DESIDOC Journal of Library & Information Technology, Vol. 41, No. 2, March 2021, pp. 130-139, DOI : 10.14429/djlit.41.2.15649

Webometric Analysis of Institutional Repositories of Malaysian Public Universities

Nor Azman Ismail*, Nurina Izzati Ramzi, Su Elya Namira Mohamed and Mohd Sharul Hafiz Razak

School of Computing, Universiti Teknologi, Johor - 81310, Malaysia
**E-mail: azman@utm.my*

ABSTRACT

An institutional repository (IR) is one of the resources available in most university libraries that have attracted external publishers, search engines and social media to link, share and index IR content. The traditional citation-based indicators of a publication may not reflect the IR quality and have led to the creation of new indicators such as webometrics or web metrics. This study aims to analyse and explore Malaysia's public university IR visibility, the numbers of an external link, page count, PDF count and URL web mention. We utilised backlinks web crawler and web search engine to collect raw data. A visualisation was created using the force-directed graphing method to interpret the IR network in the webspace. This study revealed that two research universities, Universiti Malaya (UM) and Universiti Putra Malaysia (UPM), dominate web visibility based on webometrics indicators. All non-research universities are at the bottom of the rankings. This study shows institutional repositories from research universities are more visible in academic social networks and digital library sites. In contrast, non-research universities need to improve their visibility by mapping the universities' IRs websites through hyperlink exchange and collaboration activities between each university and promoting the university publication to the academic social network sites.

Keywords: Institutional repository; Network mapping; Webometrics; Public universities

1. INTRODUCTION

The existence of the internet has resulted in the growing use of web technologies day by day. According to Thelwall *et al.* (2005), the web is likely to become essential to human activity[1]. Among the use of the internet and web technologies are information seeking and retrieval. As users commonly prefer to use the internet to gather their information needs (Prabakaran & Lihitkar, 2019)[2], many universities have established an institutional repository (IR) to house the research output of the institution[3,16].

Today, IR is one of the resources available in most university libraries. Current digital technology has made old material, or media forms such as hardbound thesis produced by students as a requirement for graduation are now accessible online. Among the popular publishing materials in institutional repositories are theses, academic articles and books. However, in most institutional repositories, there are also publication materials that do not meet the standards that allow them to be published in indexed and reputable journals, but still have value for its results, findings and as a source of references. With the increasing number of publications being added to IR daily by librarians, the IR database's size is seen to grow dramatically. The value of IR as a source of knowledge has attracted external publishers, search engines and social media to link, share and index IR content.

Among ASEAN countries, Malaysia is the second-largest IR contributor to ASEAN after Indonesia and is also the country with more than one IR per educational institution other than Singapore (Lee-Hwa *et al.*, 2013)[5]. It raises the question of how to measure this activity and its effect on IR in terms of visibility and networking between IR and external entities by visualizing this link. Therefore, the objectives of the study are as follows:

- To analyse the visibility (external links) of Malaysia's public university IR
- To explore the number of web pages (page count), PDF count and URL mention of Malaysia's public university IR.
- To evaluate and visualise Malaysia's public university IR based on external link count, page count, PDF count and URL mention count.

The hyperlink to the IRs should be able to tell the institution's research impact and can be compared with the institution's website itself as a whole[4]. To date, there are only a few empirical studies that have analysed the value of IRs, especially from a webometrics point of view. Aguillo (2020) conducted a presence study using webometrics to 2185 IRs from 28 social tools and found that the present rate of each IR was low[4]. However, according to our knowledge, no study explores IRs of Malaysia's public university's webometric evaluation specifically. Thus, the webometrics evaluation technique is appropriate for this study and answers how publications in IR universities can help universities increase their presence in academic, social networks, and external digital libraries.

In Malaysia, there are over 209 universities, including public and private universities and colleges. Twenty of them

Received : 31 March 2020, Revised : 08 January 2021
Accepted : 17 February 2021, Online published : 12 March 2021

Table 1. List of selected universities

Universities	Categories
Universiti Malaya (UM)	Research University
Universiti Teknologi Malaysia (UTM)	Research University
Universiti Sains Malaysia (USM)	Research University
Universiti Putra Malaysia (UPM)	Research University
Universiti Kebangsaan Malaysia (UKM)	Research University
International Islamic University Malaysia (IIUM)	Non-research University
Universiti Utara Malaysia (UUM)	Non-research University
Universiti Tun Hussien Onn Malaysia (UTHM)	Non-research University
Universiti Teknologi Mara (UiTM)	Non-research University
Universiti Teknikal Malaysia (UTeM)	Non-research University
Universiti Sultan Zainal Abidin (UniSZA)	Non-research University
Universiti Sains Islam Malaysia (USIM)	Non-research University
Universiti Malaysia Terengganu (UMT)	Non-research University
Universiti Malaysia Sarawak (UNIMAS)	Non-research University
Universiti Malaysia Sabah (UMS)	Non-research University
Universiti Malaysia Perak (UniMAP)	Non-research University
Universiti Malaysia Pahang (UMP)	Non-research University
Universiti Malaysia Kelantan (UMK)	Non-research University

are public universities, 85 are private universities, and the remaining 104 are private colleges (afterschool.my, 2018)[6]. From 20 public universities in Malaysia, there are only 18 universities that have an accessible IR. There are five research universities, and 13 are non-research universities, as shown in Table 1. Moving forward, universities that are publicly accessible IRs are examined using the count for an external link, page count, PDF count, and URL mention count to evaluate the website's quality and visibility.

