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Author productivity in the field of Human Computer Interaction (HCI) research

Suresh Kumar

CSIR-National Institute of Science Technology and Development Studies,
Dr. K. S. Krishnan Marg, (Pusa), New Delhi – 110012 (India), Email: sureshkr@nistads.res.in

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The study analyses the distribution of productivity of authors in the field of HCI research as reflected in their publication output from Science Citation Index-Expanded for 2006 to 2011. The purpose of this study is to test Lotka's law of author productivity using the methodology outlined by Pao (1985) and compare it with the modifications suggested by Nicholls (1987). A data set of 63137 articles is studied. Author productivity data is disaggregated into 21 data sets, one each for top 20 countries beside the world data set. The values of Lotka's exponent and constant are calculated by both linear least square method and maximum likelihood method. The K-S goodness-of-fit test is conducted at the 0.10 level of significance. There is not much difference observed in the distribution of publications and the distribution obtained using Pao's procedure and modifications suggested by Nicholls. This study finds that literature in the field of HCI research studies does conform to Lotka's law with reliable results for 18 out of 21 data sets. So, Lotka's law can be used in HCI research as a standardized means of measuring author publication productivity.

Keywords: Author productivity; Lotka's Law; Human computer interaction; Scientometrics

Introduction

In 1926 Lotka[1] studied scientific productivity of individual authors from a 10-year cumulative index of authors listed in ***Chemical Abstracts*** (1907-1916) and the contributions of physicists listed in Auerbach's Gesohiohtstafeln der Physik and found that the distribution of scientific authorship follows an inverse square law. In the generalized form, Lotka's law, referred as inverse power law was given by Bookstien[2] as:

$$x^{\alpha} \cdot y_x = c; \text{ where } x = 1, 2, 3, \ldots, x_{max}, c > 0, \alpha > 1, \quad \ldots (1)$$

y_x represents the probability of an author to publish "x" times,

x_{max} represents the maximum value of productivity

α is considered as a measure of inequality in the distribution of scientific field. This suggests that increase of α is accompanied by the increase of low productive scientists. But, Potter[3] stated that there have been no studies that replicate Lotka's methodology closely enough to be compared to Lotka's original work, giving example of the bibliographic sources used by Murphy[4], Voos[5] and Schorr[6] which lacked the coverage, in terms of either subjects or time, of the sources used by Lotka. However, studies which followed Lotka's methodology closely lead to unreliable results at the best[7]. Even now many studies are being carried out in various subject areas within the scientific field[8-11] without strictly adhering to the procedure followed by Lotka. In 1985, Pao[12] described methods for testing the applicability of Lotka's Law closely following procedures used by Lotka himself. She suggests how to compute values of the exponent 'α', using linear least square method (LLS), and the constant 'c' and also how to perform the Kolmogorov-Smirnov(K-S) test of conformity. In 1986, Pao[13] used 48 data sets taken from previous tests of Lotka's law representing more than 20 subject areas and found that when the data sets were tested using the exact procedure followed by Lotka, the majority of data sets confirmed Lotka's law. Only nine out of 48 data sets did not fit the Lotka's law. However, Nicholls[14] convincingly showed that the maximum likelihood (ML) is better method to estimate the values of parameters of Lotka's law distribution as compared to LLS method used by Pao.

