).



2012 Rating table

Institution	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	Rank
LU	57	83	100	66	89	46	76	75	91	99	1
RSU	66	88	30	55	100	42	100	95	100	100	2
RTU	61	67	96	68	90	36	59	54	97	99	3
REA	17	100	2	85	20	69	35	100	42	92	4
DU	48	76	22	63	99	52	3	68	43	96	5
LLU	44	67	38	70	60	38	2	20	73	99	6
BA	73	92	3	36	70	34	5	0	60	93	7
LJA	27	29	6	100	56	19	0	0	65	96	8
LMāA	8	70	3	14	100	56	0	0	75	97	9
RPIVA	72	87	9	46	86	42	2	0	31	89	10
RA	72	62	7	40	80	60	2	12	23	87	11
LMūA	6	79	3	14	97	45	2	0	76	94	12
VeA	19	67	4	37	86	41	1	20	44	90	13
LSPA	26	47	7	51	94	33	1	5	49	95	14
LiepU	40	77	9	54	43	38	0	8	34	93	15
LKuA	10	76	3	23	82	51	5	0	54	93	16
ViA	35	58	3	27	86	61	0	0	39	85	17
LNAA	1	17	2	25	100	75	7	0	41	88	18



Research: Clustering

Sequentially choosing the number of clusters between 2 and 10 and by applying clustering algorithm

k-means, the corresponding clusters and their components have been obtained:

Research: Clustering (cont.)

N	Cluster content								
2	LU RTU RSU	Others							
3	LU RTU RSU	REA	Others						
4	LU RTU	RSU	REA	Others					
5	LU RTU	RSU	REA	LNAA	Others				
6	LU RTU	RSU	REA	LNAA	LJA	Others			
7	LU RTU	RSU	REA	LNAA	LJA	LMāA LMūA LKūA	Others		
8	LU RTU	RSU	REA	LNAA	LJA	LMāA LMūA LKūA	BA RPIVA RA ViA	DU LLU VeA LiepU LSPA	
9	LU RTU	RSU	REA	LNAA	LJA	LMāA LMūA LKūA	RPIVA RA ViA	DU LLU VeA LiepU LSPA	BA

