Sector Mapping of Higher Education in Computer Science, China

Report by Innovation Centre Denmark, Shanghai

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PART 1: INTRODUCTION

1. PURPOSE OF THIS MAPPING

In recent decades, along with the fast-paced development of digitalization and web-based solutions, China experiences an increasing demand for innovative technology and young talents in Computer Science (CS). Over the past 20 years, China has invested heavily in building academic and innovation strength in this area, including higher education, scientific research output and construction of state key laboratory. By the end of 2021, China ranked first globally when looking at the citations of publications in computer science.

This report aims to provide an overview of China's top institutions and authors in Computer Science. We also looked into the undergraduate and master study in computer science in China to provide an initial profile of people who successfully enter this area in China's first-tier institutions. We hope that this report can help map the Chinese landscape within Computer Science.

2. DATA SOURCE

We use Scopus as the bibliographic database for publications in computer science. We chose the publications, which has affiliations with China and rank the institutions and main authors by the number of publications from 2017 to 2022. Over 686,654 publications are covered in this report.

For the 2021 graduate school admission rate, the data source is the public documents on the official sites of the graduate school of universities. When calculating the student recruitment number, the Master's Program Catalogue is limited to 0812 (Computer Science and Technology) on the official website of *China Graduate Student Recruitment Information.*

3. DEFINITION AND METHODS

3.1 TYPE OF UNIVERSITY IN CHINA

To display student data more effectively, we firstly categorized the students by the type of their university. There are four main kinds of university in China. Universities that are included in the 985-project and 211-project are usually considered as the key universities in China.

985-project University

Project 985 is the project started in 1985 May, through which China aimed to establish a list of universities for world-class international research. There are 39 universities included in the 985-project in China.

211-project University

It is the largest and highest-level construction project in the field of higher education since the founding of New China. There are 115 universities included in the 211-project in China. Different from 985-project university, 211-project university is usually strong in certain discipline.

Other University

Universities which are not included in 985-project or 211-project are recognized as other normal universities. The difficulty of entering of this kind of normal universities in China is lower than 985 and 211 universities but higher than entering a college.

Military University/Research Institution

Different from normal university, military universities are usually funded by country's defense spending in China. There have been more recruitment requirements on student's health and physical capability and the management style would be militarized.

In China, some research institutions like Chinese Academy of Sciences (CAS), Chinese Academy of Social Sciences (CASS) also have the access to recruit graduate school students, but the scale of recruitment is generally small and the research direction is usually fixed.

3.2 SUB-AREAS OF COMPUTER SCIENCE

In this report, we separate computer science into eight sub-areas to differentiate each university's strength and focus. They are **Algorithms and Data Structures, Computer Architecture, Software Engineering and Programming, Artificial Intelligence and Robotics, Database and Information Technology, Human-Computer Interaction, Security and Information Assurance, Networking and Communication**.

We chose these eight sub-areas since each has its own direction of development, and the undergraduate students usually have to choose one as their main development direction after the first year when they enter the university.

4. OVERVIEW OF THE REPORT

Part 2 presents the overview of student recruitment of China's higher education in computer science. The total volume of undergraduate students has been increasing steadily year by year, meanwhile students from 985 and 211 project universities keep at around 5% of the total undergraduate students. For graduate student, the admission rate of computer science appears rather low for some representative 985-project universities.

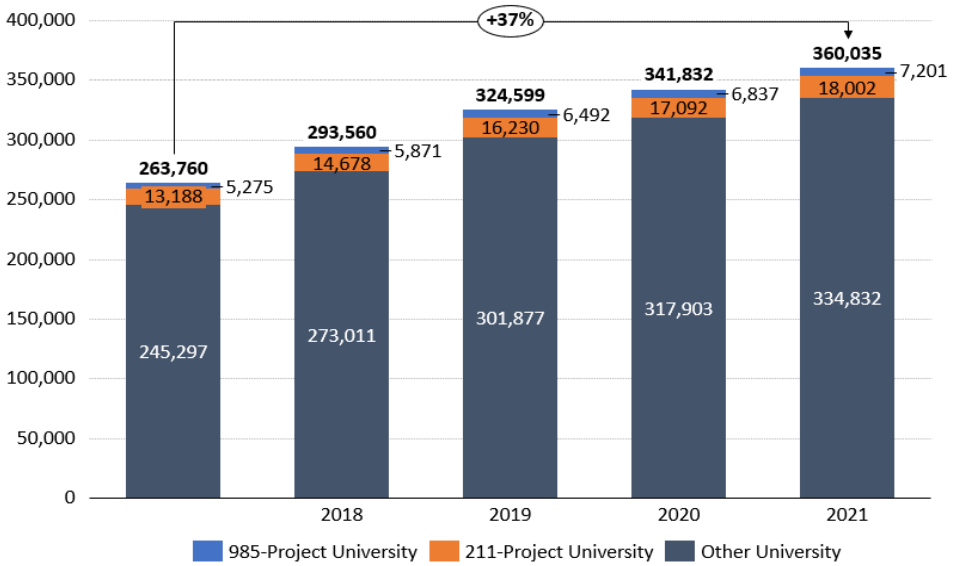
Part 3 presents the top 15 institutions in 8 sub-areas in computer science, ranked by publications indexed in Scopus from 2017 to 2022.

- Tsing Hua University, Shanghai Jiaotong University, Zhejiang University, University of Electronic Science and Technology of China, Harbin Institute of Technology and Beihang University rank in top 15 in all the sub-areas in computer science
- Chinese Academy of Sciences (Research institution) and University of Chinese Academy of Sciences (Affiliated university) both appear as top 5 institutions in nearly all the sub-areas
- Two 211-project universities: Beijing University of Post and Telecommunications and Xidian University, show strong capacity in internet security and communications sub-areas. Beijing University of Post and Telecommunications also shows strengths in programming and database & information technology.

Part 4 presents the top 15 authors with Chinese affiliations in 8 sub-areas in computer science, ranked by number of publications and number of citations from 2017 to 2022. Most of the main authors are from the top 15 institutions in Part 3, except for some authors who have changed their affiliations to technology companies.