Review of literature

Some of the recent studies testing validity of Lotka's law are discussed here. Zabed, Rahman and Anisour[15] examined the validity of Lotka's Law to authorship distribution in the field of nutrition research in Bangladesh (1972-2006) using both generalized and modified models. The results suggest that author productivity distribution predicted in Lotka's generalized inverse square law is not applicable to nutrition research in Bangladesh. While, using LLS method excluding highly productive authors, Lotka's Law was found to be applicable to nutrition research in Bangladesh. Hamadicharef[16] examined author productivity of Brain Computer Interface (BCI), a sub-field of HCI, based on data derived from Web of Science for the period 1990-2008. The exponent 'α' and constant 'c' were estimated by LLS method. The values of α was -1.8552 and c= 0.5540. Using the K-S test of goodness-of-fit, it was concluded that the BCI literature does not confirm to Lotka's law. Abrizah and Wee[17] examined author productivity of Malaysian computer science research based on 'Web of Science' data. Lotka's parameters values for α and c were -2.56 and 0.7443 respectively. Chen, Yang and Yu[18] applied Lotka's law on agent-based modeling literature taken from the Social Science Citation Index (SSCI) database. The value of parameters α and c were -3.2 and 0.8573 respectively and K-S test confirmed the author productivity distribution. Huang and Yang[19] studied author productivity in performance management. The value of α parameter and c parameter were -3.723 and 0.8963 respectively. The study proved that Lotka's law was able to explain the developing trend of literature in performance management by application of K-S test. Another author productivity study was carried out by Suen and Yang[20] on 'virtual world' which again is one of the sub-fields of HCI. All documents used in this study were accessed from SSCI for the period 1991-2011. The value of exponent α was calculated by both LLS method and ML method. K-S statistics for α= -2.058 (by LLS method) found Dmax value 0.0389 which is within the critical value at the 5% significance level. K-S statistics for ML method (α= -1.9022) is 0.0257 which is also below the 5% critical value of significance and hence, both were accepted as appropriate models for the dataset. Azadeh and Abdolreza[21] studied Lotka's law on the literature of applied mathematics of Mysore University, taking data from Web of Science for the period 1975-2011. They reported a very high value of α = -3.3488, suggesting highly skewed author productivity distribution without confirming to Lotka's law. Sivakumar et. al.[22] tested the fitness of Lotka's law on the biology literature of central universities in India from 1999-2012 on data taken from 'Science Citation Index-Expanded' and applied chi-square test and found that Lotka's law was not able to explain the author productivity distribution in this case.

Ugrinowitsch et. al.[23] has pointed out that misspecification in statistical model can substantially affect the significance level of a statistical test, so, it is crucial to select appropriate model to understand variance in structure of a data set. All the studies mentioned in this literature review are based on either least square method or maximum likelihood method to estimate parametric values of Lotka's law of author productivity. It is undesirable to compare results based on analysis which is not standardized. To dispose of the issue, the present study is an attempt to find merits or demerits of both these methods (least square and maximum likelihood) so that a certain level of harmony can be established in testing the validity of Lotka's law in various subject field of research.

Objectives of the study

The purpose of this study is to test Lotka's law of scientific publication productivity, in the field of HCI research, to ascertain if it can be used as an analytical technique that can help administrators set appropriate and statistically supported benchmark for faculty publication productivity. The main objectives are as follows;

- To examine the validity of Lotka's Law, both in generalized and modified forms as suggested by Pao[12] and Nicholls[14]; and
- To identify the main elements involved in fitting a Lotka's law.

Methodology

To fit the underlying frequency distributions and to estimate their parameters, the first step in data processing is usually the process of downloading or extracting data from bibliographic databases. Data for the present study is taken from Science Citation Index – Expanded (SCI-E) for the period 2006-2011. The search was performed in the tag 'topic', which runs the search in titles, keywords and abstracts. The search was carried out using the principal keywords related to HCI (Appendix I). Documents included in the study were articles and reviews. Letters, books chapters, proceedings, book reviews, theses, etc. were excluded from this study. The query returned with 63,137 records, which were converted into a DBase database for further standardization to achieve author frequency distribution required for the applications of Lotka's law. Prior to 2006, authors and their affiliations were listed in separate fields and there was no foolproof mechanism to relate these fields. Also, most of the authors were listed using their family name and initials only. But, around the year 2006 or so SCI-E started to give author(s) full name along with their affiliation in the same field. So, the period of study is chosen from 2006 onwards till 2011. However, still there are a large number of records, with author(s) family name and initials only. Such variations may confound the analysis or mislead the analyst. To remove the variations, each record has been manually reviewed to determine correct authorship and unify variant designations under one preferred name. Author productivity distribution for the world and top twenty countries in the field of HCI research is given in Appendix II. The size of different data sets is presented in Table 1. Due to the fact that each author, organization and country in a publication is assigned one full credit, number of papers and number of unique authors does not add up to the world output. Table 1 indicates that the USA and most of the developed countries of the west have lower than the world average of number of papers per author. All the Asian countries, except Japan, have number of papers per author in the range of world average. This indicates that strength of collaboration is less in the Asian countries as compared with the developed countries of the West.

