InTraCoM Group
Intellectual Property Solutions

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Assets on Artificial intelligence technologies - An insight from a patent perspective

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1. Methodology

Intracom used for the current analysis the patent search and analysis tool "Orbis Intellectual Property" from Bureau van Dijk[1] which combines company and patent information for intellectual property management and strategy. Orbis IP links 115 million patents on about 300 million companies.
The search was performed for the alive patents in year 2017, witch search strings like "artificial intelligence" or "machine learning" in the patent fields "abstract, claims, description and title". The used search languages were English, German, French, Chinese and Japan. For the year 2017 65.527 patents were found, classified and analysed.

The valuation was performed by applying the indicator based market analogy method from InTraCoM. Here all patents and utility models are analysed by taking different fixed indicators into account, applying mathematical algorithms and interdependencies. Within the method there are up to 26 indicators used for a full automated patent valuation (Autorating). The indicators cover the fields of Assignee, Environment, Technology and Legals of each IP. Basis for the value calculation are reference values of traded patents in the past (market analogy approach) having a similar indicator pattern to the patent that is valued (reference values)[2]. The calculated values are an external market view on the patent portfolio. **This means that they do not necessarily have to correspond to income values**.

The market analogy approach also takes the maturity of a patent strongly into account. Patents being close to their end of life (i.e. if the remaining utilization period is only 12 months or less) are decreasing in value disproportionally. This takes into account that a patent that is intended to be sold needs a certain time of being transferred and finally utilized by a potential buyer.

Important hint: Due the patent system to file a patent for a region, i.e. Europe or worldwide (PCT) there may be some distortion in the analysed data. The authors have done their best to keep this effect as low as possible.

2. Aim of the study

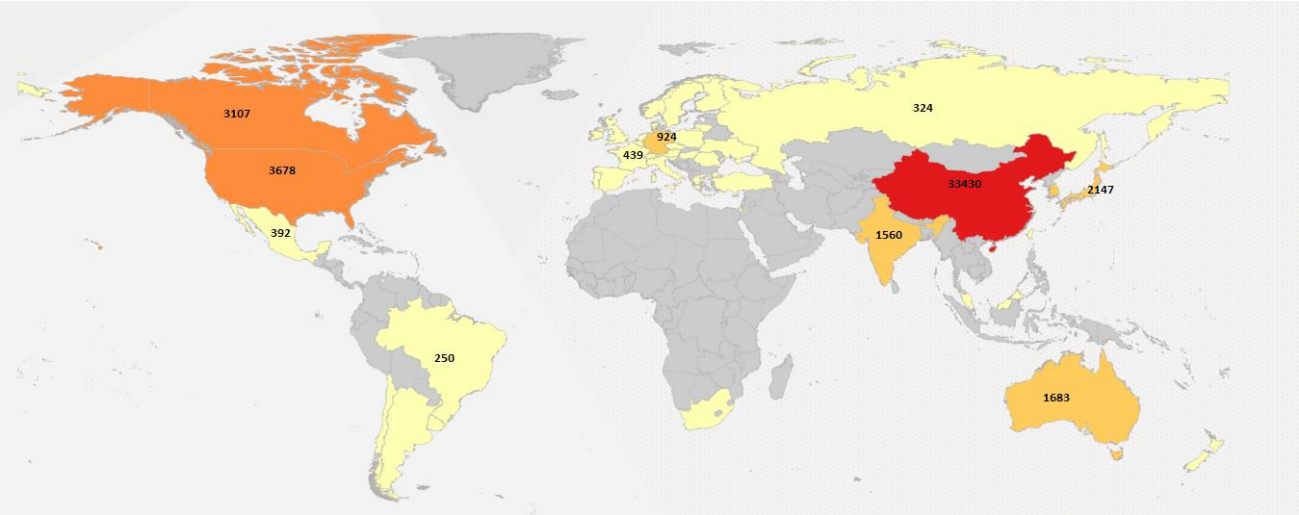
The aim of the study is to determine which regions and which companies have high valuable patent assets in the area of AI. Patent analytics based only on statistical analysis on **amount** on patents applied or granted are often misleading, because this data is not really correlated to values generated thru the patents. Based on Intracom's methodology on automated patent valuation the analysis possibilities give a deep insight into the companies' hidden intangible assets, namely patents and utility models.