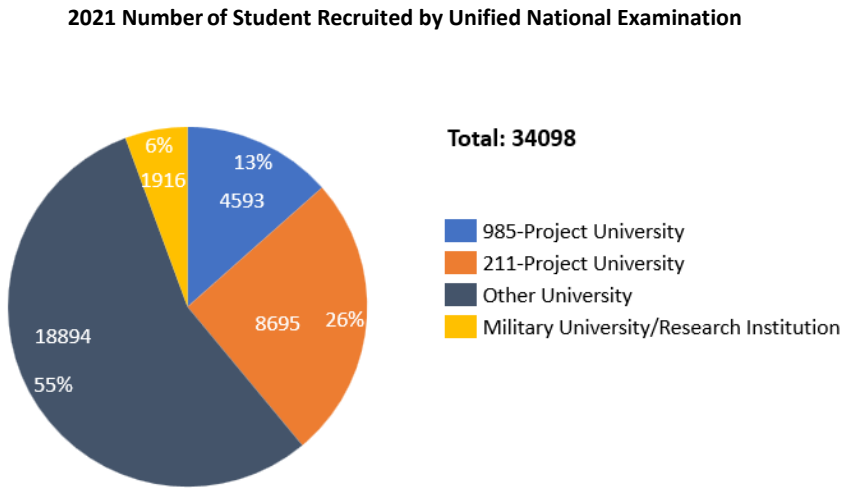
PART 2: OVERVIEW OF CHINA'S HIGHER EDUCATION IN COMPUTER SCIENCE

1. UNDERGRADUATE STUDENTS RECRUITMENT IN COMPUTER SCIENCE



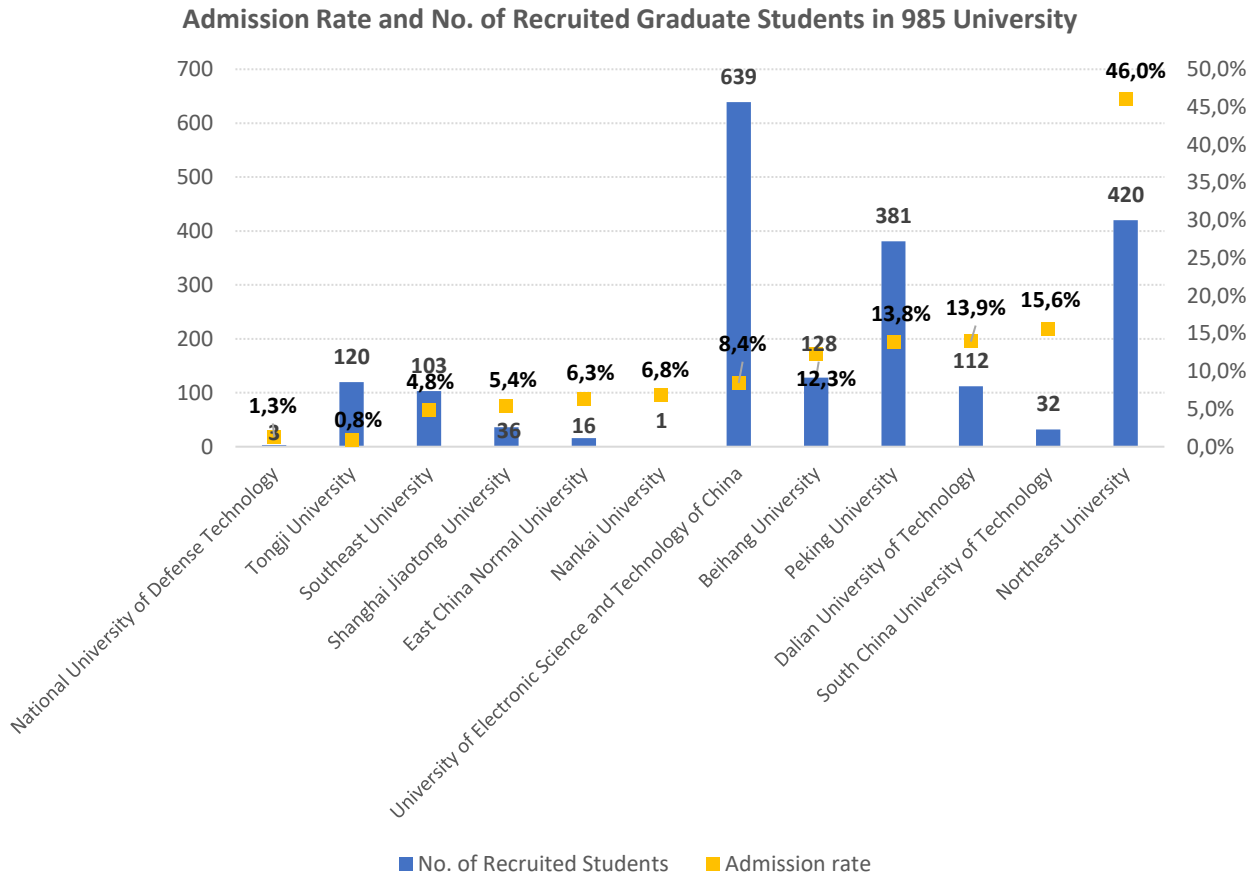
From 2017 to 2021, the number of undergraduate computer science students in China has increased 36.5%. In 2021, the computer science undergraduate students number reached 0.36 million. Percentage of 985 and 211 university students keep around 2% and 5% of the total. In 2021, 985 and 211 university recruited about 25202 students in Computer Science.

2. 2021 GRADUATE STUDENTS RECRUITMENT IN COMPUTER SCIENCE



In 2021, there were over 34,000 students are recruited by graduate school in 985, 211 project universities, other universities, military universities and research institutions through China's national unified examination. 985, 211 project universities' graduate students take about 39% of the total graduate students recruited in Computer Science major, which is a much larger proportion compared to their proportion in the undergraduate student (7%).

3. ADMISSION RATE OF TWELVE 985-PROJECT UNIVERSITIES IN COMPUTER SCIENCE



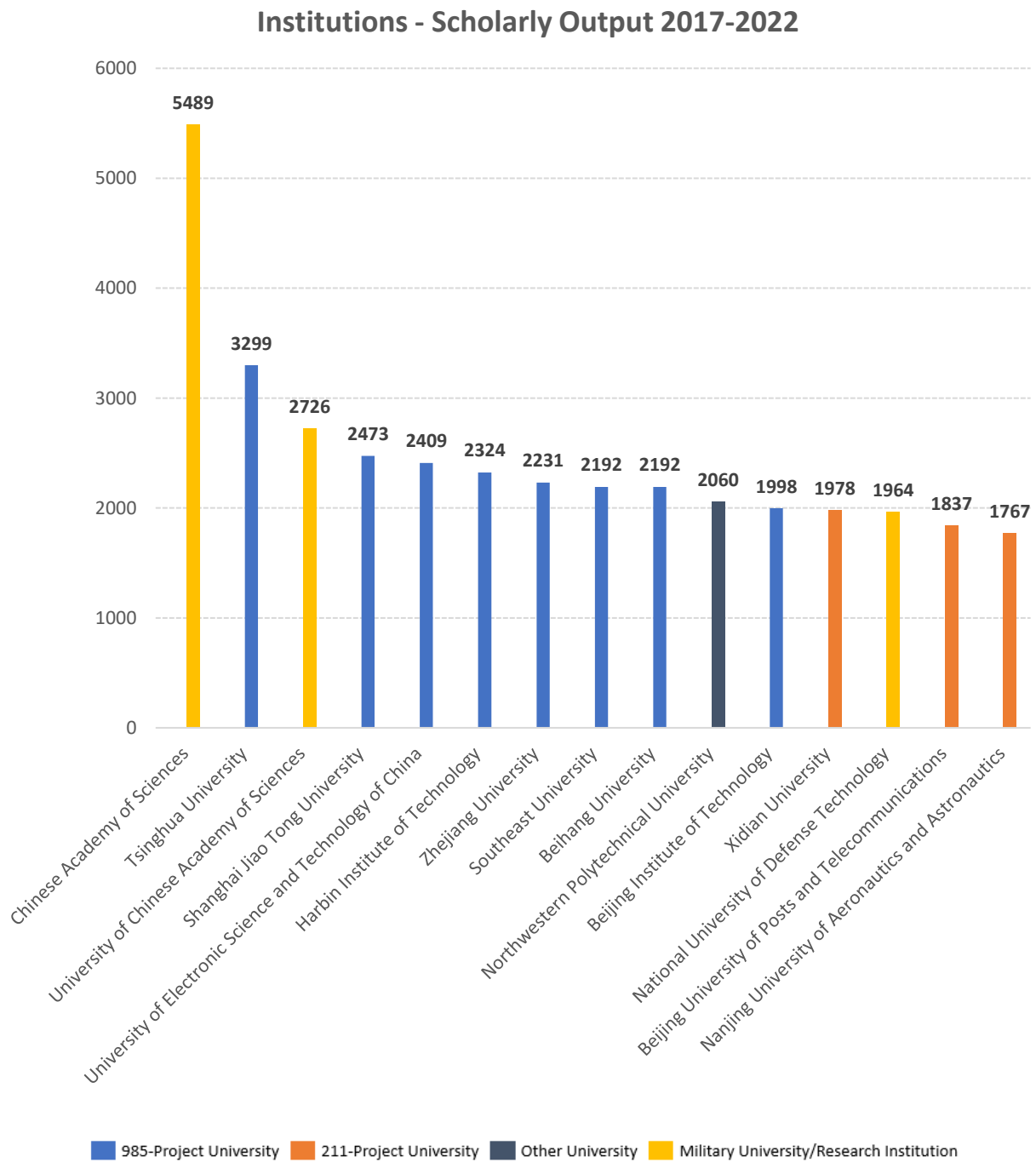
To look into the difficulty in entering the 985-project universities' graduate school of computer science, we analyzed the 2021 admission rate of twelve 985-project universities' Computer Science department. The admission rate of the other twenty-seven 985-project universities is not available on the official site.