2. RELATED WORK

2.1 Academic Institutional Repositories

IRs are online archive framework presented by universities and research institutions, used to store, preserve and distribute a university's shared research output serve as indicators of an institution's quality[3]. An IR or archive concentrates on scholarly items produced by a university's researchers. The existing system of scholarly communication restrains the public and the accessibility of most academic research, which ceases to expand it. According to Crow (2002), the decline in the number of the group of onlookers is caused by the increases in the price of the journal and consequent membership cancellations[3].

2.2 Webometrics

In a paper by Bjorneborn (2004), webometrics is defined as the study of the quantitative aspects of the construction and use of information resources, structures and technologies on the web, drawing on bibliometrics and informetrics approaches[7,19]. Various new terms for the research field were proposed rapidly from the mid-1990's such as netometrics, webometry, internetometrics, webometrics, cyber metrics, and web bibliometry[15]. Currently, the two most widely adopted terms are webometrics and cyber metrics. They are often used as synonyms[7]. However, webometrics and cyber metrics have different definitions where cyber metrics is the study of the quantitative aspects of the whole internet. In contrast, webometrics focuses on the quantitative aspects of the web.

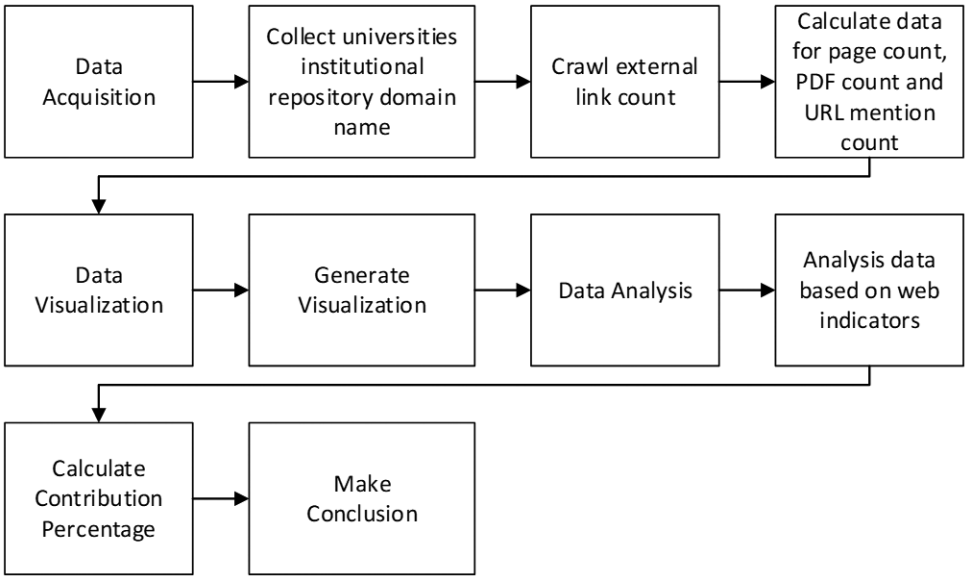

Figure 1. Overview of the webometric evaluation process.

2.3 Page Count

The page count has not been discussed too much in any paper. However, it is mentioned frequently in documents related to Web Impact Factor calculations. In an article by Ingwersen (1998), the page count was referred to as the number of pages in a website and was used to calculate Web Impart Factor[8]. In another study by Arif and Ismail (2013), the term page count refers to the same metric[9].

2.4 PDF Count

As mentioned by Aguillo *et al.* (2010), PDF count is the number of files in PDF format from a search engine such as Google and Yahoo[10].

Other than PDF files, others are used in the repositories, for example, Word and HTML file, or any other similar files.

2.5 URL Mention Count

In a study by Kousha and Thelwall (2007), URL citation or URL mention counts the number of times a URL of a website is mentioned in another website[11]. Thelwall, Sud and Wilkinson (2012) stated that a URL mention of a website happens between website A and B[12]. URL citation of website B by website A is any page from website A that have or contain the URL or domain name of website B, but it does not necessarily have to link to it. URL citations are vague to hyperlink as they are embedded in one site page and point to another site page. In another study by Thelwall and Sud (2011), URL citation is the mention of the URL of a page or site on another site page, regardless of accompanied by a hyperlink or not[13]. URL citation count can be assessed by submitting URLs as expression hunts to the web search tool.

