

AI in Biomedical Publications

A PubMed-Based Survey

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Dec. 24, 2021



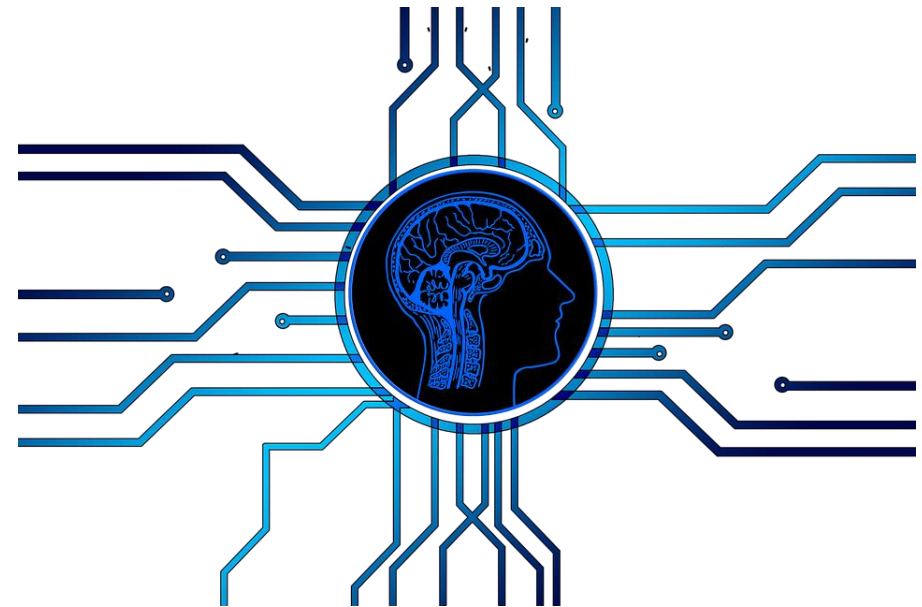
Why limited to AI?

- **Smart healthcare** is a fashion term with a broad meaning



<https://free-vectors.net/technology/fitness-bracelet-vector>

- **Artificial intelligence (AI)** is well-documented keyword for indexing



<https://www.maxpixel.net/Artificial-Intelligence-Brain-Think-Control-3382509>

Why limited to PubMed?

- Biomedicine oriented
- Comprehensive indexing with controlled vocabulary thesaurus (MeSH: Medical Subject Headings)
- Free

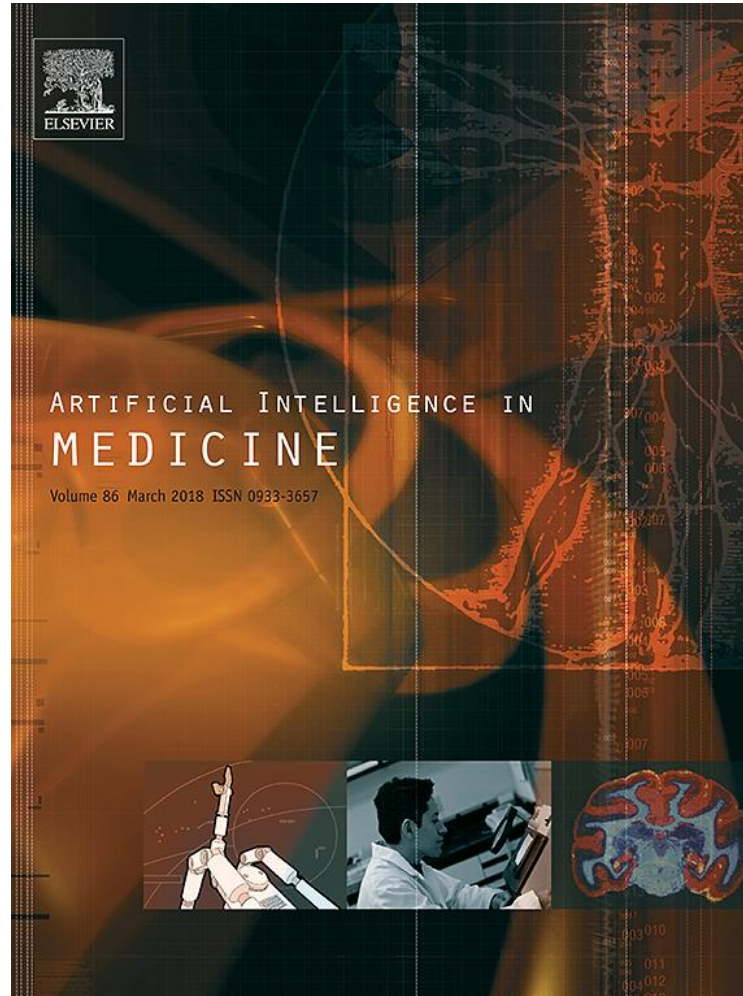


America's two greatest gifts
to the world are
jazz and Medline.