[1] https://www.bvdinfo.com/en-gb/our-products/data/international/orbis-intellectual-property

[2] Kiehne, D.-O.: Automated patent valuation: background and main questions; Stuttgart, 02.2016; http://www.media.intracomgroup.de/WP-Patentvaluation_with_indicators.pdf

3. Results – Macro level

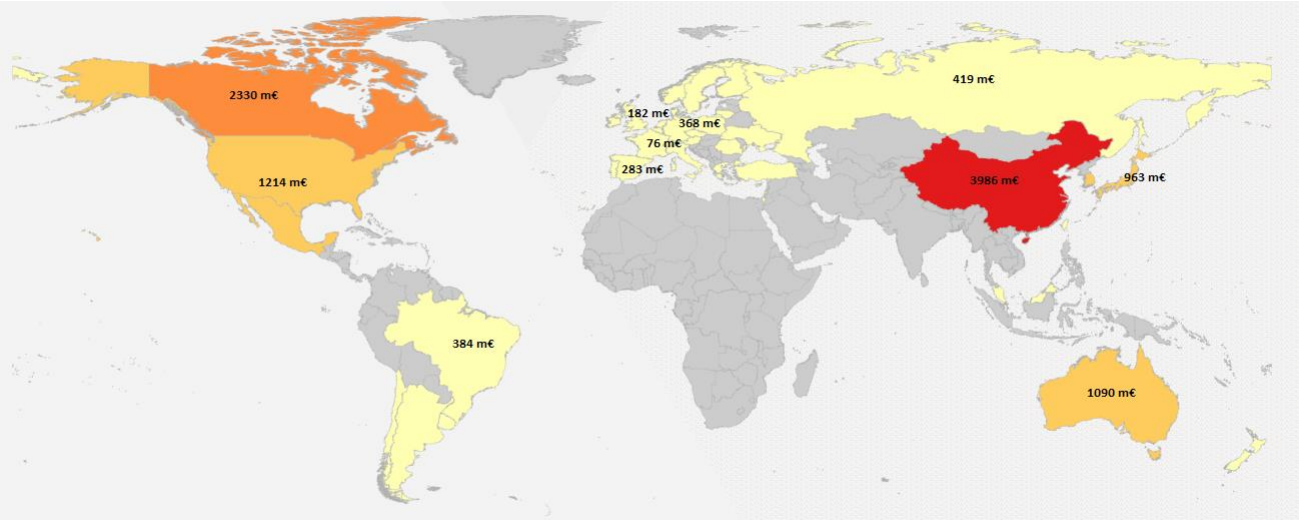
The total amount on filed and granted patents in AI globally are as follows:



Zone	Number of patents
China	33,430
United States of America	3,678
Canada	3,107
Japan	2,147
South Korea	2,009
Australia	1,683
India	1,560
Germany	924
United Kingdom	645
Taiwan	446
France	439
Mexico	392
Russia	324
Brazil	250
Spain	245
Austria	49
Denmark	33
Israel	32
Ireland	25

There is a strong focus on China, beside US, Canada and Japan.

The generated patent values in the certain regions are as follows:



Zone	Patent values in EUR
China	3,986,145,500
Canada	2,329,949,000
United States of America	1,213,799,500
Australia	1,090,301,500
South Korea	1,048,684,000
Japan	962,694,000
Mexico	604,178,000
Russia	418,600,500
Brazil	383,533,000
Germany	368,117,000
Spain	283,023,000
United Kingdom	181,539,500
Taiwan	170,070,000
France	76,072,000
Portugal	70,388,500
Denmark	58,013,500
Israel	39,537,000
Austria	28,261,500