Table 2. External link for each IR

Public universities	URL	Institutional repository
UM	um.edu.my	eprints.um.edu.my
UTM	utm.my	eprints.utm.my
USM	usm.my	eprints.usm.my
UPM	upm.edu.my	psasir.upm.edu.my
UKM	ukm.my/portal	smk.ukm.my/erep
IIUM	iium.edu.my	irep.iium.edu.my
UUM	uum.edu.my	repo.uum.edu.my
UTHM	uthm.edu.my	eprints.uthm.edu.my
UiTM	uitm.edu.my	ir.uitm.edu.my
UTeM	utem.edu.my	eprints.utem.edu.my
UniSZA	unisza.edu.my	erep.unisza.edu.my
USIM	usim.edu.my	ddms.usim.edu.my
UMT	umt.edu.my	umt-ir.umt.edu.my/xmlui
UNIMAS	unimas.my	ir.unimas.my
UMS	ums.edu.my	eprints.ums.edu.my
UniMAP	unimap.edu.my/ index.php/my	dspace.unimap.edu.my
UMP	ump.edu.my	umpir.ump.edu.my
UMK	umk.edu.my/index. php/en	umkeprints.umk.edu.my

Table 3. Corresponding URL for academic social network

Academic Social Network Site	URL
Google Scholar	scholar.google.com
Mendeley	mendeley.com
ResearchGate	researchgate.net
Academia.edu	academia.edu
IEEEXplore	ieeexplore.ieee.org
ScienceDirect	sciencedirect.com

3. METHODOLOGY

Figure 1 summarises the steps of the webometric evaluation process used in this study. The list of IR was collected from the Ranking Web of Repositories in 2018, and we identified that only 18 IRs are accessible. We choose to use Ahref crawler and Google search engine to collect raw data and analyse it by calculating the contribution percentage in this work. A visualisation was created using force-directed graphing methods to interpret the IR network in the web space[17]. A conclusion is made based on the level of visibility of each IR in the webspace and the utilisation of the academic, social network.

3.1 External Link Count

This study uses an SEO tool; Ahrefs to find the total backlink of selected IRs. Table 2 shows the total number of external links obtained for each IR.

3.2 Web Indicators

Table 3 is produced to find the contribution percentage (CP) of the external link. Table 3 will only have external links within and outside IR categories. As discussed by Fan[7], to find the external links within and outside the IR, the below method was used;

$$CP = \frac{a1}{b1}$$

Where,

a1 = site:eprints.utm.my (the external link within IRs)

b1=site:utm.my (the external link count outside the IRs)

As mentioned in the previous section, the page count had its own calculation method. For this study, the count is divided into several parts according to the academic and social network sites. Table 3 shows the list of selected academic, social networks and digital libraries used and the site's links. The calculation for the contribution percentage (CP) of the page count is as follows;

$$CP = \frac{a2}{b2}$$

Where,

a2= site:eprints.utm.my site: scholar.google.com (page count within IRs)

b2=site:utm.my site: scholar.google.com (page count outside IRs).

For PDF count, which include Google Scholar, ResearchGate, Mendeley, ScienceDirect, IEEEXplore and Academia.edu, the method of obtaining the count is as below:

$$CP = \frac{a3}{b3}$$

Where,

a3= site:eprints.utm.my filetype: pdf site: scholar.google.com (PDF count within IRs)

b3=site:utm.my filetype: pdf site: scholar.google.com (PDF count outside IRs)

Table 4. Figures for number of links given and received by each university

ID	UM	UTM	USM	UPM	UKM	IIUM	UUM	UTHM	UiTM	UTeM	UniSZA	USIM	UMT	UNIMAS	UMS	UniMAP	UMP	UMK	UPNM
UM	-	3	18	4	3	4	258089	4	26	2	1	4	1	0	20469	2	3	1	0
UTM	450198	-	27	12	10	2	449824	11	22	5	18	6	0	14	20472	8	7	3	0
USM	398720	10	-	4	4	0	398185	4	23	1	18	4	1	4	20474	2	2	2	0
UPM	675501	17	20	-	5	1	675127	2	36	1	19	4	0	8	20477	1	4	2	0
UKM	377	3	0	2	-	0	13	0	59	0	0	0	1	0	0	0	0	0	0
IIUM	305038	15	23	6	10	-	304357	4129	19	1	1	5	0	0	1	1	1	2	0
UUM	187	34	6	8	4	4	-	2	32	1	0	5	0	1	16107	2	1	3	0
UTHM	64796	18	19	5	5	2	64418	-	19	6	0	6	0	3	20466	9	13	4	0
UiTM	93652	2	0	2	0	2	93631	0	-	1	0	0	0	0	0	0	0	2	0
UTeM	163780	4	1	2	1	0	163758	3	4	-	0	1	0	1	0	0	1	1	0
UniSZA	25562	0	0	0	0	0	25541	0	0	0	-	0	0	0	0	0	0	0	0
USIM	32569	3	2	4	1	4	32540	1	8	1	1	-	0	0	20464	42	1	2	0
UMT	3891	0	0	27	0	0	3870	0	0	0	0	0	-	0	0	0	0	0	0
UNIMAS	147652	0	4	6	1	0	147293	0	11	2	0	1	0	-	1	0	0	1	0
UMS	172633	4	13	3	3	2	172271	5	17	1	0	3	0	1	-	5	2	2	0
UniMAP	155483	16	9	14	3	3	155441	12	28	22	0	3	0	9	52677	-	8	2	0
UMP	153811	11	18	5	2	3	153447	3	13	5	1	4	3	0	20466	2	-	2	0
UMK	39451	6	3	2	2	0	39422	2	2	1	0	0	0	0	1	0	1	-	0
UPNM	204	17	0	2292	0	0	204	0	1	0	29	3	123	12	0	0	6	15	-