Smith R, Chalmers I.
Britain's gift: a "Medline" of synthesised evidence.
BMJ 2001;323:1437-1438.
PMID: 11751342

Medicine has a long tradition in AI

Artificial Intelligence in Medicine



1989
Vol. 1

MeSH

All MeSH Categories

Phenomena and Processes Category

Mathematical Concepts

Algorithms

Artificial Intelligence

Machine Learning

Deep Learning

Supervised Machine Learning +

Unsupervised Machine Learning

Sentiment Analysis

All MeSH Categories

Information Science Category

Information Science

Computing Methodologies

Algorithms

Artificial Intelligence

Computer Heuristics

Expert Systems

Fuzzy Logic

Knowledge Bases

Biological Ontologies +

Machine Learning

Deep Learning

Supervised Machine Learning +

Unsupervised Machine Learning

Natural Language Processing

Neural Networks, Computer

Deep Learning

Robotics

Sentiment Analysis

Artificial Intelligence

Year introduced: 1986

Machine Learning

Year introduced: 2016

Deep Learning

Year introduced: 2019

Natural Language Processing

Year introduced: 1987

Neural Networks, Computer

Year introduced: 1992

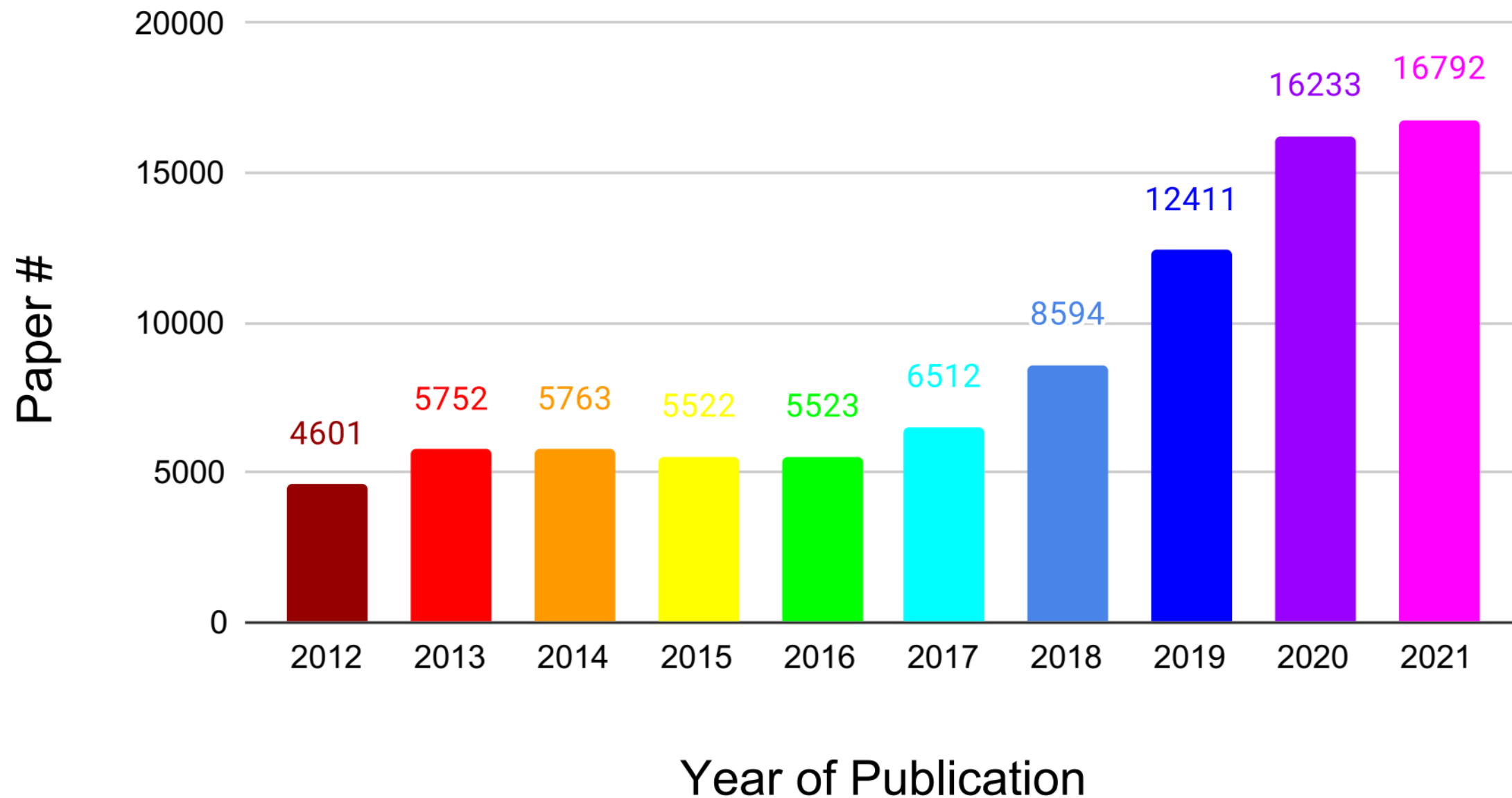
Sentiment Analysis

Year introduced: 2022



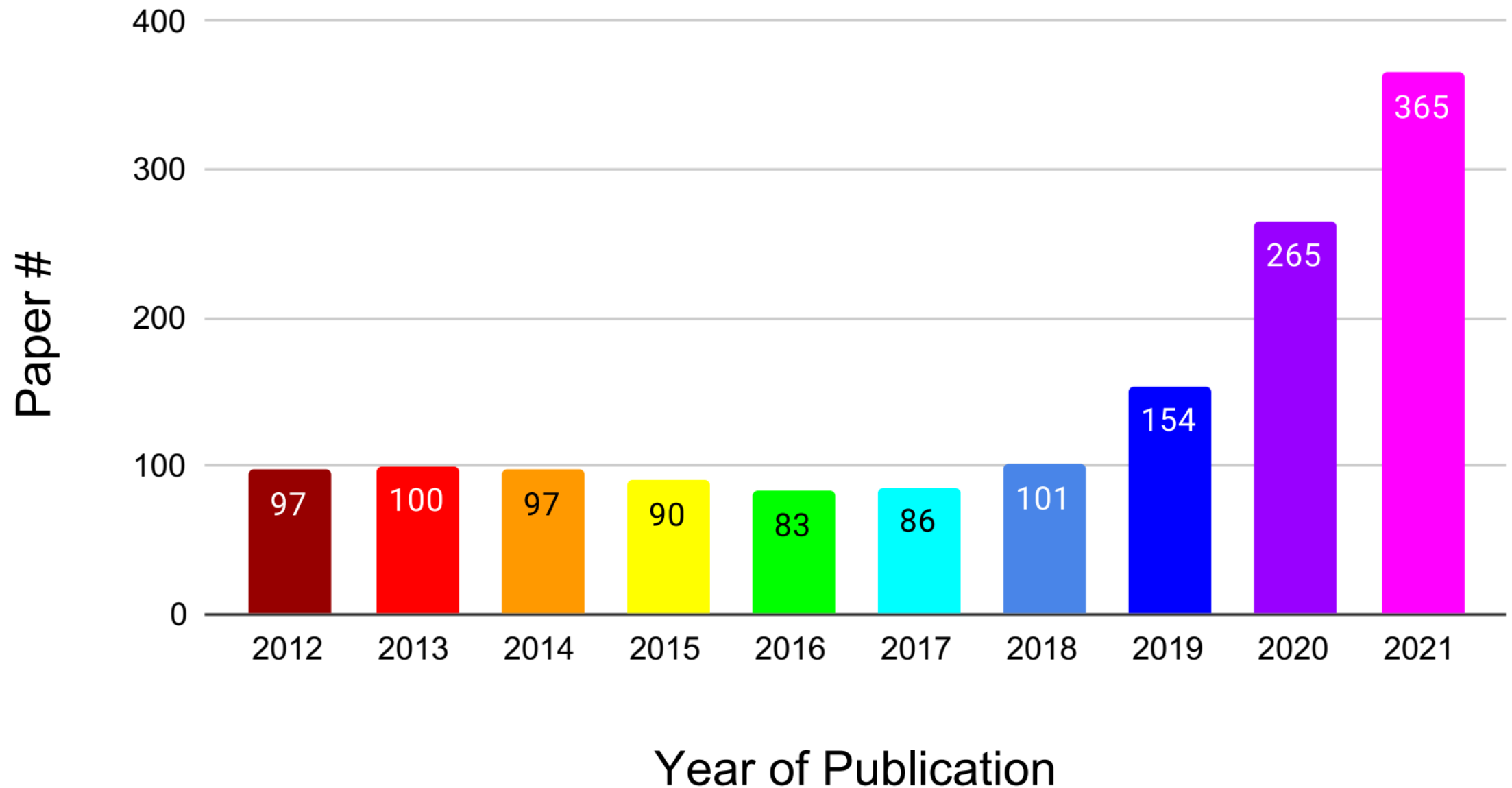
"artificial intelligence"[mh]

Total: 131,872 records



"artificial intelligence"[mh] AND taiwan[ad]

Total: 2,067 records



Journals with AI Papers (> 100) in 2020

Journal	Paper #
Scientific Reports	654
Sensors	628
PLOS ONE	590
Neural Networks	344
Annual International Conference of the IEEE Engineering in Medicine and Biology Society	341
IEEE Journal of Biomedical and Health Informatics	215
Computer Methods and Programs in Biomedicine	181
International Journal of Molecular Sciences	169
Bioinformatics	167
Nature Communications	148
Computers in Biology and Medicine	142

Journals with AI Papers (> 100) in 2020

Journal	Paper #