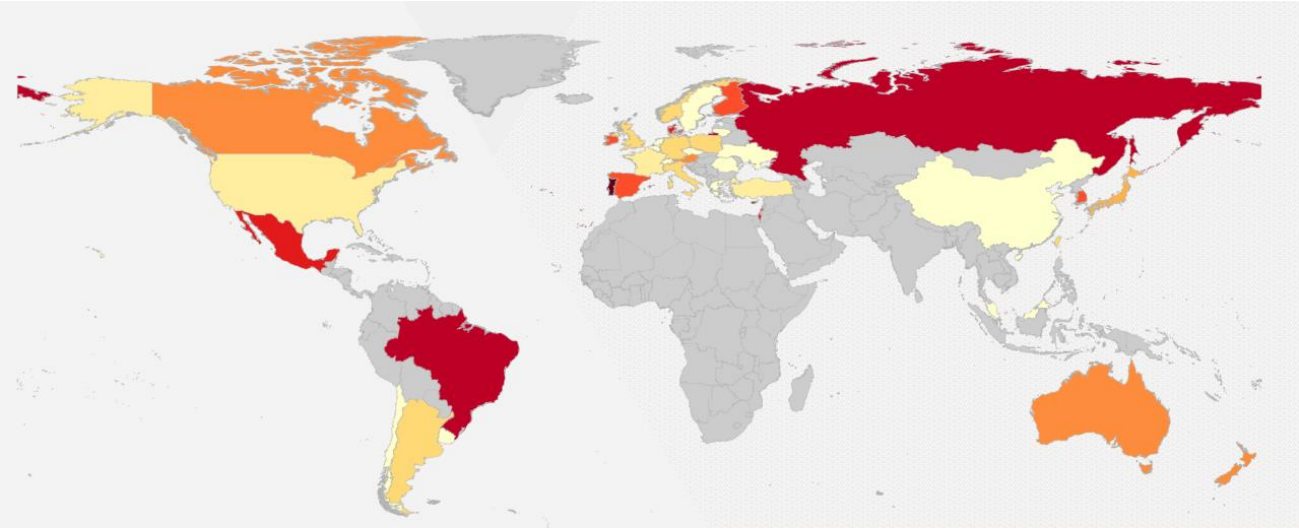
By comparing amount on patents with generated values we receive the following analysis (the coloured arrow indicates the difference between amount on patents and generated value):

Patent values by countries

Difference in ranking	Zone	Patent valuesEUR	Patent value ranking	Amount on patents ranking
→	China	3,986,145,500	1	1
→	Canada	2,329,949,000	2	3
→	United States of America	1,213,799,500	3	2
↓	Australia	1,090,301,500	4	6
→	South Korea	1,048,684,000	5	5
↓	Japan	962,694,000	6	4
↑	Mexico	604,178,000	7	12
↑	Russia	418,600,500	8	13
↑	Brazil	383,533,000	9	14
↓	Germany	368,117,000	10	8
↑	Spain	283,023,000	11	15
↓	United Kingdom	181,539,500	12	9
↓	Taiwan	170,070,000	13	10
↓	France	76,072,000	14	11
↑	Portugal	70,388,500	15	20
→	Denmark	58,013,500	16	17
→	Israel	39,537,000	17	18
↓	Austria	28,261,500	18	16
↑	Finland	12,755,500	19	22
→	Ireland	10,456,500	20	19

It is striking that patents in the countries Mexico, Russia, Brazil, Spain, Portugal and Finland are of certain interest. In Brazil Qualcomm and Microsoft are very active, in Russia are Apple, Qualcomm and Microsoft.