In this study Lotka's Law and standard testing methodology, described by Pao[12], is applied on author productivity distribution of HCI research. The results were then compared with modifications suggested by Nicholls[14]. This study has taken into consideration some of the recommendations of previous researchers which includes; (a) To capture intensity of scientific collaboration, full or integer counting scheme, assigning one full credit to each contributing author; (b) Using a sizable sample consisting of over 1,000 cases as suggested by Huber and Wagner-Dobler[25]; (c) Using a source that is sufficient in breadth and scope as indicated by Nicholls[14]; and (d) Calculating the values of α and $\boldsymbol{c}$ for each data set rather than using the value $\boldsymbol{n} = 2$ (Potter[3] and Pao[13]).

Calculation of the exponent 'α'

The formula to calculate the slope of α, the exponent, is given in equation 2. Value of slope is calculated on smaller number of data pairs. Lotka determined the cut off by visually inspecting the log graph of number of papers and number of authors. In the present study, cut off is computed by formula: $\sqrt{\sum \boldsymbol{Y}_x}$, where $\sum \boldsymbol{Y}_x$ is total number of authors in the data set. The same is used by Osareh and Mostafavi[24], stating it as the best cut off method.

The formula to calculate the slope of α, the exponent, is given as follows:

$$\alpha = \frac{\boldsymbol{N}\sum \boldsymbol{XY} - \sum \boldsymbol{X} \sum \boldsymbol{Y}}{\boldsymbol{N}\sum \boldsymbol{X}^2 - \left(\sum \boldsymbol{X}\right)^2} \quad \dots (2)$$

$\boldsymbol{N}$ = number of pairs of data
$\boldsymbol{X}$ = logarithm of x, i. e. number of publications
$\boldsymbol{Y}$ = logarithm of y, i. e. number of authors

Calculation of the constant 'c'

The value of the constant $\boldsymbol{c}$ is calculated using the following formula:

$$\boldsymbol{c} = \frac{1}{\left[\sum_{1}^{\boldsymbol{p}-1} \frac{1}{\alpha^2} + \frac{1}{(\alpha-1)\left(\boldsymbol{p}^{\alpha-1}\right)} + \frac{1}{2\,\boldsymbol{p}^{\alpha}} + \frac{\alpha}{24\,(\boldsymbol{p}-1)^{\alpha+1}}\right]} \quad \dots (3)$$

p = 1, 2, 3………20

Rousseau and Rousseau[26] developed a program called Lotka for calculating best fitting parameters and critical values of K-S test and value of Dmax using ML method suggested by Nicholls[14].

Kolmogorov-Smirnov (K-S) test

K-S test is a goodness-of-fit statistical test to assert that the observed author productivity distribution is not significantly different from a theoretical distribution. It compares cumulative observed and cumulative expected frequencies of author productivity. The maximum deviation between the

Table 1—Number of publications and unique contributing authors for different data sets

Sl. no.	Data Set	Number of papers	Number of unique authors	Number of papers per author
1	World	63137	126802	0.50
2	USA	15515	36916	0.42
3	China	8613	16605	0.52
4	UK	5178	11051	0.47
5	Taiwan	4106	6919	0.59
6	Spain	3678	9188	0.40
7	Germany	3626	9809	0.37
8	South Korea	3187	6372	0.50
9	Canada	3096	7118	0.43
10	France	3023	8336	0.36
11	Italy	2913	7005	0.42
12	Japan	2437	5929	0.41
13	Australia	2043	4502	0.45
14	Turkey	1459	2454	0.59
15	Greece	1448	3397	0.43
16	Netherlands	1363	3718	0.37
17	India	1306	2870	0.46
18	Singapore	1261	2742	0.46
19	Switzerland	974	2812	0.35
20	Brazil	970	2802	0.35
21	Belgium	912	2361	0.39