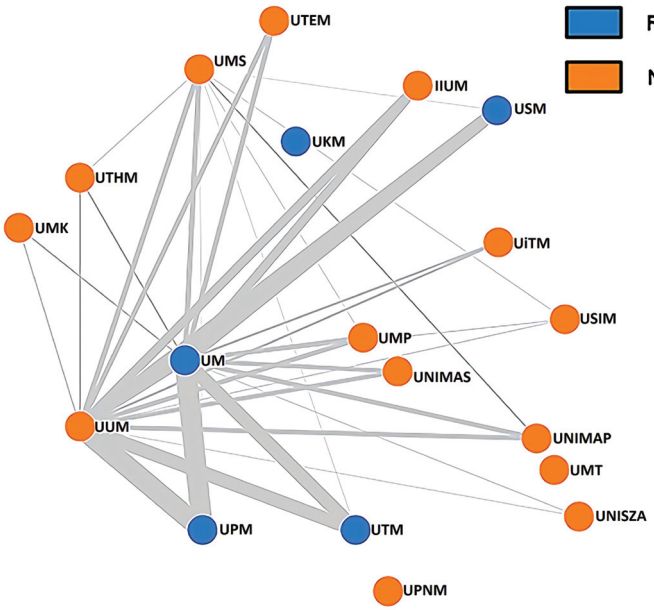

Figure 2. Mapping of IR network external link.

URL mention count is a domain name mentioned in Google Scholar, ResearchGate, Mendeley, ScienceDirect, IEEEXplore and Academia.edu. According to Smith (2013)[14], URL mention count is counted as below:

$$CP = \frac{a4}{b4}$$

Where,

a4 = site:"eprints.utm.my" -site: utm.my site: scholar.google.com

b4=site:"utm.my" -site: utm.my site: scholar.google.com

4. RESULTS AND DISCUSSION

4.1 External Link Count

Table 4 and visualisation graph in Fig. 2 show that most universities formed a relationship with UUM through their backlinks. It can be explained through the thickness of the link. The link shows which university had links with other

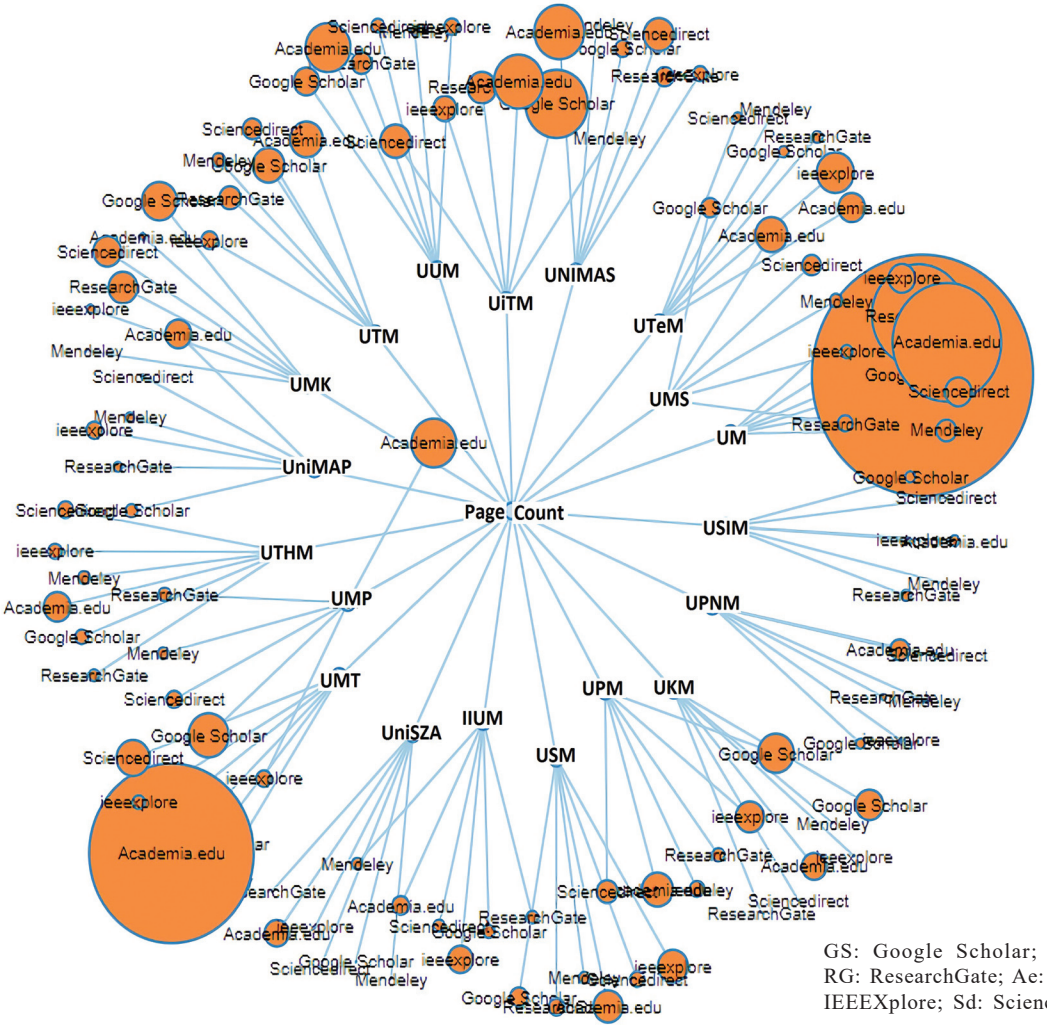

Figure 3. Mapping of IR network page count.

universities. The number of backlinks for IR of each university is represented as the thickness of the link. The more the number of the external link, the thicker the link. Figure 2 shows the most significant number of external links come from UUM. Some of the links linked widely to USM, IIUM, UM, UTM and UPM, while UPNM also linked to other universities in a way. However, due to the scaling factor used to plot the links, the links between nodes for some universities cannot be seen. The figure differentiates between research and non-research universities where the nodes for research universities are given in blue colour. The nodes for non-research universities are presented in orange colour.