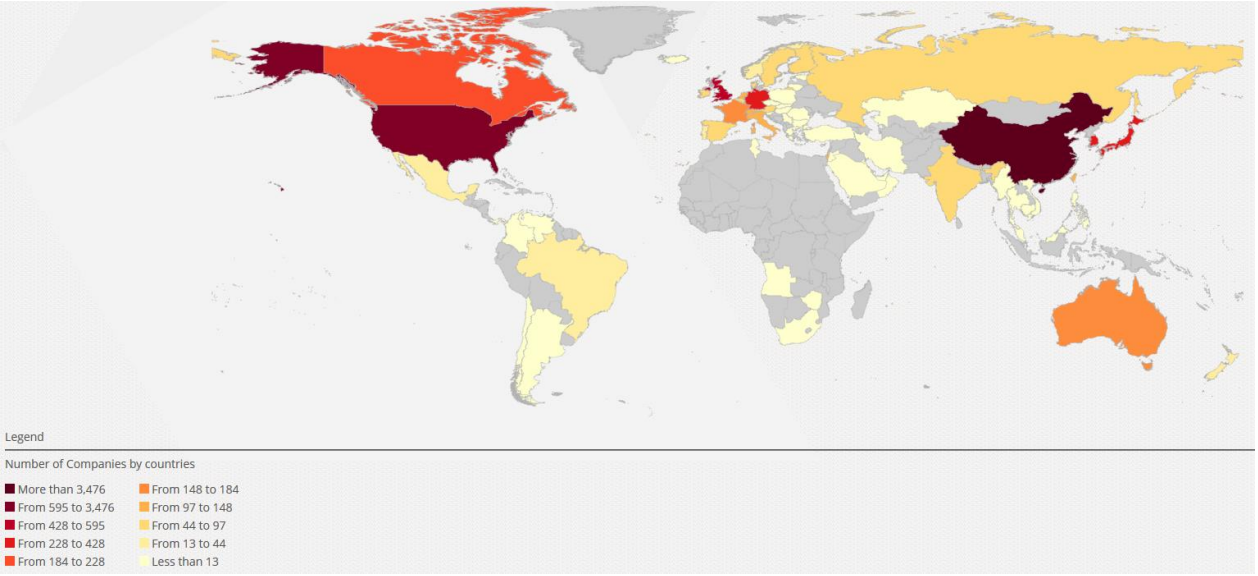
The average value per patent is shown in the following analysis:



Average patent values per patent

More than 3,360 th	From 857 th to 1,103 th
From 2,540 th to 3,360 th	From 697 th to 857 th
From 1,871 th to 2,540 th	From 478 th to 697 th
From 1,594 th to 1,871 th	From 192 th to 478 th
From 1,103 th to 1,594 th	Less than 192 th

The number of the companies and research centers per country having AI patents are:



Zone	Number of Companies
China	4,749
United States of America	3,476
United Kingdom	595
Germany	428
South Korea	395
Japan	374
Canada	228
Australia	184
France	178
Israel	148
Netherlands	147
Switzerland	136
Taiwan	123
Hong Kong S.A.R.	117
Italy	116
Spain	97
Sweden	96
Singapore	84
Luxembourg	82
India	78

The patents are classified with WIPO definition as follows:

WIPO	Number of patents
Computer technology	22.936
Control	5.752
Digital communication	5.744
IT methods for management	4.566
Measurement	3.888
Handling	2.819
Medical technology	2.694
Telecommunications	2.184
Audio-visual technology	1.922
Furniture, games	1.902
Electrical machinery, apparatus, energy	1.869
Transport	1.655
Other special machines	815
Biotechnology	747
Civil engineering	688
Machine tools	549
Thermal processes and apparatus	511
Other consumer goods	410
Engines, pumps, turbines	398
Analysis of biological materials	381
Optics	339
Chemical engineering	318
Environmental technology	307
Mechanical elements	285
Semiconductors	245
Materials, metallurgy	219
Organic fine chemistry	160
Surface technology, coating	153
Basic communication processes	152
Textile and paper machines	147
Pharmaceuticals	139
Food chemistry	116
Macromolecular chemistry, polymers	105
Basic materials chemistry	102
Micro-structural and nano-technology	8

Based on the average value per patent the ranking of the technical classifications is as follows:

WIPO classification	Number of patents	Patent value (th EUR)	Average value per patent in €
Digital communication	5.744	1.629.214	283.638
Telecommunications	2.184	464.355	212.617
Medical technology	2.694	395.470	146.797
Biotechnology	747	99.224	132.830
Pharmaceuticals	139	17.580	126.475
Textile and paper machines	147	18.060	122.857
Analysis of biological materials	381	46.467	121.961
Semiconductors	245	27.550	112.449
Furniture, games	1.902	212.688	111.823
Computer technology	22.936	2.555.526	111.420
Audio-visual technology	1.922	203.797	106.034
Civil engineering	688	70.715	102.783
Optics	339	33.717	99.460
Electrical machinery, apparatus, energy	1.869	177.906	95.188
Measurement	3.888	366.928	94.374
Food chemistry	116	10.760	92.759
Organic fine chemistry	160	14.498	90.613
Transport	1.655	139.891	84.526
Surface technology, coating	153	12.163	79.497
Engines, pumps, turbines	398	28.738	72.206
Control	5.752	414.725	72.101
Mechanical elements	285	19.743	69.274
IT methods for management	4.566	308.338	67.529
Macromolecular chemistry, polymers	105	6.170	58.762
Basic materials chemistry	102	5.936	58.196
Machine tools	549	28.474	51.865
Other special machines	815	40.860	50.135
Thermal processes and apparatus	511	25.156	49.229
Basic communication processes	152	7.470	49.145
Other consumer goods	410	19.150	46.707
Chemical engineering	318	13.432	42.239
Environmental technology	307	10.912	35.544
Micro-structural and nano-technology	8	260	32.500
Handling	2.819	84.374	29.930
Materials, metallurgy	219	5.294	24.174

The sectors like Computer technology and Control have the highest patent activity, but the most valueables patents are in the area of Digital communication, Telecommunications and medical technology.

The amount on patents for the important countries/regions are:

	Office of publication													
	European Patent Office	Australia	Brazil	Canada	China	Germany	France	United Kingdom	India	Japan	Korea (South)	Russian Federation	United States of America	All
WIPO	Number of patents													
Electrical machinery, apparatus, energ	115	44	3	67	**1.227**	21	13	13	28	34	64	4	32	1.869
Audio-visual technology	139	55	8	73	**864**	12	15	58	56	78	77	8	81	1.922
Telecommunications	214	42	28	136	**696**	41	13	38	156	110	127	11	144	2.184
Digital communication	554	131	33	415	**2.736**	60	35	99	173	181	158	22	189	5.744
Basic communication processes	9	3	0	9	**77**	5	3	2	3	14	1	1	1	152
Computer technology	1.290	482	63	908	**11.231**	272	191	175	546	946	564	131	1.953	22.936
IT methods for management	231	285	19	272	**1.815**	52	15	26	132	74	250	4	345	4.566
Semiconductors	8	2	0	3	**112**	3	2	1	2	17	24	1	17	245
Optics	28	2	0	4	**163**	12	2	5	6	14	8	1	8	339
Measurement	224	86	26	235	**2.242**	69	34	66	59	85	41	18	116	3.888
Analysis of biological materials	21	25	5	43	**116**	6	8	6	6	14	3	4	19	381
Control	259	105	14	171	**3.623**	102	32	21	78	116	117	26	271	5.752
Medical technology	187	117	7	223	**926**	49	17	14	64	102	79	19	139	2.694
Organic fine chemistry	1	9	1	8	**20**	2	0	0	2	4	4	0	4	160
Biotechnology	45	56	9	**109**	93	7	4	4	17	39	5	0	16	747
Pharmaceuticals	4	15	3	11	**27**	1	0	0	5	4	1	1	3	139
Macromolecular chemistry, polymers	0	0	0	1	**87**	0	0	0	1	0	4	0	1	105
Food chemistry	6	3	1	7	**50**	0	1	0	3	3	21	0	1	116
Basic materials chemistry	2	4	0	5	**61**	1	0	0	3	3	0	0	0	102
Materials, metallurgy	1	1	0	0	**194**	0	0	0	4	5	2	5	0	219
Surface technology, coating	5	2	0	6	**105**	0	2	3	2	7	2	0	6	153
Micro-structural and nano-technology	0	0	0	1	**3**	0	0	0	1	0	0	0	0	8
Chemical engineering	13	8	1	14	**223**	2	3	2	6	1	8	0	3	318
Environmental technology	11	6	4	13	**169**	8	5	1	7	11	20	2	3	307
Handling	56	8	2	21	**2.440**	22	16	4	15	43	40	6	19	2.819
Machine tools	21	2	0	23	**407**	13	0	3	4	15	14	5	4	549
Engines, pumps, turbines	36	8	1	24	**172**	20	2	7	12	12	11	4	15	398
Textile and paper machines	10	5	1	15	**72**	3	0	0	2	9	13	1	0	147
Other special machines	22	23	1	28	**538**	12	0	2	10	9	29	13	15	815
Thermal processes and apparatus	20	3	3	14	**341**	10	3	3	2	11	40	1	11	511
Mechanical elements	13	1	3	16	**194**	11	2	1	4	1	5	0	3	285
Transport	86	38	4	50	**942**	84	9	24	24	44	60	15	40	1.655
Furniture, games	92	57	1	83	**831**	16	1	8	17	103	151	9	180	1.902
Other consumer goods	30	6	1	15	**207**	4	2	4	6	26	46	0	14	410
Civil engineering	27	45	6	79	**319**	4	9	26	2	11	20	12	14	688