cumulative proportions of the observed and theoretical frequency is determined by the following formula:

$$D\ \max = \left|F_0(x) - S_n(x)\right| \quad \text{... (4)}$$

$F_0(x)$ = theoretical cumulative frequency

$S_n(x)$ = observed cumulative frequency

The test is performed at the 0.05 or at the 0.01 level of significance. When sample size is greater than 35, the critical value of significance is calculated by the following formula:

The critical value at the 0.05 level of significance:

$$\frac{1.36}{\sqrt{\sum y}} \quad \text{… (5)}$$

The critical value at the 0.01 level of significance:

$$\frac{1.63}{\sqrt{\sum y}} \quad \text{… (6)}$$

$\sum y$ = the total population under study

When Dmax is less than critical value, at certain level of significance, then the data set confirms to Lotka's law at that certain level of significance. But if it exceeds the critical value the null hypothesis must be rejected at a certain level of significance and concluded that the observed distribution is significantly different from the theoretical distribution.

Results and discussions

Calculation of parameter 'α' by LLS method

The first step in the application of Lotka's law is to determine the value of α, which is determined by LLS method by using the mathematical formula (2). Different calculated values from Table 2 are substituted into the formula (2) as given below.

$$\alpha = \frac{8 * 76.6774 - (10.6045 * 64.7036)}{8 * 17.5202 - (10.6045)\text{^}2} = \text{-}2.625$$

Table 2 give different calculations for author frequency distribution of World's research output in the field of HCI. Similarly values of α for all the 21 data sets are calculated and presented in the Table 3.

Table 2—Calculations for estimation of α using linear least square method for World's HCI research

Pair of observations (N)	Number of papers (x)	Number of authors (y)	X=log(x)	Y=log(y)	XY	XX
1	1	94293	0.0000	11.4542	0.0000	0.0000
2	2	18252	0.6931	9.8120	6.8012	0.4804
3	3	6500	1.0986	8.7796	9.6453	1.2069
4	4	2995	1.3863	8.0047	11.0969	1.9218
5	5	1606	1.6094	7.3815	11.8801	2.5902
6	6	919	1.7918	6.8233	12.2257	3.2105
7	7	614	1.9459	6.4200	12.4927	3.7865
8	8	415	2.0794	6.0283	12.5355	4.3239
Total		125594	10.6045	64.7036	76.6774	17.5202

Calculation of value 'c'

The values of the constant 'c' are calculated by substituting the given values of α, as calculated by LLS method. Values of c is estimated by the formula 3 and given in Table 3, under heading 'LLS method' in column 4.

Calculation of Lotka's law parameters using ML method

Using the program written by Rousseau and Rousseau[25], parameters, α, c values is calculated. This program provides K-S statistics as well. Author productivity distribution of the 21 data sets are submitted to the program and analysed. The program returned with value of α, c and K-S statistics, K-S critical value and corresponding Dmax value. The same are presented in Table 3 under heading 'ML method'.

Application of K-S statistical test

The K-S statistical test is applied on world's HCI research literature and results are tabulated in Table 4.

Similarly, the K-S test is applied to all the other data sets as well and corresponding Dmax values and K-S critical values are presented in Table 3. The maximum deviation, Dmax, is identified. The critical value of Dmax in K-S test at 0.01% level of significance is compared. While using ML method, the comparison indicates that 17 out of 21 data sets, values of Dmax is less than the critical value of K-S test. Whereas, the value of Dmax is less than K-S critical for 18 out of 21 data sets using LLS method. Therefore, the test confirming that both the methods, ML and LLS, can be used to explain author productivity distribution in the field of HCI research literature.