For some well-known 985-project universities like Shanghai Jiaotong University, Tongji University, they have extremely high thresholds for Computer Science graduate students and the rate of admission is less than 6%. Particularly, for military university like National University of Defense Technology, they have relatively stricter recruitment requirements despite examination score. Among these twelve 985-project universities, Northeast University has an outstanding high admission rate of computer science student, which is up to 46%.

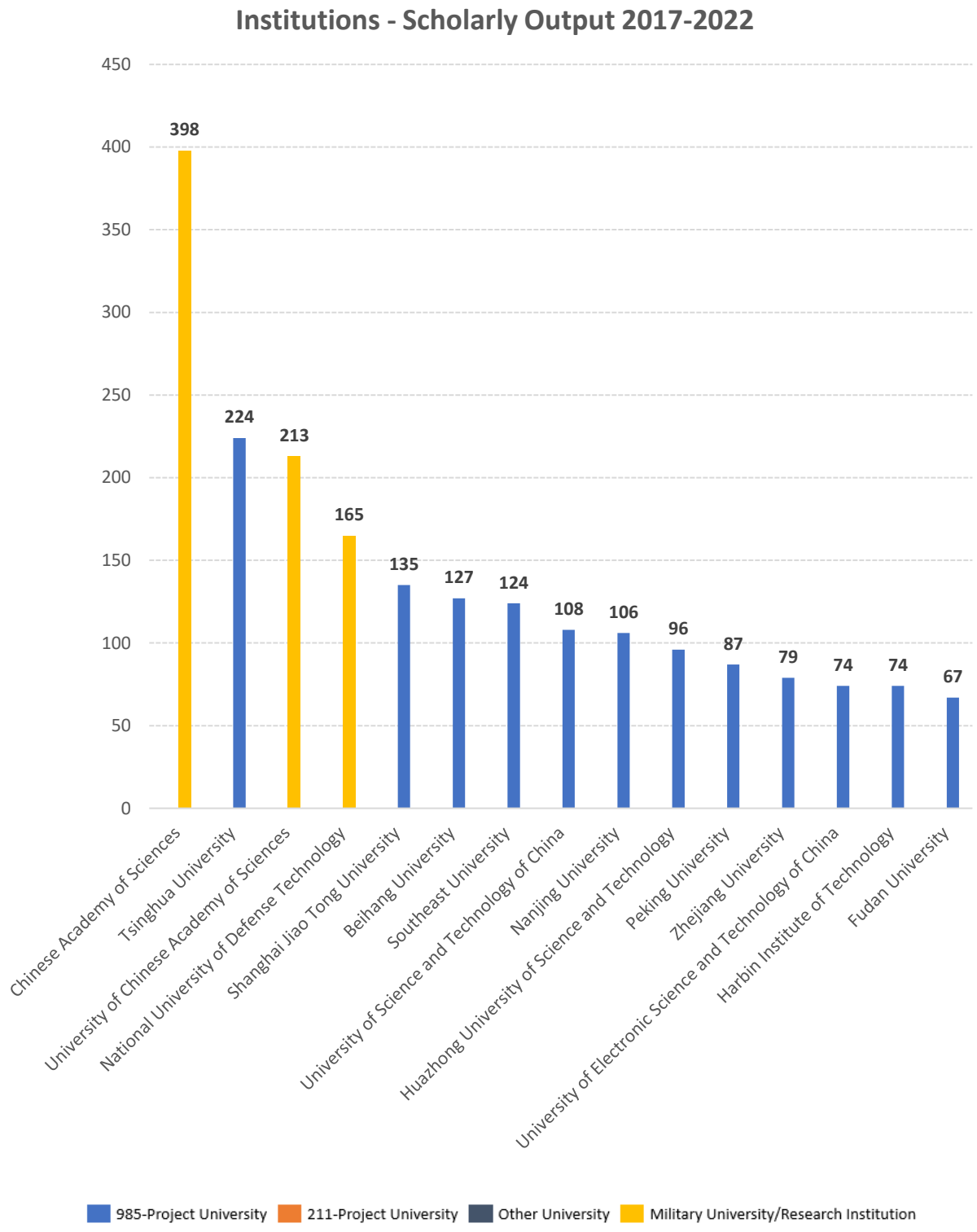
PART 3: INSTITUTIONS

TOP INSTITUTIONS IN TERMS OF SCHOLARLY OUTPUT 2017-2022