4.2 Page Count

This layout takes the size of every site's page count and uses it as the node radius[18]. From Annexure I, a form of visualisation is made.

In this visualisation (Fig. 3), UM has the most page count on Google Scholar. Aside from UM, UiTM also has a large number of Google Scholar page count, but due to the massiveness of UM page count (more than 1 million), the size of the node for UiTM on Google Scholar cannot be compared clearly. For Mendeley, the university that has the most significant number of the page count is UM. However, the number is relatively small compared to other academic social network sites that the node cannot be seen clearly. UM also has the highest number of page count in ResearchGate.

For the same reason as before, the node is small compared to Google Scholar. For Academia.edu, UMT has the highest number of page count, which can be seen clearly from the visualisation that Academia.edu is the only large enough node for UMT. For IEEEXplore, the university that has the highest number of the page count is UTeM. From the visualisation, IEEEXplore and Academia.edu nodes for UTeM can be seen clearly. For ScienceDirect, UMT has the highest number of page count, but the node is overshadowed by Academia.edu

4.3 PDF Count

The numbers of PDF count for each university are tabulated in Annexure II and are used to create visualisation as in Fig. 4. It can be said that most PDF files from the IRs are obtained from ScienceDirect, Academia.edu and Mendeley. The size of the nodes depends on the number of PDF count obtained by each IRs.

Figure 4 shows the mapping of the IR network and PDF file count. UM has the most PDF count in Academia.edu with

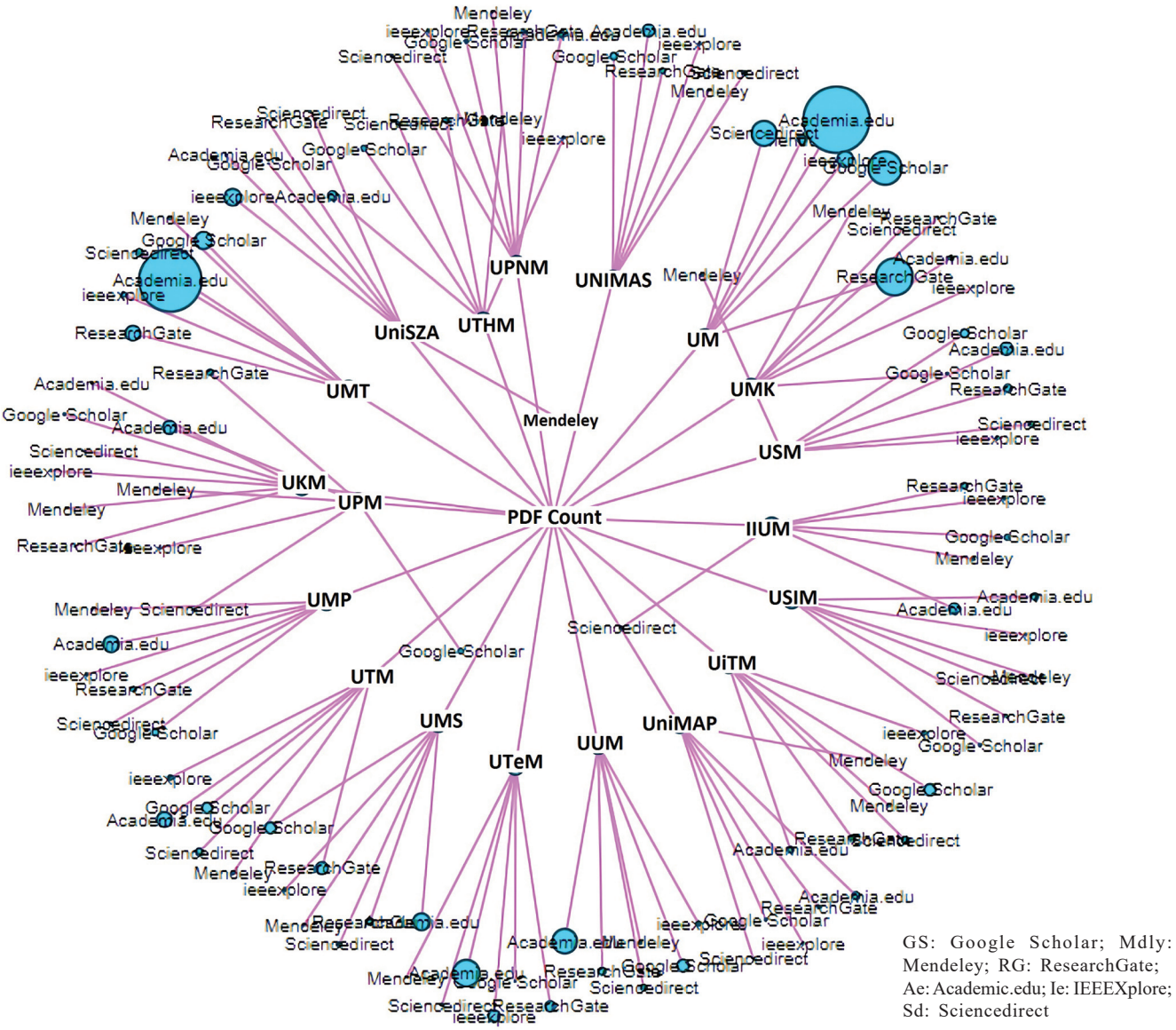

Figure 4. Mapping of IR network PDF count.