Conclusions

Validity of Lotka's law of author productivity has been studied for different subject areas of scientific research. The present study has tried to find a statistically reliable method to measure author productivity in the field of HCI research. The results can be used to set mathematically proven thresholds for publication expectations in the field of HCI research across organizations in different countries. The value of 'α', using LLS method, varies between 2.377 for China and 3.161 for Brazil author productivity distribution. Whereas, values of α lies between 2.438 for China to 3.167 for Brazil by using ML method. The comparison between value of α calculated by LLS method and ML method, indicates that both methods gave almost equal values of α for all the 21 data sets as given in Table 3. This is contrary to Newman's[27] view that linear least square method tends to returns with higher values of Lotka's exponent 'α'. However, he has expressed his views on data without any cut off. Therefore, similar results are obtained by LLS method and ML method as the ML method is able to explain the author productivity of 17 out of 21 data sets whereas LLS method provided still better results as it was able to explain 18 out of 21 data sets. So, both the methods can be adopted to explain the author productivity distribution in field of HCI research. Most of the data sets reported a higher value of alpha 'α' as compared with values of alpha (α=2 and α=1.89), calculated by Lotka. This indicates that HCI research is dominated by a very high number

Table 3—Values of parameters for different dataset using different methods

Sl. no.	Data Set	LLS method		ML method		(LLS) method	(ML) method	K-S test critical value
		α	c	α	C	Dmax		
1	World	2.625	0.7685	2.580	0.7619	0.0249	0.0183	0.0046
2	USA	2.778	0.7966	2.776	0.7979	0.0115	0.0128	0.0085
3	China	2.377	0.7188	2.438	0.7318	0.0127	0.0116	0.0126
4	UK	2.629	0.7693	2.642	0.7740	0.0101	0.0148	0.0155
5	Taiwan	2.414	0.7222	2.454	0.7353	0.0195	0.0182	0.0196
6	Spain	2.581	0.7596	2.607	0.7674	0.0159	0.0216	0.0170
7	Germany	2.967	0.8263	3.003	0.8323	0.0075	0.0110	0.0165
8	South Korea	2.513	0.7451	2.546	0.7550	0.0153	0.0251	0.0204
9	Canada	2.842	0.8073	2.885	0.8153	0.0071	0.0074	0.0193
10	France	3.125	0.8475	3.064	0.8405	0.0226	0.0156	0.0179
11	Italy	2.614	0.7663	2.704	0.7855	0.0140	0.0128	0.0195
12	Japan	2.702	0.7832	2.813	0.8040	0.0129	0.0101	0.0212
13	Australia	2.740	0.7900	2.781	0.7988	0.0095	0.0070	0.0243
14	Turkey	2.533	0.7494	2.644	0.7744	0.0237	0.0185	0.0329
15	Greece	2.572	0.7577	2.718	0.7881	0.0206	0.0098	0.0280
16	Netherlands	2.938	0.8221	2.963	0.8267	0.0066	0.0109	0.0267
17	India	2.890	0.8149	2.976	0.8286	0.0094	0.0059	0.0304
18	Singapore	2.562	0.7556	2.594	0.7649	0.0098	0.0125	0.0311
19	Switzerland	3.025	0.8344	3.009	0.8332	0.0111	0.0100	0.0307
20	Brazil	3.161	0.8519	3.167	0.8533	0.0093	0.0106	0.0308
21	Belgium	2.753	0.7923	2.760	0.7596	0.0051	0.0023	0.0335

Table 4—Application K-S test on World HCI research literature

No. of Articles	No. of Authors	Observed		Estimated values by LLS method		
		Frequency of Authors	Cumulative Frequency of authors	Frequency of Authors	Cumulative Frequency of authors	Dmax
1	94293	0.7436	0.7436	0.7685	0.7685	0.0249
2	18252	0.1439	0.8875	0.1246	0.8931	0.0056
3	6500	0.0513	0.9388	0.0430	0.9361	0.0027
4	2995	0.0236	0.9624	0.0202	0.9563	0.0061
5	1606	0.0127	0.9751	0.0112	0.9675	0.0076
6	919	0.0072	0.9823	0.0070	0.9745	0.0078
7	614	0.0048	0.9871	0.0046	0.9791	0.0080
8	415	0.0033	0.9904	0.0033	0.9824	0.0080
9	284	0.0022	0.9926	0.0024	0.9848	0.0078
10	201	0.0016	0.9942	0.0018	0.9866	0.0076
11	151	0.0012	0.9954	0.0014	0.9880	0.0074