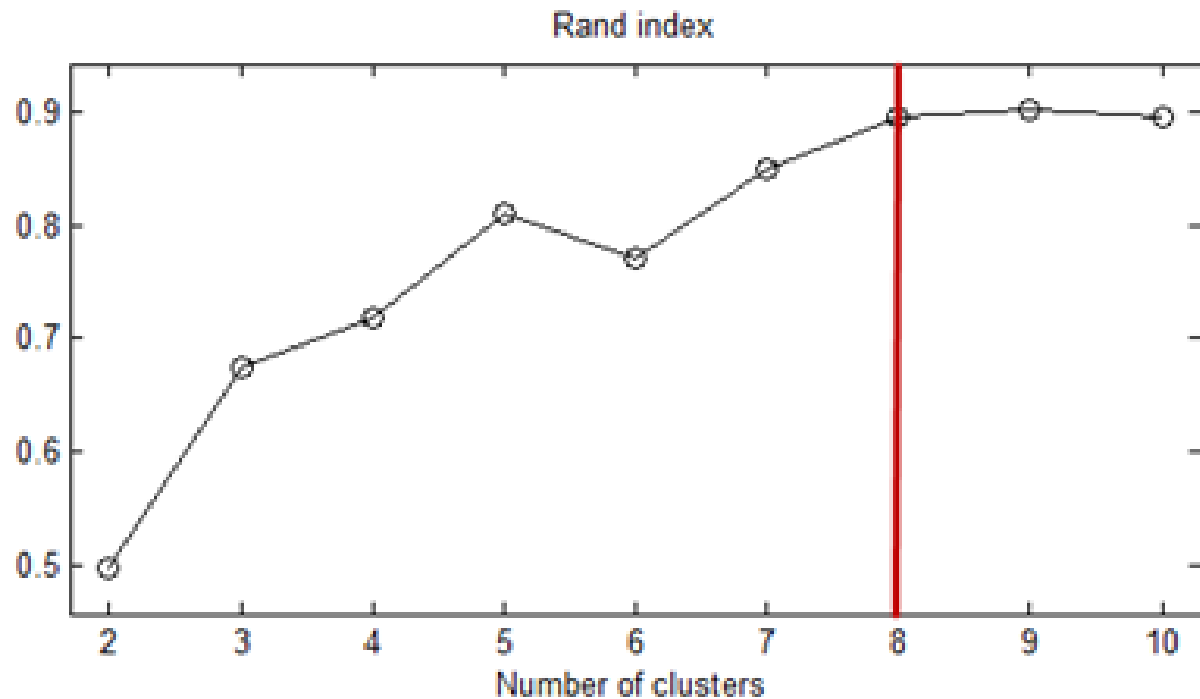


Research: Validity

In order to verify clustering validity, quality index has been calculated – Rand index for ten clusters. Cluster structure C (consecutively with the number of clusters between 2 and 10 clusters) has been compared with specified divisions P containing various possible clusters.

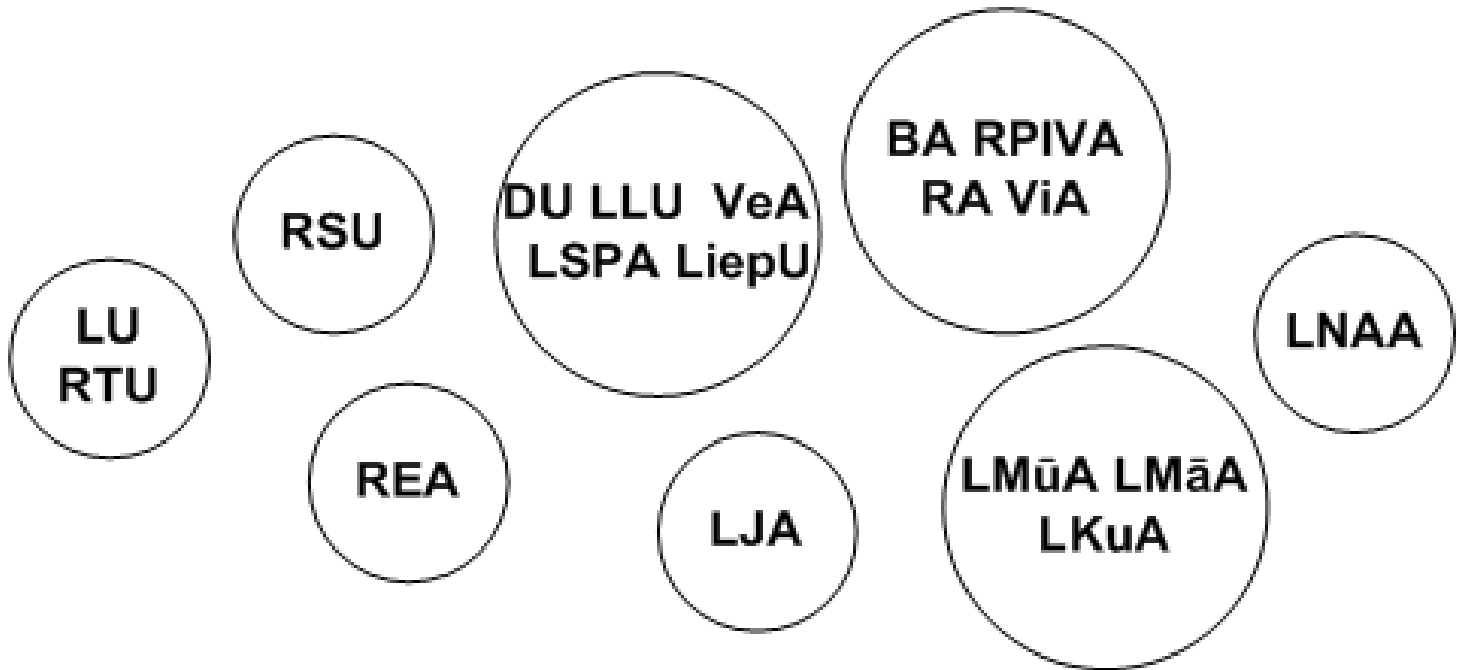
Research: Validity (cont.)