a total of 132,000. For Google Scholar, UM has the most significant number of PDF count with 33,300, and the size of the node can be seen clearly in the Fig. 4. UM also has the greatest number of PDF count in Mendeley and ResearchGate with the total of 1,960 and 41,000, respectively. However, the node's size is relatively small, making it overshadowed by nodes from other academic social network sites. The size of the node for ScienceDirect for UM can be seen clearly, and this is because UM has the greatest number of PDF count in ScienceDirect with 18,500.

4.4 URL Mention

The numbers of URL mention count for each university are tabulated in Annexure III. The radius of the node at the centre is the total number of URL mention from all universities. In contrast, the size of the node for each university reflects the total number of URL mention from each academic social network site. UPM has the largest node compared to other universities because UPM has a greater number of URL mention.

From the graph in Fig. 5, Academia.edu has the highest URL mention count for some universities. Other than Academia.edu, Google Scholar and ScienceDirect have a relatively significant number of URL mention count for particular IRs. IEEEXplore, ResearchGate and Mendeley are visualised to have less count of the page for most universities. UPM and USM are visualised to have the greatest URL mention from all academic social network sites

5. CONCLUSIONS

Overall, research universities have more web presence compared to non-research universities. From the mapping of the IR network discussed, research universities have more number of links given and received from other universities. The external links linked widely among research universities even though the external links come from a non-research university. It means that research universities have more source that can be referred to by non-research universities. A similar explanation can be used in other cases. Compare to non-