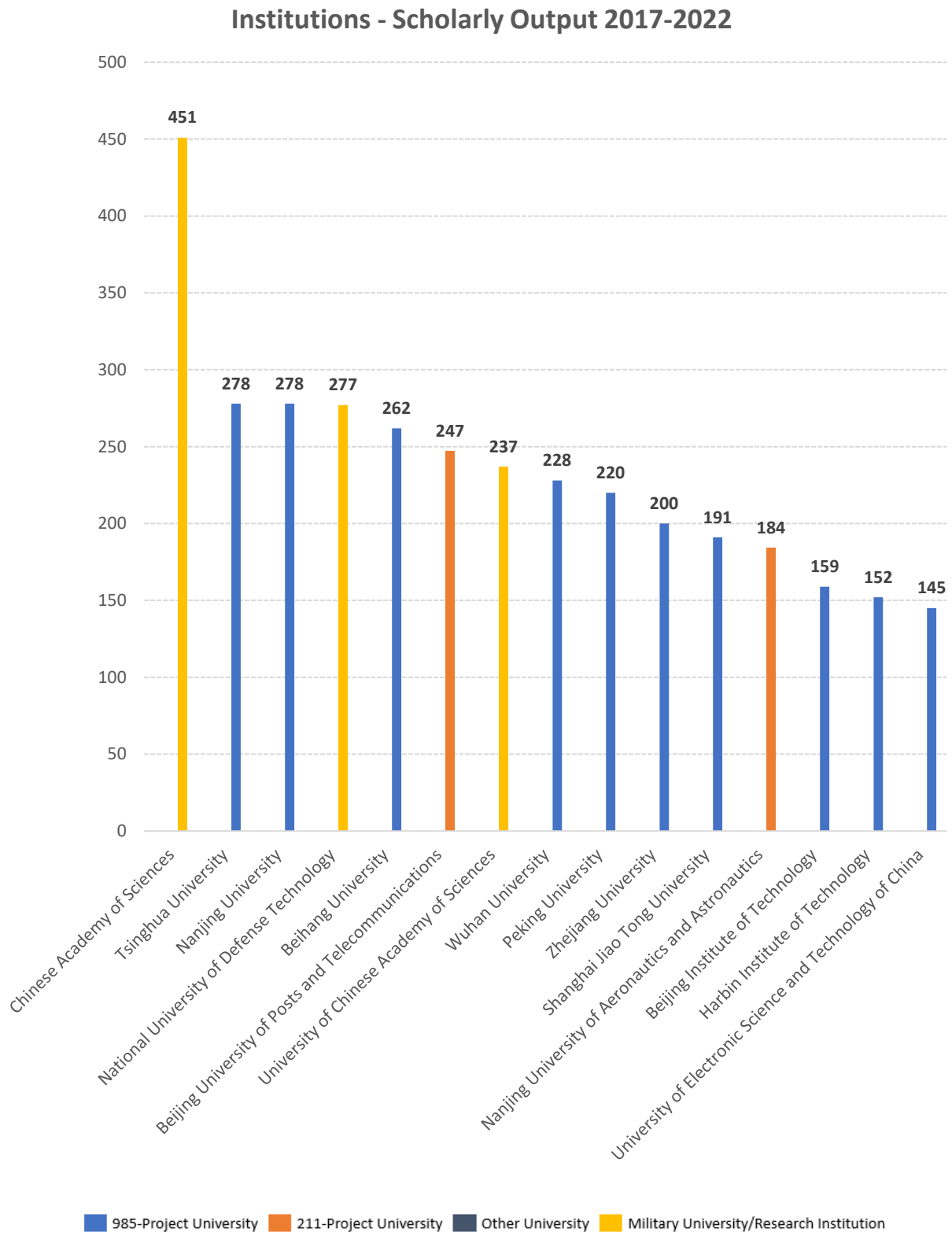
3.1 ALGORITHMS AND DATA STRUCTURES



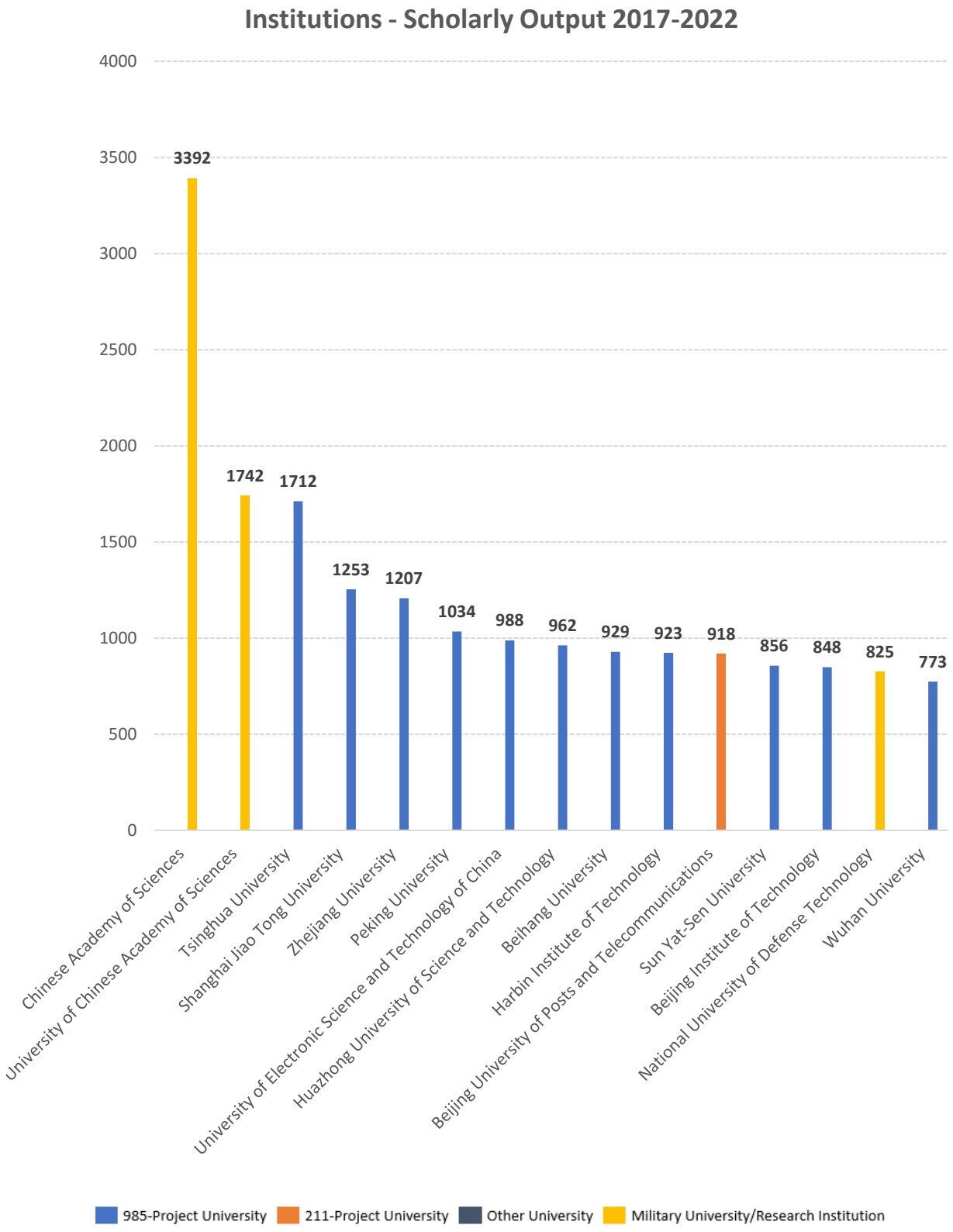
3.2 COMPUTER ARCHITECTURE



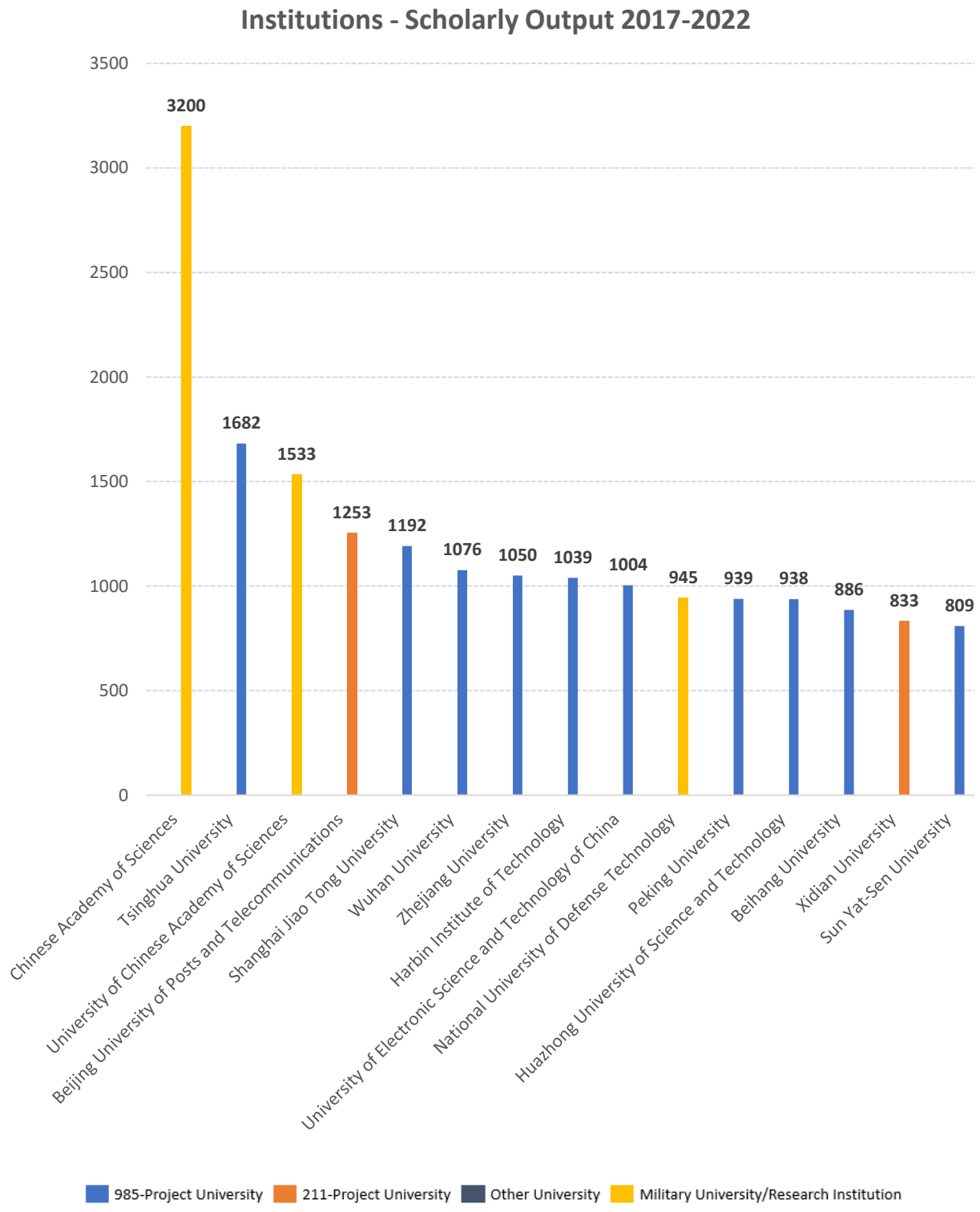
3.3 SOFTWARE ENGINEERING & PROGRAMMING



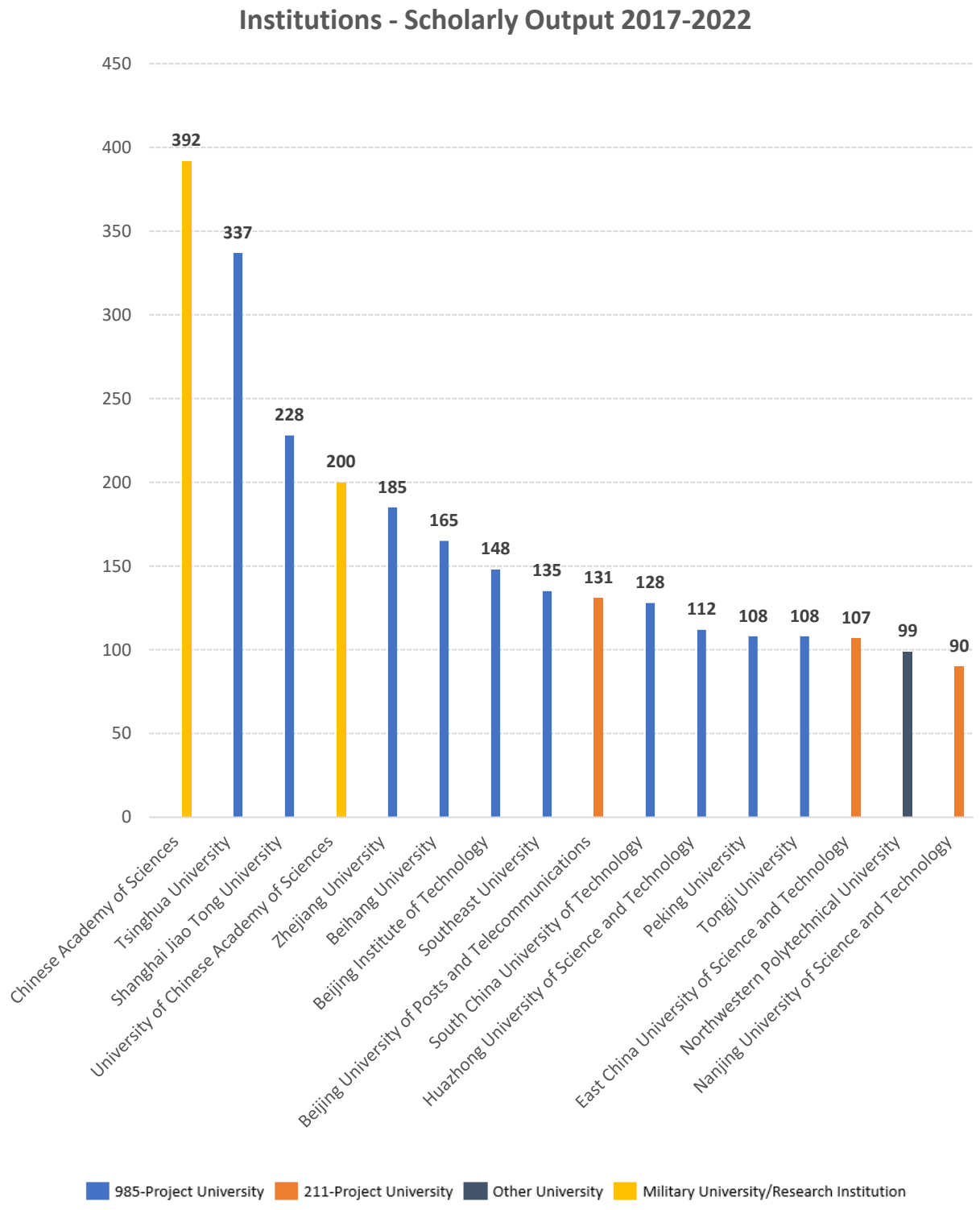
3.4 ARTIFICIAL INTELLIGENCE AND ROBOTICS