Contd—

Table 4—Application K-S test on World HCI research literature

—Contd

No. of Articles	No. of Authors	Observed		Estimated values by LLS method		
		Frequency of Authors	Cumulative Frequency of authors	Frequency of Authors	Cumulative Frequency of authors	Dmax
12	114	0.0009	0.9963	0.0011	0.9891	0.0072
13	89	0.0007	0.9970	0.0009	0.9900	0.0070
14	74	0.0006	0.9976	0.0008	0.9908	0.0068
15	56	0.0004	0.9980	0.0006	0.9914	0.0066
16	41	0.0003	0.9983	0.0005	0.9919	0.0064
17	27	0.0002	0.9985	0.0005	0.9924	0.0061
18	25	0.0002	0.9987	0.0004	0.9928	0.0059
19	23	0.0002	0.9989	0.0003	0.9931	0.0058
20	11	0.0001	0.9990	0.0003	0.9934	0.0056
21	11	0.0001	0.9991	0.0003	0.9937	0.0054
22	11	0.0001	0.9992	0.0002	0.9939	0.0053
23	13	0.0001	0.9993	0.0002	0.9941	0.0052
24	9	0.0001	0.9994	0.0002	0.9943	0.0051
25	4	0.0000	0.9994	0.0002	0.9945	0.0049
26	5	0.0000	0.9994	0.0001	0.9946	0.0048
27	4	0.0000	0.9994	0.0001	0.9947	0.0047
28	6	0.0000	0.9994	0.0001	0.9948	0.0046
29	6	0.0000	0.9994	0.0001	0.9949	0.0045
30	2	0.0000	0.9994	0.0001	0.9950	0.0044
31	3	0.0000	0.9994	0.0001	0.9951	0.0043
32	6	0.0000	0.9994	0.0001	0.9952	0.0042
33	7	0.0001	0.9995	0.0001	0.9953	0.0042
34	3	0.0000	0.9995	0.0001	0.9954	0.0041
35	4	0.0000	0.9995	0.0001	0.9955	0.0040
36	3	0.0000	0.9995	0.0001	0.9956	0.0039
37	1	0.0000	0.9995	0.0001	0.9957	0.0038
39	3	0.0000	0.9995	0.0001	0.9958	0.0037
42	1	0.0000	0.9995	0.0000	0.9958	0.0037
43	2	0.0000	0.9995	0.0000	0.9958	0.0037
47	1	0.0000	0.9995	0.0000	0.9958	0.0037
48	1	0.0000	0.9995	0.0000	0.9958	0.0037
54	1	0.0000	0.9995	0.0000	0.9958	0.0037
55	1	0.0000	0.9995	0.0000	0.9958	0.0037
56	1	0.0000	0.9995	0.0000	0.9958	0.0037
61	1	0.0000	0.9995	0.0000	0.9958	0.0037
74	1	0.0000	0.9995	0.0000	0.9958	0.0037
75	1	0.0000	0.9995	0.0000	0.9958	0.0037
Total	126802					

of low productive authors and there are fewer number of high productive authors. "Assigning full one credit to each author in the author list could be one of the reasons for high number of low productive authors"[28]. Sample size does not seem to matter in empirical testing of Lotka's law because 18 out of 21 data sets, where the Lotka's law found fit, had highly varied sample size ranging from 2361 authors for Belgium data set to 36916 authors for the USA data set. Value of α for all the data sets is higher than 2, suggesting that value of α should be calculated separately for each data set.