International Journal of Environmental Research and Public Health	142
IEEE Transactions on Medical Imaging	134
Biomed Research International	133
BMC Bioinformatics	132
Medical Physics	131
Journal of Chemical Information and Modeling	126
Studies in Health Technology and Informatics	125
Journal of Medical Internet Research	117
Artificial Intelligence in Medicine	109
Physics in Medicine and Biology	101

Total: 2,292 journals

AI Papers in 2020 (n = 16,233) by Subject

Subject	Paper #	Subject	Paper #
Medical Informatics	1,970	Radiology	852
Science	1,613	Biology	710
Medicine	1,558	Chemistry	579
Biomedical Engineering	1,397	Biochemistry	573
Neurology	1,092	Biophysics	505
Diagnostic Imaging	1,052	General Surgery	441
Biotechnology	959	Neoplasms	428
Molecular Biology	909	Environmental Health	420
Technology	862	Genetics	342
Computational Biology	862	Physics	341

* Broad Subject Terms for Indexed Journals
<https://journal-reports.nlm.nih.gov/broad-subjects/>

AI Papers in 2020 (n = 16,233) by Subject

Subject	Paper #	Subject	Paper #
Cell Biology	295	Nuclear Medicine	173
Cardiology	282	Physical and Rehabilitation Medicine	172
Gastroenterology	240	Brain	170
Ophthalmology	228	Toxicology	169
Public Health	224	Psychology	156
Vascular Diseases	216	Health Services Research	155
Pharmacology	206	Physiology	138
Radiotherapy	201	Therapeutics	131
Urology	190	Pulmonary Medicine	130
Psychiatry	177	Genetics, Medical	123

Total: 117 subjects

AI Papers in 2020 (n = 16,233) by MeSH

<u>Computer Heuristics</u>	11	
<u>Expert Systems</u>	37	
<u>Fuzzy Logic</u>	202	
<u>Knowledge Bases</u>	142	
<u>Biological Ontologies</u> +	68	
<u>Machine Learning</u>	5,025	
<u>Deep Learning</u>	2,843	
<u>Supervised Machine Learning</u> +	262	
<u>Unsupervised Machine Learning</u>	145	
<u>Natural Language Processing</u>	390	
<u>Neural Networks, Computer</u>	4,191	
<u>Deep Learning</u>		
<u>Robotics</u>	1,316	
<u>Sentiment Analysis</u>	0	