Among all structures the lowest mistake occurs with 8 clusters, namely, 8 cluster structure in this case is the most optimal.



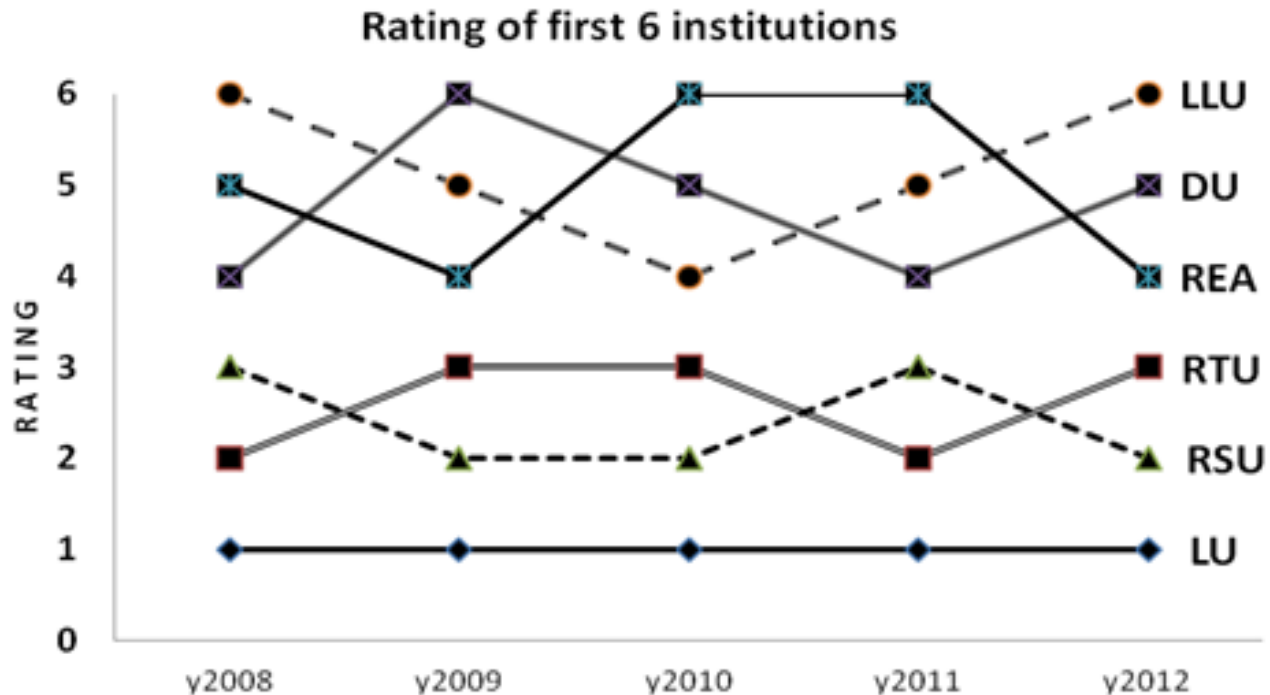


Resulting division in clusters



Conclusions

Rating leaders in recent years did not change – the first six positions were occupied by the following higher educational institutions: LU, RSU, RTU, REA, DU, LLU





Conclusions (cont.)

Certainly, for all higher educational institutions the following question is topical – what changes of indicator values affect the overall rating.

The analysis of first three winners in the 2012 higher educational institutions' rating allows making the following assumptions:

Conclusions (cont.)

- replacing weight values of all indicators to **1**, the order is as follows: **RSU, LU, RTU**;
- changing indicator **I8** weight value to **1** – place order does not change;
- changing indicator **I7** weight value to **1** – place order is as follows: **RSU, LU, RTU**;
- changing indicator **I2** weight value to **1** – place order does not change;
- without **I9** and **I10** place order does not change.



Recommendation

In order for RTU to qualify for leader's position in the rating of higher educational institutions, it can be concluded from Table that it should increase the proportion of the graduates (12), as well as, the proportion of foreign students (17) and, especially, the volume of publications (18).



Thanks !