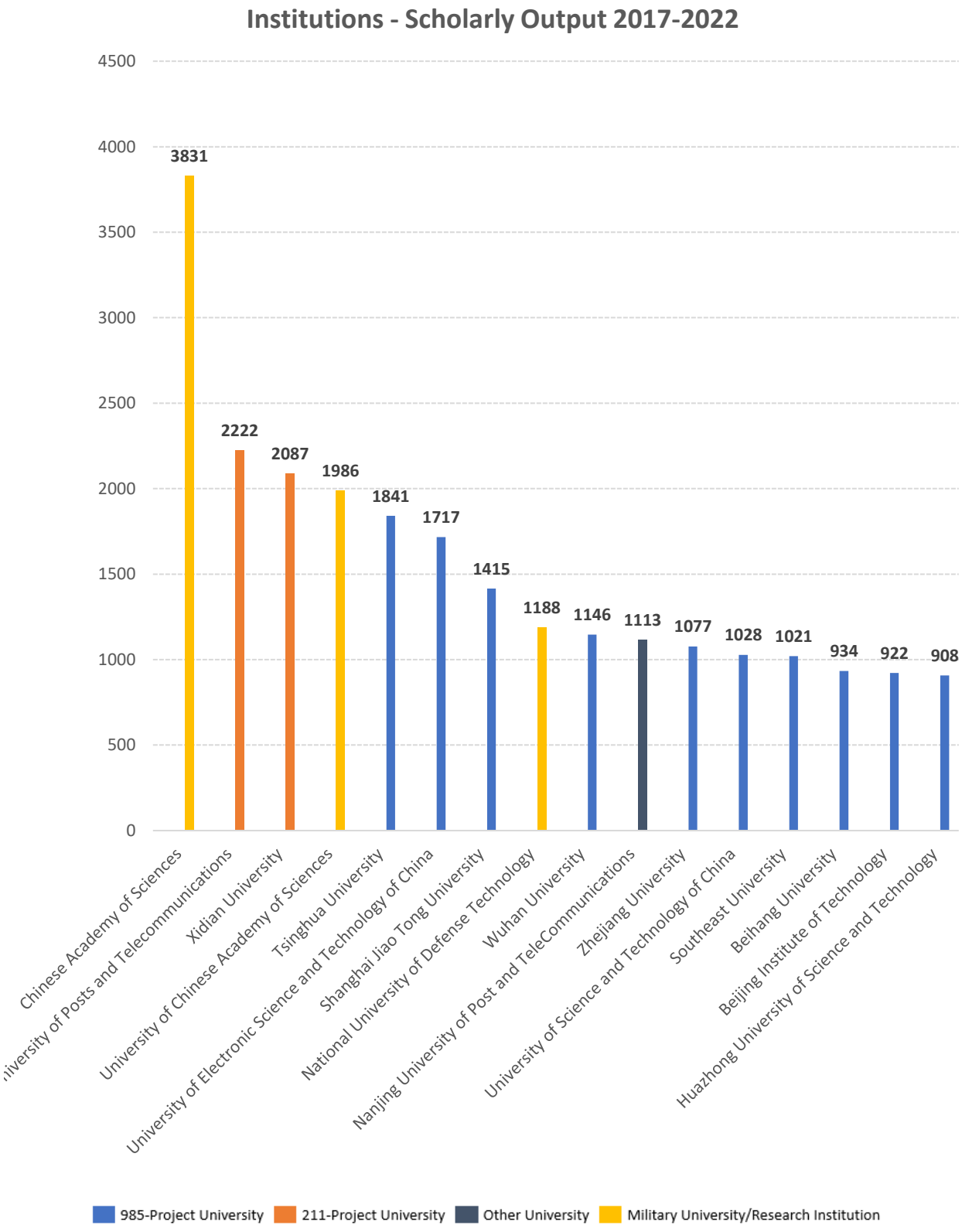
3.5 DATABASE AND INFORMATION TECHNOLOGY



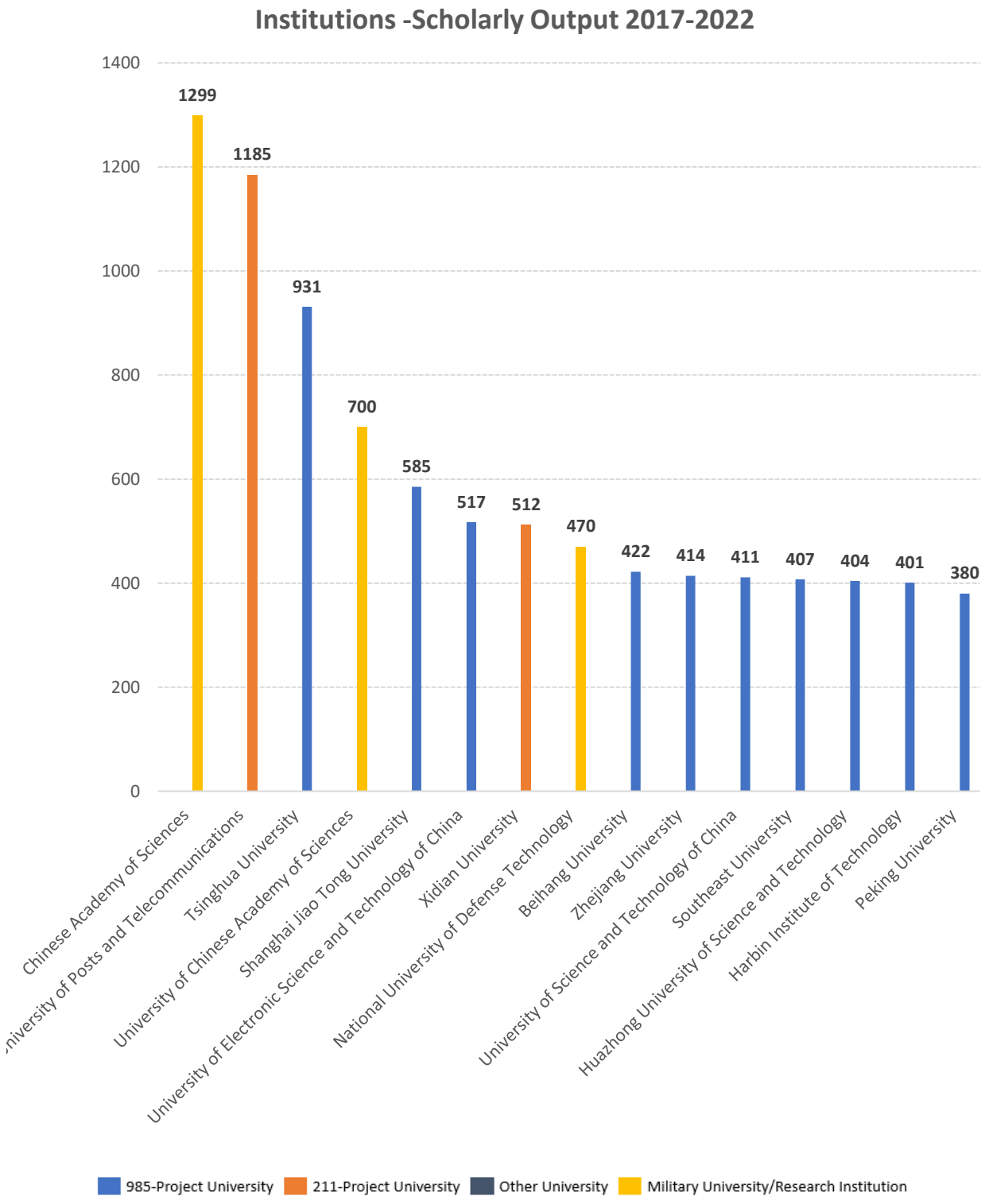
3.6 HUMAN-COMPUTER INTERACTION



3.7 SECURITY AND INFORMATION ASSURANCE



3.8 NETWORKING AND COMMUNICATION



PART 4: MAIN AUTHORS

CHINA'S TOP 15 MAIN AUTHORS RANKED BY NO. OF PUBLICATIONS IN 2017-2022

4.1 ALGORITHMS AND DATA STRUCTURES

No.	Author	Current Affiliation (Scopus)	2017-2022 Documents by author (Scopus)	Cited by Documents (Scopus)
1	Han, Zhu	East China University of Political Science and Law	836	29302
2	Leung, Victor C.M.	Shenzhen University	545	27072
3	Gao, Liang	Huazhong University of Science and Technology	544	11581
4	Zhang, Huaguang	Northeastern University	544	15782
5	Jin, Hai	Huazhong University of Science and Technology	524	13511
6	Jin, Shi	Southeast University	380	9755
7	Chen, Guihai	Shanghai Jiao Tong University	345	8516
8	Wang, Zidong	Shandong University of Science and Technology	282	22348
9	Song, Lingyang	Peking University	240	9528
10	Zhang, Zhaoyang	Zhejiang University	231	6193
11	Huang, Yongming	Southeast University	223	5145
12	Cui, Guolong	University of Electronic Science and Technology of China	212	2075
13	He, Zishu	University of Electronic Science and Technology of China	191	2381
14	Yang, Luxi	Southeast University	178	3953
15	Wei, Qinglai	Chinese Academy of Sciences	158	3585

4.2 COMPUTER ARCHITECTURE

No.	Author	Current Affiliation (Scopus)	2017-2022 Documents by author (Scopus)	Cited by Documents (Scopus)

1	Zhao, Weisheng	Beihang University	302	5439
2	You, Xiaohu	Southeast University	256	8249
3	Yang, Huazhong	Tsinghua University	238	6130
4	Liu, Leibo	Tsinghua University	186	2480
5	Wang, Zhongfeng	Nanjing University	182	2120
6	Wei, Shaojun	Tsinghua University	178	2092
7	Zhang, Chuan	Southeast University	177	1363
8	Xie, Yuan	Alibaba DAMO Academy	171	10474
9	Yin, Shouyi	Tsinghua University	161	2028
10	Zhang, Zaichen	Southeast University	115	1862
11	Meng, Dan	University of Chinese Academy of Sciences	113	1428
12	Lin, Jun	Nanjing University	110	1062
13	Hu, Wei	Northwestern Polytechnical University	40	285
14	Niu, Xinyu	Shenzhen Corerain Technologies Co., Ltd.	33	460
15	Fan, Hongxiang	Shenzhen Corerain Technologies Co., Ltd./Tianjin University	27	130