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Display options ⚙

By publ. year

2016: 1
2017: 61
2018: 705
2019: 1,874
2020: 2,843
2021: 3,071
2022: 35

8,590 results



Page

1

of 43



Journals with DL Papers

Journal	Paper #
Scientific Reports	498
Sensors	386
PLOS ONE	282
Annual International Conference of the IEEE Engineering in Medicine and Biology Society	193
IEEE Journal of Biomedical and Health Informatics	169
Computers in Biology and Medicine	161
Neural Networks	161
IEEE Transactions on Medical Imaging	158
Medical Physics	153
Computer Methods and Programs in Biomedicine	136

Journals with DL Papers

Journal	Paper #
Nature Communications	123
European Radiology	118
Medical Image Analysis	111
BMC Bioinformatics	109
Radiology	100
Physics in Medicine and Biology	93
Bioinformatics	91
International Journal of Computer Assisted Radiology and Surgery	85
Computational and Mathematical Methods in Medicine	76
Briefings in Bioinformatics	75

Total: 1,137 journals

DL Papers (n = 8,590) by Subject

Subject	Paper #	Subject	Paper #
Medical Informatics	1,259	Biology	432
Diagnostic Imaging	1,008	Biophysics	405
Science	1,002	Physics	357
Radiology	893	Molecular Biology	279
Medicine	768	Neoplasms	243
Biomedical Engineering	753	Radiotherapy	239
Computational Biology	553	Chemistry	217
Neurology	502	Biochemistry	201
Biotechnology	469	Ophthalmology	191
Technology	444	Nuclear Medicine	190

DL Papers (n = 8,590) by Subject

Subject	Paper #	Subject	Paper #
General Surgery	154	Genetics, Medical	67
Environmental Health	128	Toxicology	65
Gastroenterology	123	Therapeutics	63
Cardiology	121	Pharmacology	61
Vascular Diseases	96	Brain	55
Genetics	94	Physiology	55
Cell Biology	90	Orthopedics	55
Pathology	78	Dermatology	52
Clinical Laboratory Techniques	70	Public Health	48
Health Services	67	Dentistry	48

Total: 109 subjects

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Sorted by: Most recent ↓

Display options ⚙️

By publ. year

2018: 4

2019: 28

2020: 56

2021: 88

2022: 1

177 results



Page

1

of 1



Journals with Taiwan's DL Papers

Journal	Paper #
Sensors	26
Scientific Reports	12
Computers in Biology and Medicine	8
Computer Methods and Programs in Biomedicine	7
International Journal of Environmental Research and Public Health	7
Nature Communications	5
BMC Bioinformatics	4
International Journal of Molecular Sciences	4
Journal of Medical Internet Research	4
Studies in Health Technology and Informatics	4
Translational Vision Science & Technology	4