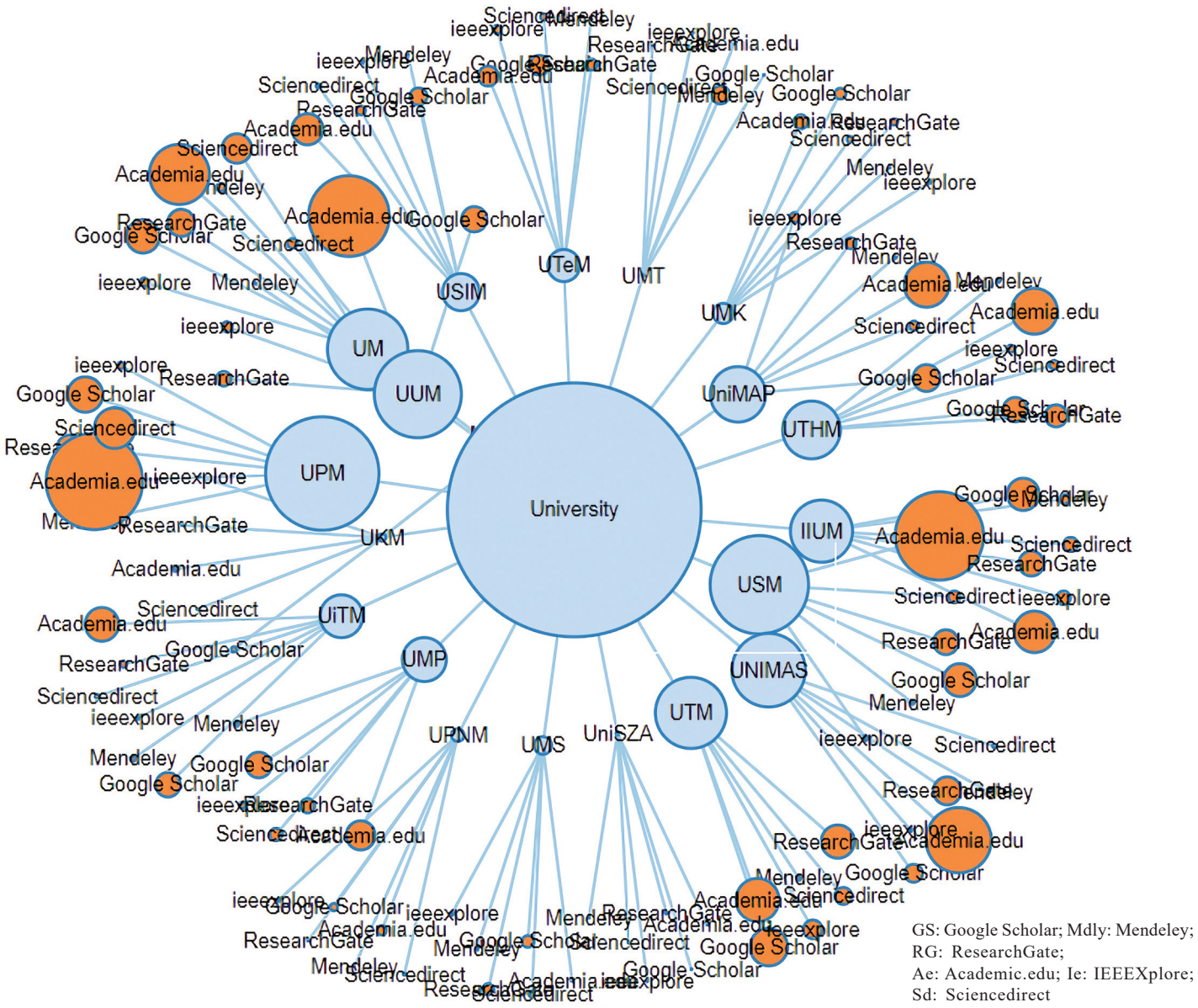

Figure 5. Mapping of IR network URL Mention.

research universities, research universities have more number of the page on a particular website. The numbers' difference is significant that it clearly shows the research universities dominate the page count under most academic social network and digital libraries. For PDF count, research universities have more visibility in the area since many of the files formats under a certain research university name could be found under the academic social network and digital libraries. URL citation or URL mention for some research universities are more extensive in number compared to non-research universities. It means that the universities IR are mentioned in digital libraries and academic social networks more often than non-research universities. Overall, research universities have more web presence compare to non-research universities.

Most external links come from UUM, and some of the links are linked widely to USM, IIUM, UM, UTM and UPM. According to the results, it is clear that UM dominates the academic social network site, which proves that the institution is a research university. Data of page count and PDF count show that this institution had produced and published a lot of research work which also indicates that they are utilizing the academic social network site to contribute to their level of visibility in the webspace. While for URL mention count, UPM dominates the academic social network site.

To enhance universities' web presence and visibility, universities should strengthen their academic publication policies. Because most universities in Malaysia already have their own IR websites, the mapping between the universities' IRs websites through hyperlink exchange and collaboration activities between each university can be one of the most effective methods. In this way, each university's web presence can reflect the collaboration among those university, including local and international activities.

REFERENCES

1. Thelwall, M.; Vaughan, L. & Björneborn, L. Annual review of information science and technology. *Webometrics*, 2006, **39**(1), 81-135. doi: 10.1002/aris.1440390110.
2. Prabakaran, R. & Lihitkar, Shalini R. Webometric analysis of library websites: Emerging research and opportunities. Today & Tomorrows Printers and Publishers, 2019. http://www.ttpp.in/books/view/id/21429. (Accessed on 20th December 2019).
3. Crow, R. The case for institutional repositories: A SPARC position paper. Washington DC, Estados Unidos: The Scholarly Publishing Academic Resources Coalition. 2002.
4. Aguillo I. Altmetrics of the open access institutional repositories: A webometrics approach. *Scientometrics*, 2020.
5. Lee-Hwa, T.; Abrizah, A. & Noorhidawati, A. Availability and visibility of open access digital repositories in ASEAN countries. *Inf. Dev.*, 2013, **29**(3), 274-285. doi: 10.1177/026666691246675.
6. Afterschool, 2017 SETARA University Rankings Out Now, 2018. https://afterschool.my/find-university-in-malaysia/2017-setara-university-rankings-out-now. (Accessed on 20th December 2019).
7. Björneborn, L. Small-world link structures across an academic web space: a library and information science approach. Royal School of Library and Information Science. Department of Information Studies. 2004, PhD Thesis.
8. Ingwersen, P. The calculation of web impact factors. *J. Doc.*, 1998, **54**(2), 236–243. doi: 10.1108/eum0000000007167.
9. Arif, A. & Ismail, N.A. Web impact factor for Malaysian public universities. *Int. J. Future Comp. Commun.*, 2013, **2**(3), 151-154.
10. Aguillo, I.F.; Ortega, J.L.; Fernández, M. & Utrilla, A. M. Indicators for a webometric ranking of open access repositories. *Scientometrics*, 2010, **82**(3), 477–486. doi: 10.1007/s11192-010-0183-y.
11. Kousha, K. & Thelwall, M. Google Scholar citations and Google Web/URL citations: A multi-discipline exploratory analysis. *J. Am. Soc. Inf. Sci. Technol.*, 2007, **58**(7), 1055–1065. doi: 10.1002/asi.20584.
12. Thelwall, M.; Sud, P. & Wilkinson, D. Link and co-inlink network diagrams with URL citations or title mentions. *J. Am. Soc. Inf. Sci. Technol.*, 2012, 63(4), 805–816. doi: 10.1002/asi.21709.
13. Thelwall, M. & Sud, P. A comparison of methods for collecting web citation data for academic organisations. *J. Am. Soc. Inf. Sci. Technol.*, 2011, 62(8), 1488–1497. doi: 10.1002/asi.21571.
14. Smith, A.G. Web based impact measures for institutional repositories. 2013.
15. Björneborn, L. & Ingwersen, P. Perspective of webometrics. *Scientometrics*, 2001, **50**(1), 65-82.
16. Fan, W. Contribution of the institutional repositories of the Chinese Academy of Sciences to the webometric indicators of their home institutions. *Scientometrics*, 2015, **105**(3), 1889–1909. doi: 10.1007/s11192-015-1758-4.
17. Stephen G. Kobourov, "Spring Embedders and Force Directed Graph Drawing Algorithms," CoRR, Vol. abs/1201.3011, Jan. 2012.
18. Smith, A.G. Webometric evaluation of institutional repositories, 2012. https://researcharchive.vuw.ac.nz/. (Accessed on 21st December 2019).
19. Thelwall, M. A history of webometrics. Bulletin of the Association for Information Science and Technology, 2012, **38**(6), 18-23.