4.3 SOFTWARE ENGINEERING & PROGRAMMING

No.	Author	Current Affiliation (Scopus)	2017-2022 Documents by author (Scopus)	Cited by Documents (Scopus)
1	Lo, David	Zhejiang University	259	6857
2	Liu, Yang	Zhejiang Sci-Tech University	219	2682
3	Xia, Xin	Zhejiang University	188	3074
4	Jin, Zhi	Peking University	135	4306
5	Wang, Tao	National University of Defense Technology	110	5431
6	Xing, Zhengchang	Zhejiang University	102	2197
7	Chen, Xiang	Nanjing University of Aeronautics and Astronautics	92	891
8	Akbar, Muhammad Azeem	Nanjing University of Aeronautics and Astronautics/LUT University	79	389
9	Liang, Peng	Wuhan University	67	1286
10	Wang, Qing	Chinese Academy of Sciences	67	2136
11	Peng, Xin	Fudan University	66	1217
12	Khan, Arif Ali	Nanjing University of Aeronautics and Astronautics	59	574

13	Yu, Yue	National University of Defense Technology	57	655
14	Zhang, He	Nanjing University	56	1561
15	Yin, Gang	National University of Defense Technology	50	943

4.4 ARTIFICIAL INTELLIGENCE AND ROBOTICS

No.	Author	Current Affiliation (Scopus)	2017-2022 Documents by author (Scopus)	Cited by Documents (Scopus)
1	Wang, Feiyue	Chinese Academy of Sciences	526	18743
2	Shen, Dinggang	ShanghaiTech University	521	24221
3	Tao, Dacheng	Chinese University of Hong Kong	480	36373
4	Shao, Ling	Terminus Group/University of Electronic Science and Technology of China	409	16669
5	Nie, Feiping	Tsinghua University	373	11556
6	Gao, Xinbo	Xidian University	364	12448
7	Yang, Jian	Nanjing University of Science and Technology	327	15765
8	Li, Xuelong	Northwestern Polytechnical University	323	28901
9	Tian, Qi	Huawei Technologies Co., Ltd./Shanghai Jiao Tong University	252	6296
10	Li, Guanglin	Chinese Academy of Sciences	225	4098
11	Li, Gongfa	Wuhan University of Science and Technology	207	2015
12	Wang, Jianzhou	Macau University of Science and Technology	150	6898
13	Lin, Haotian	Sun Yat-Sen University	136	2338
14	Yan, Junchi	Shanghai Jiao Tong University	125	2918
15	Samuel, Oluwarotimi Williams	Chinese Academy of Sciences	105	1174

4.5 DATABASE AND INFORMATION TECHNOLOGY

No.	Author	Current Affiliation (Scopus)	2017-2022 Documents by author (Scopus)	Cited by Documents (Scopus)
1	Choo, Kim Kwang Raymond	University of South Australia, Adelaide, Australia/ Fuzhou University	765	16648
2	Jin, Hai	Huazhong University of Science and Technology	524	13506
3	Yu, Philip S.	Tsinghua University	485	49319
4	Lin, Jerry Chun Wei	Qingdao University of Technology	362	2816
5	Li, Keqin	Hunan University	315	8634
6	Chen, Enhong	University of Science and Technology of China,	291	8954
7	Tian, Wang	Beijing Normal University	274	4492
8	Liu, Ximeng	Xidian University	273	3148
9	Zhu, Liehuang	Beijing Institute of Technology	237	3744
10	Fournier-Viger, Philippe	Harbin Institute of Technology/ Shenzhen University	222	2755
11	Xiaolong, Xu	Nanjing University	213	2302
12	Xiong, Hui	Hong Kong University of Science and Technology	212	10798
13	Shen, Jian	Nanjing University of Information Science & Technology	193	4998
14	Wu, Xindong	Ministry of Education China/Chinese Academy of Sciences	191	17297
15	Wang, Lizhen	Yunnan University	94	340

4.6 HUMAN-COMPUTER INTERACTION

No.	Author	Current Affiliation (Scopus)	2017-2022 Documents by author (Scopus)	Cited by Documents (Scopus)
1	Li, Gongfa	Wuhan University of Science and Technology	207	2015
2	Ju, Zhaojie	Chinese Academy of Sciences	172	1710
3	Liu, Yue	Beijing Institute of Technology	136	1796
4	Xue, Chengqi	Southeast University	122	274
5	Rau, Pei-Luen Patrick	Tsinghua University	116	3459
6	Hu, Jun	Jiangnan University	104	1222

7	Liang, Haining	Xi'an Jiaotong-Liverpool University	102	797
8	Weng, Dongdong	Beijing Institute of Technology	86	620
9	Feng, Zhiquani Quan	University of Jinan	81	535
10	Shi, Yuanchun	Tsinghua University	79	2141
11	Tian, Feng	University of Chinese Academy of Sciences	63	785
12	Yu, Chun	Tsinghua University	63	739
13	Fu, Shan	Shanghai Jiao Tong University	60	451
14	Liu, Wei	Beijing Normal University	58	115
15	Yu, Lei	Zhejiang University	57	490

4.7 SECURITY AND INFORMATION ASSURANCE

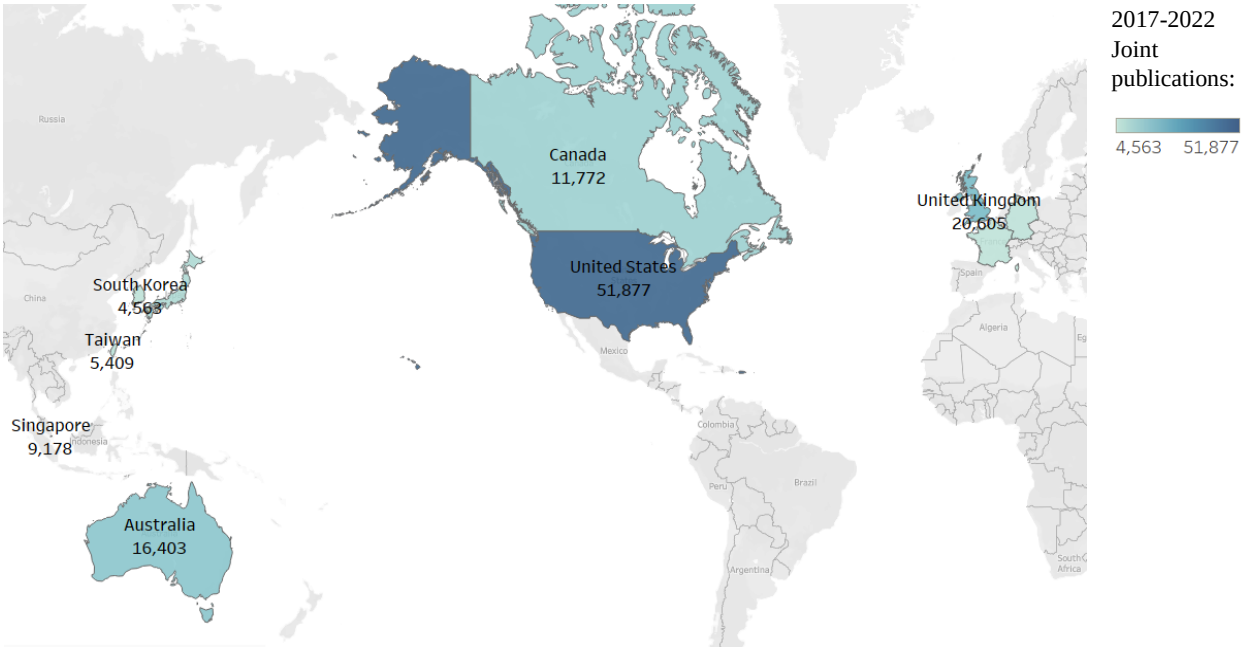
No.	Author	Current Affiliation (Scopus)	2017-2022 Documents by author (Scopus)	Cited by Documents (Scopus)
1	Jin, Hai	Huazhong University of Science and Technology	524	13506
2	Liu, Ximeng	Fuzhou University	273	3148
3	Susilo, Willy	Hubei University of Technology	265	9387
4	Wang, Xingyuan	Dalian University of Technology	241	8689
5	Wang, Guojun	Central South University	239	6242
6	Zhu, Liehuang	Beijing Institute of Technology	237	3744
7	Ma, Jianfeng	Xidian University	193	3906
8	He, Debiao	Wuhan University	190	6672
9	Liu, Jianwei	Beihang University	172	1660
10	Yan, Zheng	Xidian University	170	4149
11	Mu, Yi	Fuzhou University	158	6266
12	Li, Hui	Xidian University	157	5067
13	Huang, Xinyi	Wuhan University	156	6359
14	Li, Xiong	University of Electronic Science and Technology of China/Hunan University of Science and Technology/Xidian University	145	3942
15	Zhong, Hong	Anhui University	133	2294