Total: 80 journals

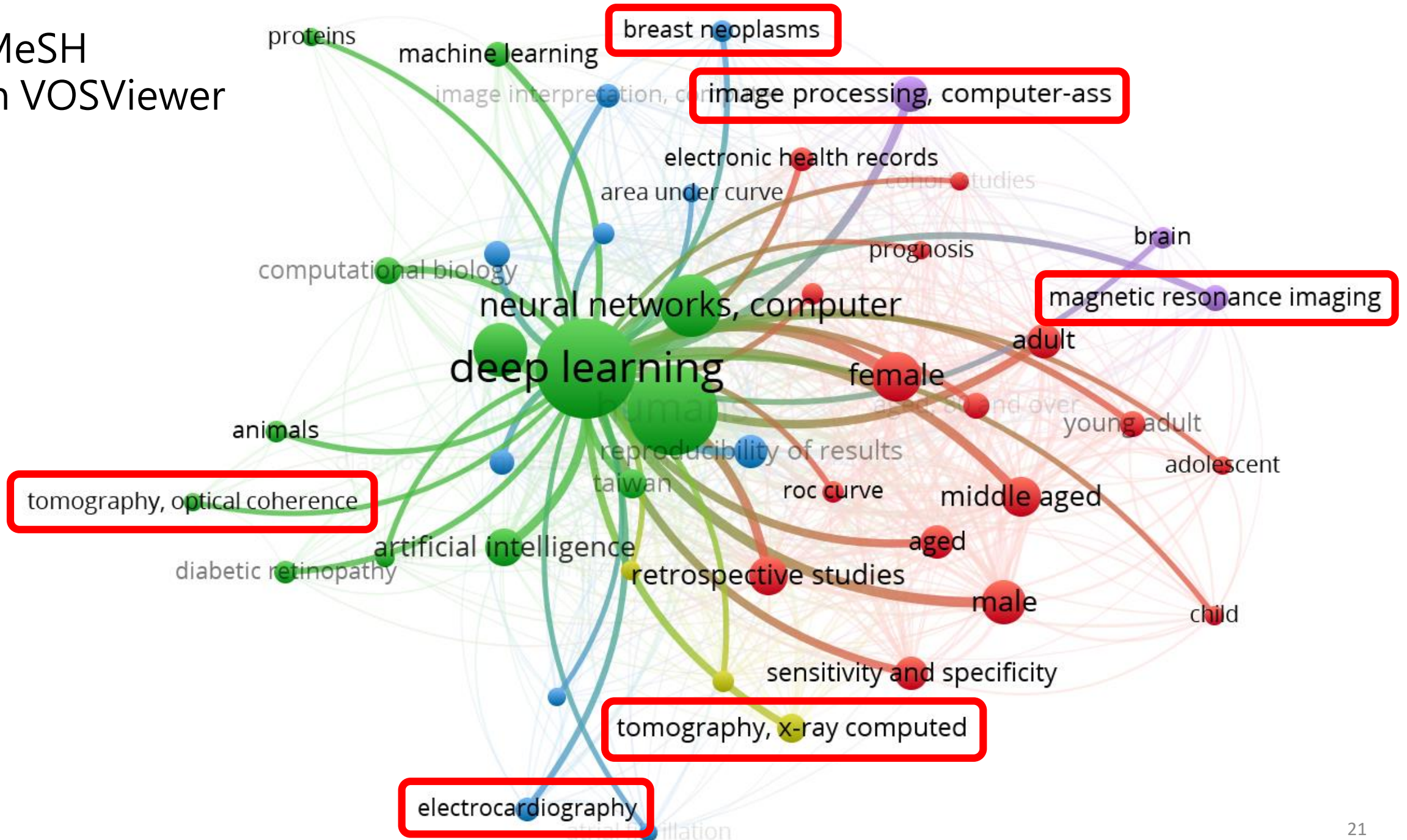
Taiwan's DL Papers (n = 177) by Subject

Subject	Paper #
Medical Informatics	40
Technology	30
Biotechnology	27
Science	20
Medicine	17
Biology	16
Computational Biology	11
Chemistry	11
Diagnostic Imaging	11
Radiology	10

Subject	Paper #
Environmental Health	8
Public Health	7
Physics	6
Biophysics	5
Health Services Research	5
Biomedical Engineering	5
Nuclear Medicine	4
Cardiology	4
Biochemistry	4
Neurology	4

Total: 40 subjects

MeSH in VOSViewer



Taiwan's DL Papers by Institution

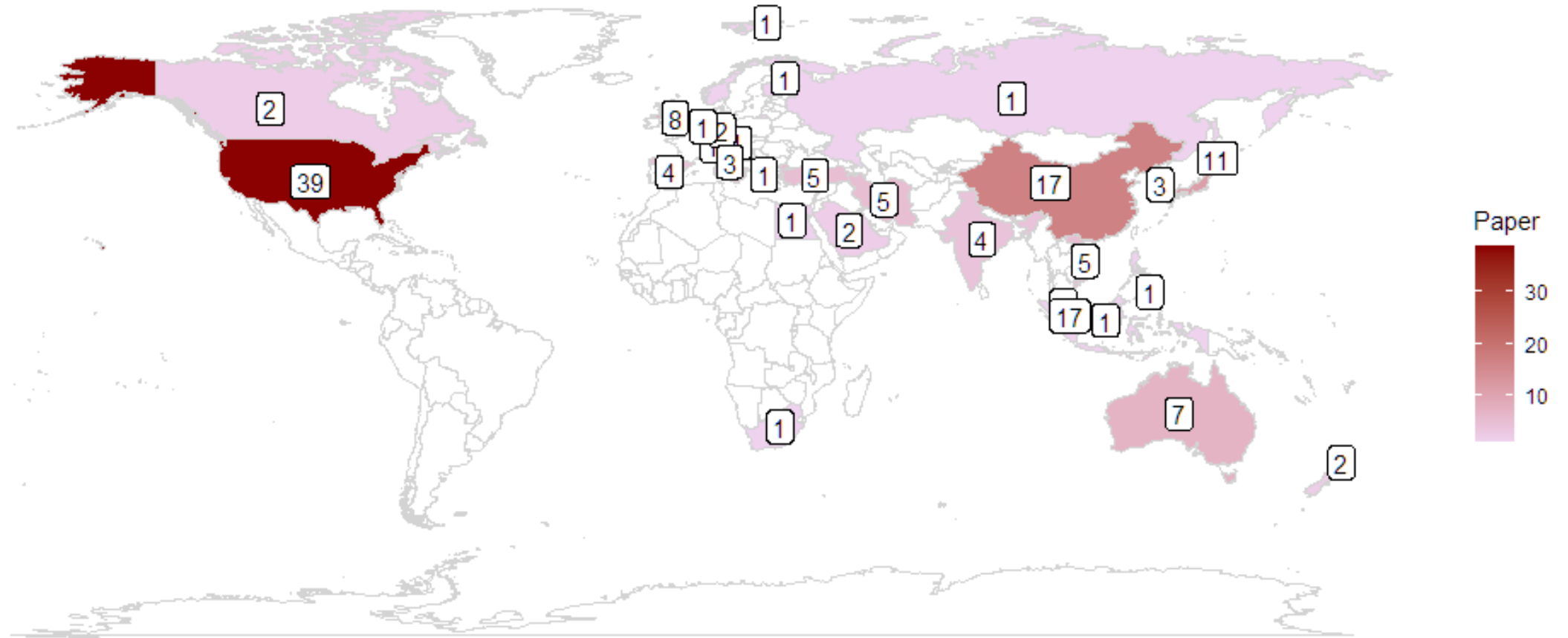
University (n = 50)	Paper #
National Yang Ming Chiao Tung University	34
National Taiwan University	32
Taipei Medical University	21
Asia University	20
Chang Gung University	18
Yuan Ze University	12
National Central University	8
National Defense Medical Center	8
National Tsing Hua University	7
China Medical University	6
Kaohsiung Medical University	6
National Cheng Kung University	6
National Taiwan Normal University	6

Hospital (n = 44)	Paper #
National Taiwan University Hospital	12
China Medical University Hospital	10
Taipei Veterans General Hospital	9
Linkou Chang Gung Memorial Hospital	8
Taipei Medical University Hospital	8
Tri-Service General Hospital	7
Wan Fang Hospital	7
Cheng Hsin General Hospital	6
Far Eastern Memorial Hospital	5
Taichung Veterans General Hospital	5
E-Da Hospital	4
Kaohsiung Chang Gung Memorial Hospital	4
Keelung Chang Gung Memorial Hospital	4 ²²