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Appendix I

Keywords used for downloading the Bibliographic data

Human Computer Interaction, User Interface*, User Centered Design, Virtual Reality, GUI, Human Factors, User Experience, Augmented Reality, Interaction Design, Semantic Web, Affective Computing, Image Processing, Information Visualization, Decision Support System*, Ubiquitous Computing, Usability Evaluation, Bioinformatics, Emotion Recognition, Interface Design, Assistive Technology, Mobile Computing, Natural Language Processing, Web Services, Data Mining, Information Retrieval, Middleware, Speech Recognition, Usability Testing, Internet, Pattern Recognition, Data Management, Face Detection, Fitts' Law, Gesture-Based Interaction, Multimodal Interaction, Multimedia, Open Source, Navigation, Pervasive Computing, Social Media, Teleoperation, User Modeling, User Interaction, Web 2.0, Data Analysis, Data Acquisition, Decision Making, Facial Expression, Eye Tracking, Expert System, Gesture Recognition, Grid Computing, Interaction Techniques, Man-Machine Interaction, Neural Networks, Participatory Design, Ajax, Ambient Intelligence, Artificial Intelligence, Animation, Context-Awareness, Decision Support Systems, E-Learning, Embedded System, Educational Software, Fuzzy Logic, Graphical User Interfaces, Human-Computer Interface, Human-Robot Interaction, Knowledge Acquisition, Mixed Reality, Multimodal, Semantics, Virtual Environments, Adaptive User Interfaces, Cloud Computing, Computer Graphics, E-Commerce, Face Recognition, Graphic User Interface, Icon, Information Extraction, Image Registration, Interoperability, Robotics, Social Network, Virtual World.

Appendix II:

Author productivity distribution for different data sets
(x=number of papers; y=number of authors)

World

x	y	x	y	x	y	x	y	x	y
1	94293	11	151	21	11	31	3	47	1
2	18252	12	114	22	11	32	6	48	1
3	6500	13	89	23	13	33	7	54	1
4	2995	14	74	24	9	34	3	55	1
5	1606	15	56	25	4	35	4	56	1
6	919	16	41	26	5	36	3	61	1
7	614	17	27	27	4	37	1	74	1
8	415	18	25	28	6	39	3	75	1
9	284	19	23	29	6	42	1	Total	126802
10	201	20	11	30	2	43	2		

USA

x	y	x	y	x	y	x	y	x	y
1	28983	7	124	13	22	19	2	31	1
2	4762	8	82	14	7	20	1	35	1
3	1552	9	58	15	10	22	3	39	1
4	663	10	39	16	2	23	1	Total	36916
5	351	11	24	17	2	26	1		
6	199	12	22	18	2	27	1		

China

x	y	x	y	x	y	x	y	x	y
1	11959	11	28	21	4	31	1	72	1
2	2358	12	30	22	4	32	2	Total	16606
3	888	13	16	23	4	33	1		
4	452	14	24	24	2	34	2		
5	282	15	11	25	1	35	1		
6	149	16	12	26	1	42	1		
7	126	17	11	27	3	43	2		
8	82	18	10	28	3	52	1		
9	63	19	10	29	1	55	1		
10	50	20	6	30	1	56	1		

UK

x	y	x	y	x	y	x	y	x	y
1	8390	7	51	13	6	19	6	29	2
2	1517	8	28	14	7	20	1	34	1
3	530	9	21	15	4	22	1	36	1
4	244	10	14	16	5	23	1	48	1
5	124	11	11	17	1	25	1	Total	11051
6	76	12	5	18	1	27	1		

Taiwan

x	y	x	y	x	y	x	y	x	y
1	4962	7	51	13	1	19	4	29	1
2	978	8	23	14	6	20	1	32	3
3	428	9	24	15	6	22	1	33	1
4	210	10	12	16	2	23	1	39	1
5	121	11	15	17	1	24	2	47	1
6	55	12	4	18	2	26	2	Total	6919