4.8 NETWORKING AND COMMUNICATION

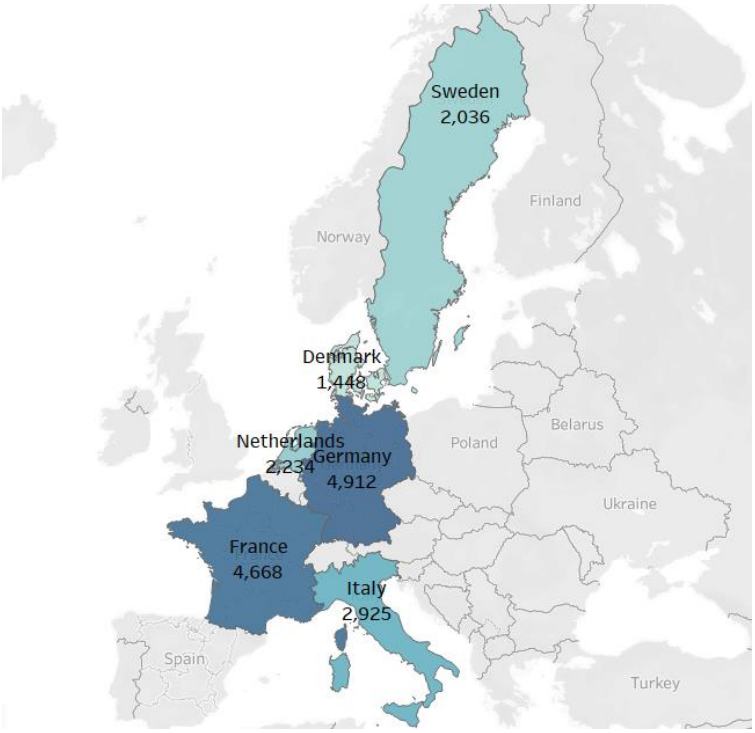
No.	Author	Current Affiliation (Scopus)	2017-2022 Documents by author (Scopus)	Cited by Documents (Scopus)
1	Han, Zhu	East China University of Political Science and Law	835	29283
2	Leung, Victor C.M.	Shenzhen University	545	27080
3	Jin, Hai	Huazhong University of Science and Technology	524	13506
4	Yu, F. Richard	Beijing University of Posts and Telecommunications	349	15566
5	Zhang, Jie	Beijing University of Posts and Telecommunications	333	1605
6	Yang, Huazhong	Tsinghua University	238	6130
7	Liu, Jiajia	Northwestern Polytechnical University	182	5020
8	Wang, Zhongfeng	Nanjing University	182	2120
9	Wei, Shaojun	Tsinghua University	178	2093
10	Huang, Tao	Beijing University of Posts and Telecommunications	175	2289
11	Wu, Jun	Shanghai Jiao Tong University	138	2490
12	Li, Jianhua	Shanghai Jiao Tong University	133	3856
13	Wang, Ying	Chinese Academy of Sciences	132	789
14	Liu, Yunjie	Beijing University of Posts and Telecommunications	122	2681
15	Zhang, Hongke	Beijing Jiaotong University	114	4598

APPENDIX 1 – COLLABORATION OVERVIEW IN 2017 - 2022

WORLD TOP 10 COUNTRIES/DISTRICT COLLABORATED WITH CHINA



TOP 5 EU COUNTRIES +DENMARK COLLABORATED WITH CHINA



APPENDIX 2 – LIST OF CHINA 985-PROJECT UNIVERSITIES

Chinese Name	English Name	Location	QS Ranking 2021	Shanghai Ranking 2021	CWTS Leiden Ranking 2022
同济大学	Tongji University	Shanghai	256	151-200	72
东南大学	Southeast University	Nanjing	493	151-200	68
上海交通大学	Shanghai Jiaotong University	Shanghai	47	59	6
华东师范大学	East China Normal University	Shanghai	Out of 500	301-400	242
南开大学	Nankai University	Tianjin	377	201-300	116
电子科技大学	University of Electronic Science and Technology of China	Chengdu	Out of 500	151-200	83
北京航空航天大学	Beihang University	Beijing	449	201-300	77
北京大学	Peking University	Beijing	23	45	16
大连理工大学	Dalian University of Technology	Dalian	Out of 500	301-400	78
华南理工大学	South China University of Technology	Guangzhou	462	151-200	52
中国人民解放军国防科技大学	National University of Defense Technology	Changsha	N/A	601-700	333
中国人民大学	Renmin University of China	Beijing	Out of 500	601-700	705
东北大学	Northeast University	Shenyang	Out of 500	301-400	146
清华大学	Tsing Hua University	Beijing	15	28	5
浙江大学	Zhejiang University	Hangzhou	53	52	4
厦门大学	Xiamen University	Xiamen	432	201-300	119
中南大学	Central South University	Changsha	Out of 500	151-200	18
中山大学	Sun Yat-sen University	Guangzhou	267	89	23
武汉大学	Wuhan University	Wuhan	246	151-200	31
复旦大学	Fudan University	Shanghai	34	77	38
华中科技大学	Huazhong Technology University	Wuhan	396	101-150	9
南京大学	Nanjing University	Nanjing	124	101-150	65
四川大学	Sichuan University	Chengdu	Out of 500	151-200	30
山东大学	Shandong University	Shandong	485	151-200	54
吉林大学	Jilin University	Jilin	493	151-200	57
湖南大学	Hunan University	Changsha	Out of 500	201-300	67
重庆大学	Chongqing University	Chongqing	Out of 500	201-300	91
西安交通大学	Xi'an Jiaotong University	Xi'an	303	101-150	29
哈尔滨工业大学	Harbin Institute of Technology	Harbin	260	151-200	26
中国科学技术大学	University Of Science and Technology of China	Hefei	93	63	43
中国海洋大学	Ocean University of China	Qingdao	N/A	301-400	352
天津大学	Tianjin University	Tianjin	387	151-200	44
北京师范大学	Beijing Normal University	Beijing	279	201-300	182
北京理工大学	Beijing Institute of Technology	Beijing	392	151-200	105
兰州大学	Lanzhou University	Lanzhou	Out of 500	301-400	200

西北工业大学	Northwestern Polytechnical University	Xi'an	Out of 500	151-200	81
西北农林科技大学	Northwest A & F University	Shanxi Yanglin	Out of 500	501-600	190
中国农业大学	China Agricultural University	Beijing	Out of 500	201-300	143
中央民族大学	Minzu University of China	Beijing	N/A	N/A	N/A

CWTS Leiden Ranking is based on bibliographic data from the Web of Science database. Here we chose number of publications of a university belonging to the top 10% of their field as the indicator for this ranking.

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