Taiwan's DL Papers by Institution

Others (n = 14)	Paper #
Academia Sinica	9
Industrial Technology Research Institute	4
aetherAI Co.	3
Acer Inc.	2
Atgenomix Inc.	1
AU Optronics Co.	1
Boardtek Electronics Co.	1
Ministry of Science and Technology	1
Muen Biomedical and Optoelectronic Technologies Inc.	1
National Center for High-Performance Computing	1
National Health Research Institutes	1
Naval Academy	1
Naval Meteorological and Oceanographic Office	1
Taiwan Endemic Species Research Institute	1

Taiwan's DL Papers by Collabor. Country

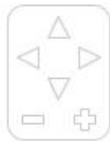


Taiwan's DL Papers by Collabor. Country

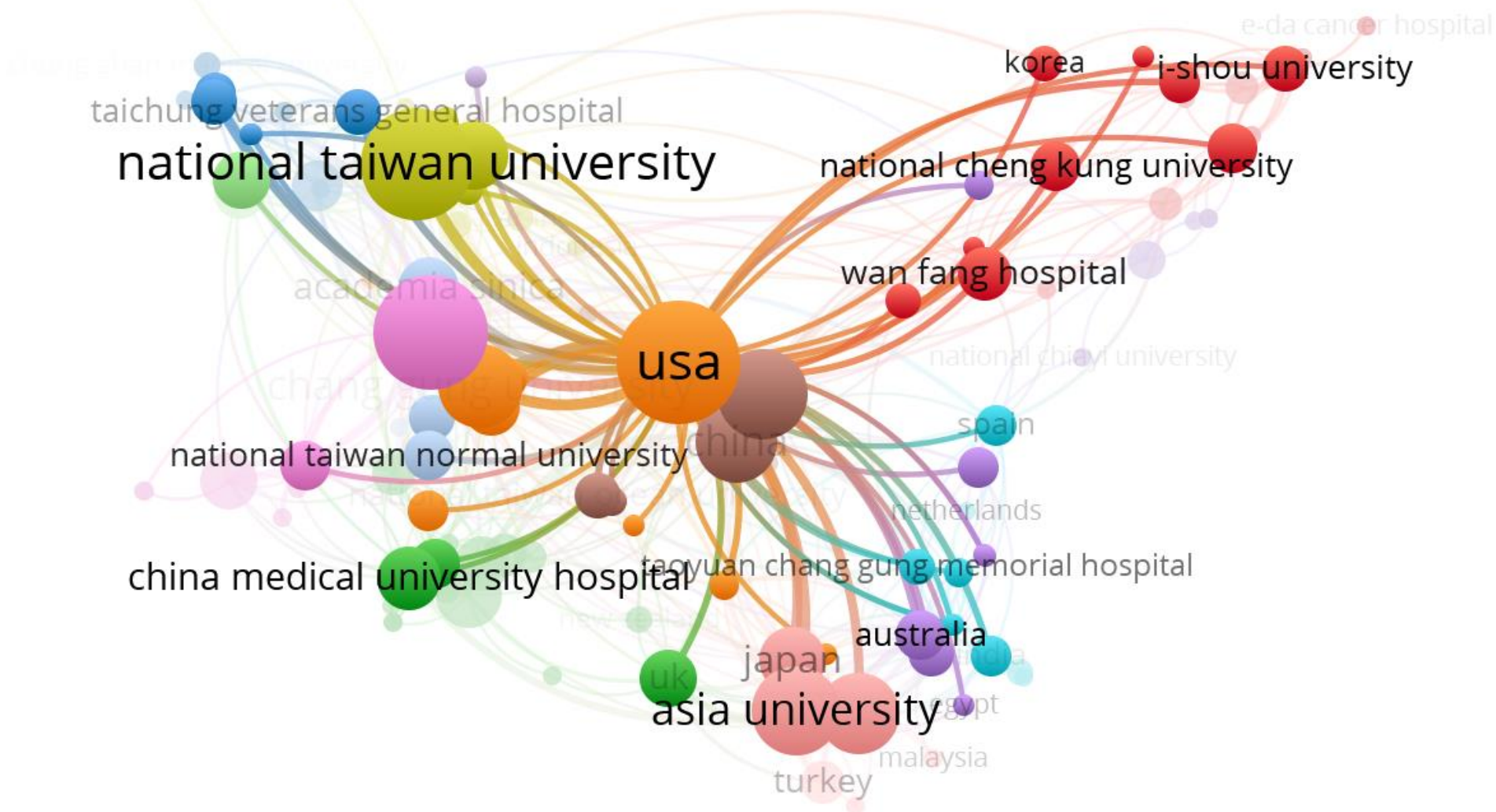
Country	Paper #
USA	39
China	17
Singapore	17
Japan	11
UK	8
Australia	7
Iran	5
Turkey	5
Vietnam	5
India	4

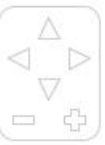
Country	Paper #
Spain	4
Italy	3
South Korea	3
Canada	2
Germany	2
New Zealand	2
Saudi Arabia	2
Austria	1
Egypt	1
Finland	1

Country	Paper #
Greece	1
Indonesia	1
Malaysia	1
Netherlands	1
Norway	1
Philippines	1
Russia	1
South Africa	1
Switzerland	1