CONTRIBUTORS

Dr Nor Azman bin Ismail obtained Master of Information Technology from National University of Malaysia, and PhD in the field of Human Computer Interaction from Loughborough University, United Kingdom. His research interests include Multimodal Interaction, Social Media Analytic, Human Performance Measurement, Webometric and Web Mining.
Contribution in the current study, he is the main author who came out with the idea and designing main structure of the research.

Mr Nurina Izzati Ramzi obtained her Bachelor of Computer Science in Computer Graphics and Multimedia Software from Universiti Teknologi Malaysia. She is currently working with Fargoes Infotech Sdn. Bhd as an Application Content Developer and Consultant.
She contributes in the mathematical work and visualisation.

Mr Su Elya Namira Mohamed obtained her Bachelor of Computer Science in Computer Graphics and Multimedia Software from Universiti Teknologi Malaysia.
She works on the analyzing the results in this research and make an insightful information for the discussion.

Mohd Sharul Hafiz Razak obtained Bachelor of Computer Science in Computer Graphics and Multimedia Software from Universiti Teknologi Malaysia (UTM).
Contribution in the current study, He contributed to data mining and processing and investigating the current trends of webometrics in the academic web.

Annexure 1

Figures for page count

ID	Page Count					
	Google Scholar	**Mendeley**	**Research Gate**	**Academia.edu**	**ieeexplore**	**Sciencedirect**
UM	1732000	13900	312000	418000	24700	24700
UTM	35600	5660	15700	37900	9170	12600
USM	10600	3710	8550	31800	7080	5070
UPM	45400	7430	5270	34100	28400	15200
UKM	27300	8	7	21300	7	7
IIUM	4870	3650	4580	10100	22000	4190
UUM	22800	2120	14000	71700	7750	5560
UTHM	6230	4850	3930	25800	6540	8260
UiTM	138000	10	29400	86300	18700	32700
UTeM	3550	6	3930	25100	48800	2730
UniSZA	6	5	7	20800	8	5
USIM	3550	8	3420	3320	9	9
UMT	94300	10	9350	958000	5420	38500
UNIMAS	8420	9	11100	87700	6730	32300
UMS	10800	5320	7670	36500	5030	12300
UniMAP	5160	2590	2670	24300	8610	339
UMP	57600	3790	5200	70600	7930	8590
UMK	43800	6	3690	29600	1300	27300
UPNM	2820	232	1120	13000	171	879

Annexure II

Figures for page count

ID	PDF Count					
	Google Scholar	**Mendeley**	**Research Gate**	**Academia.edu**	**ieeexplore**	**Sciencedirect**
UM	33300	1960	41000	132000	7370	18500
UTM	3220	160	4250	6530	530	1380
USM	1940	109	1630	4430	214	790
UPM	615	39	888	5050	51	184

ID	PDF Count					
	Google Scholar	**Mendeley**	**Research Gate**	**Academia.edu**	**ieeexplore**	**Sciencedirect**
UKM	68	4	5	45	1	2
IIUM	664	57	942	3160	226	237
UUM	4130	79	1460	17900	453	894
UTHM	719	9	528	2410	104	308
UiTM	3870	113	959	959	460	842
UTeM	7	7	2960	21100	4040	159
UniSZA	4	2	2	9	0	5
USIM	122	5	120	1230	6	54
UMT	8790	148	6310	118000	657	1480
UNIMAS	1270	57	691	4100	91	451
UMS	3540	59	1260	8380	146	500
UniMAP	124	8	197	1470	75	55
UMP	1290	10	544	7360	84	211
UMK	60	1	63	532	3	9
UPNM	126	23	108	1120	95	87

Annexure III

Figures for URL mention count

ID	URL mention count					
	Google Scholar	**Mendeley**	**Research Gate**	**Academia. edu**	**ieeexplore**	**Sciencedirect**
UM	6820	432	4490	22100	448	5300
UTM	8690	147	6780	11400	2150	1790
USM	6630	109	3780	47800	155	858
UPM	7650	191	3410	57100	278	10100
UKM	171	6	7	155	2	4
IIUM	6370	576	3830	7	1140	1260
UUM	3910	22	1310	39900	670	591
UTHM	3610	76	2980	12900	332	513
UiTM	2680	174	263	6970	53	99
UTeM	2440	6	725	2430	424	267

ID	URL mention count					
	Google Scholar	**Mendeley**	**Research Gate**	**Academia.edu**	**ieeexplore**	**Sciencedirect**
UniSZA	5	5	27	8	6	6
USIM	1810	9	485	5950	48	117
UMT	6	0	8	9	1	5
UNIMAS	1970	37	4780	39600	86	111
UMS	850	41	772	7	67	169
UniMAP	4420	43	777	117	576	558
UMP	4030	127	1260	5190	250	966
UMK	737	9	280	1210	39	225
UPNM	337	1	6	562	63	28