Spain

x	y	x	y	x	y	x	y	x	y
1	6852	5	98	9	21	13	6	19	1
2	1342	6	62	10	14	14	7	21	1
3	470	7	32	11	12	15	2	25	1
4	231	8	24	12	7	16	4	28	1
								Total	9188

Germany

x	y	x	y	x	y	x	y	x	y
1	8056	5	70	9	10	17	1		
2	1149	6	26	10	5	20	1		
3	320	7	20	11	2	27	1		
4	133	8	12	12	2	34	1	Total	9809

South Korea

x	y	x	y	x	y	x	y	x	y
1	4651	6	47	11	7	17	1	26	1
2	1001	7	36	12	6	19	1	29	1
3	325	8	26	13	8	20	1	32	1
4	137	9	14	15	1	21	1	33	1
5	89	10	13	16	2	25	1	Total	6372

Canada

x	y	x	y	x	y	x	y	x	y
1	5750	6	30	11	4	16	2	21	1
2	844	7	23	12	3	17	2	23	1
3	258	8	10	13	3	18	1	30	1
4	102	9	7	14	1	19	1	Total	7118
5	64	10	8	15	1	20	1		

France

x	y	x	y	x	y	x	y	x	y
1	6876	4	85	7	8	10	3	19	1
2	1011	5	42	8	7	11	2	Total	8336
3	271	6	24	9	3	12	3		

Italy

x	y	x	y	X	y	x	y	x	y
1	5413	5	80	9	12	13	2	35	1
2	920	6	58	10	5	14	1	39	1
3	298	7	32	11	6	17	1	Total	7005
4	151	8	16	12	7	20	1		

Japan

x	y	x	y	x	y	x	y
1	4707	5	58	9	4	13	2
2	725	6	37	10	3	14	1
3	238	7	12	11	6	17	2
4	112	8	17	12	5	Total	5929

Australia

x	y	x	y	x	y	x	y	x	y
1	3565	6	23	11	6	16	1	33	1
2	567	7	16	12	3	18	1	Total	4502
3	159	8	11	13	5	23	1		
4	85	9	6	14	3	30	1		
5	37	10	9	15	1	31	1		

Turkey

x	y	x	y	x	y	x	y	x	y
1	1855	6	17	11	2	16	1	Total	2454
2	350	7	5	12	3	18	1		
3	124	8	6	13	3	24	1		
4	54	9	1	14	4	32	1		
5	22	10	2	15	1	35	1		

Greece

x	y	x	y	x	y	x	y	x	y
1	2644	5	35	9	7	13	1	24	1
2	416	6	26	10	5	15	1	Total	3397
3	165	7	4	11	2	16	1		
4	72	8	14	12	2	18	1		

Netherlands

x	y	x	y	x	y	x	y	x	y
1	3033	4	53	7	10	10	2	14	1
2	447	5	24	8	6	11	2	19	1
3	119	6	16	9	3	12	1	Total	3718

India

x	y	x	y	x	y	x	y	x	y
1	2361	4	41	7	8	10	2	16	1
2	311	5	19	8	4	13	1	20	1
3	107	6	10	9	2	14	2	Total	2870

Singapore

x	y	x	y	x	y	x	y	x	y
1	2063	6	23	11	5	18	1	Total	2742
2	379	7	15	12	4	19	1		
3	132	8	9	13	2	20	1		
4	58	9	8	14	4	23	1		
5	31	10	3	16	1	30	1		

Switzerland

x	y	x	y	x	y	x	y	x	y
1	2315	4	39	7	3	10	1	17	1
2	331	5	18	8	2	13	2	23	1
3	81	6	15	9	2	15	1	Total	2812

Brazil

x	y	x	y	x	y	x	y	x	y
1	2361	3	71	5	15	7	4	10	2
2	310	4	26	6	11	8	2	Total	2802

Belgium

x	y	x	y	x	y	x	y	x	y
1	1874	5	27	9	3	13	4	18	2
2	277	6	16	10	1	15	2	32	1
3	91	7	6	11	2	16	1	Total	2361
4	39	8	11	12	3	17	1		