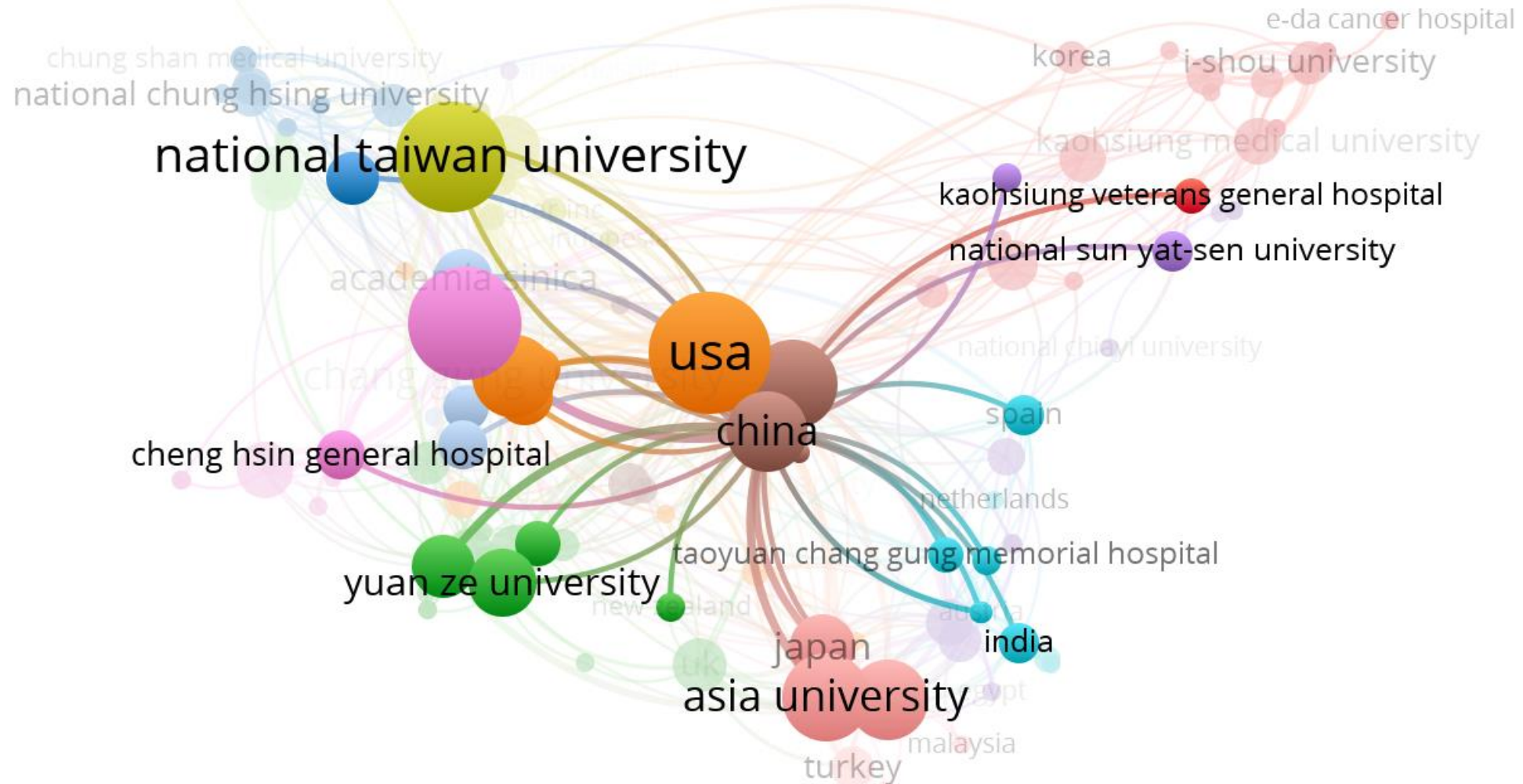
USA Network

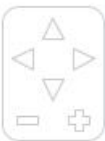




national taiwan university hospital beihu branch

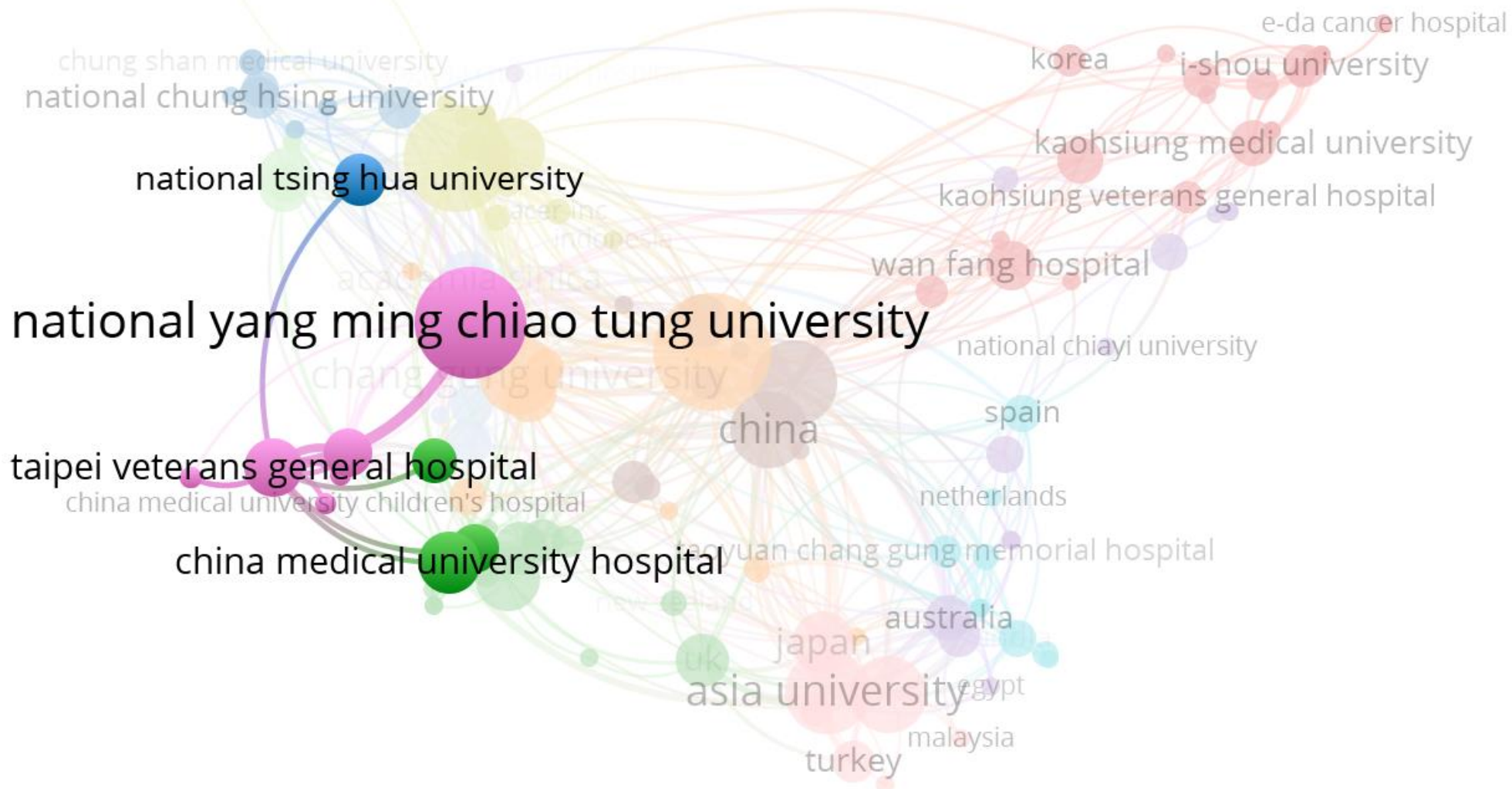
China Network





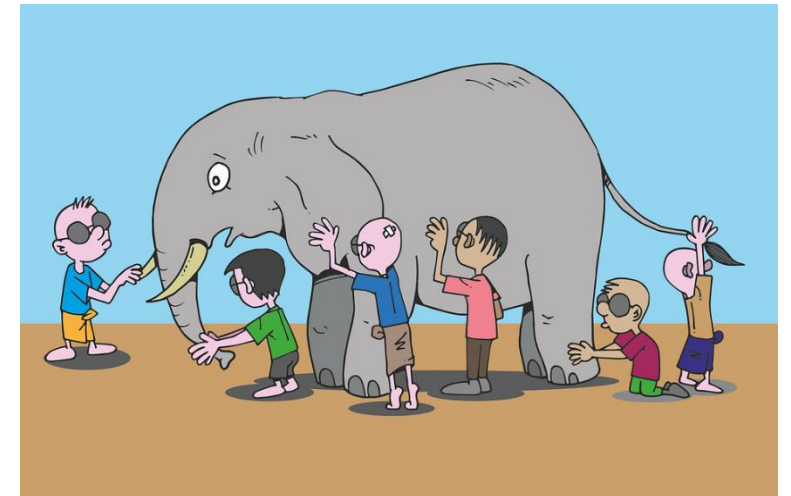
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TVGH Network



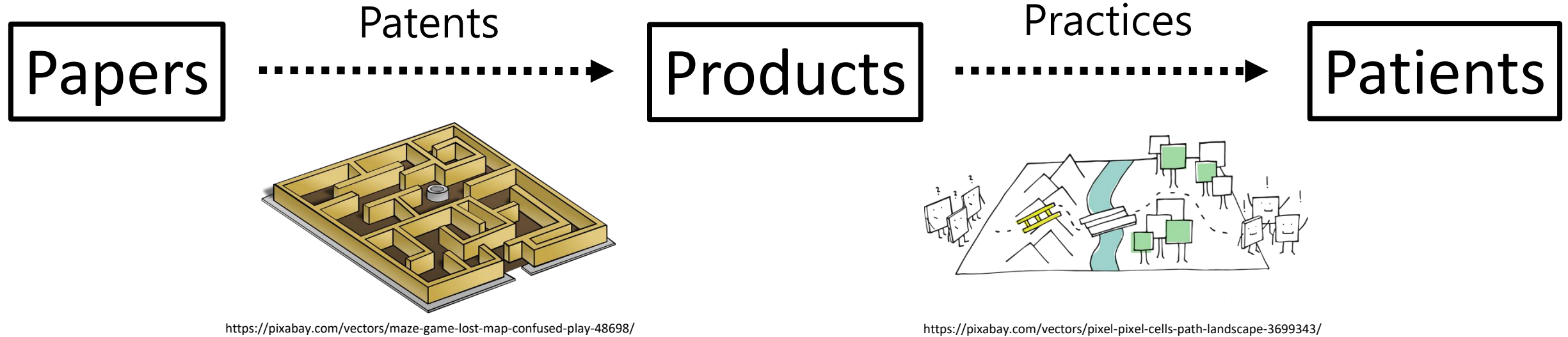
Limitations

- Not purely biomedical
- Only bibliometric analysis
- No ranking of authorship
- No fractional counting in bibliometric networks
- Lag in indexing
- Inaccuracy in indexing
- Ambiguity in author names
- Unorganized organization names



<https://pixabay.com/vectors/blind-men-elephant-story-feel-see-1458438/>

Prospects



Challenges
Changes
Chances



臺北榮民總醫院 大數據中心

Big Data Center

最新消息

單位簡介

申請流程

相關法規

部科宣導

<https://wd.vghttp.e.gov.tw/bdc/>



<https://pixabay.com/vectors/merry-christmas-happy-holidays-227915/>