China is leading in nearby all sectors, except of Biotechnology. If we do the same analysis based on patent values, the result is different:

	Office of publication									
	European Patent Office	Australia	Canada	China	Japan	Korea (South)	Russian Federation	Taiwan	United States of America	All
WIPO	PATENT VALUES									
Electrical machinery, apparatus, energ	51.630	8.478	29.562	**47.494**	1.281	11.260	945	24	9.511	177.906
Audio-visual technology	45.670	6.674	17.577	48.016	6.741	7.074	11.486	267	7.918	203.797
Telecommunications	**156.161**	12.022	48.206	78.568	3.622	21.608	1.454	61	86.350	464.355
Digital communication	**613.036**	70.142	295.480	398.121	5.946	33.104	5.168	3.916	96.826	1.629.214
Basic communication processes	1.124	192	2.522	1.652	110	0	0	0	0	7.470
Computer technology	490.648	78.846	253.656	**654.942**	41.890	55.004	11.469	6.084	576.806	2.555.526
IT methods for management	31.092	23.316	**56.029**	43.694	1.643	14.964	1.889	698	49.766	308.338
Semiconductors	4.312	0	8	10.302	192	408	3	402	**8.750**	27.550
Optics	6.462	0	856	**8.811**	1.124	1.300	5	2.648	734	33.717
Measurement	**105.186**	17.304	44.707	90.702	6.006	3.098	51	3.009	41.012	366.928
Analysis of biological materials	**14.804**	4.522	1.582	5.820	0	721	3.987	0	4.826	46.467
Control	88.398	25.681	24.241	**153.875**	2.284	876	929	394	59.423	414.725
Medical technology	91.620	17.319	**97.589**	35.600	16.403	8.425	1.820	40	75.762	395.470
Organic fine chemistry	774	5.740	1.888	**1.374**	132	0	0	0	498	14.498
Biotechnology	**31.699**	11.022	20.196	7.420	5.152	51	0	0	2.652	99.224
Pharmaceuticals	**4.670**	1.840	0	1.571	0	0	82	0	5.765	17.580
Macromolecular chemistry, polymers	0	0	0	**4.749**	0	52	0	0	54	6.170
Food chemistry	**3.938**	12	3.366	1.272	0	64	0	0	0	10.760
Basic materials chemistry	84	74	0	**4.877**	60	0	0	0	0	5.936
Materials, metallurgy	339	15	0	**4.810**	0	12	27	0	0	5.294
Surface technology, coating	**3.259**	0	494	2.140	330	0	0	0	2.832	12.163
Micro-structural and nano-technology	0	0	0	**5**	0	0	0	0	0	260
Chemical engineering	**7.490**	209	686	4.260	0	65	0	5	172	13.432
Environmental technology	2.448	1.133	146	**3.837**	158	398	1.840	0	15	10.912
Handling	32.084	480	354	**33.286**	2.648	433	2.433	30	598	84.374
Machine tools	6.790	0	218	**12.488**	4.976	108	14	80	442	28.474
Engines, pumps, turbines	**13.715**	0	3.017	8.617	271	248	5	0	157	28.738
Textile and paper machines	**16.447**	58	589	646	0	129	35	0	0	18.060
Other special machines	3.518	1.958	7.045	**10.328**	10	186	57	41	3.549	40.860
Thermal processes and apparatus	5.902	118	938	**8.790**	464	175	0	18	3.400	25.156
Mechanical elements	3.107	5	2.624	**8.395**	0	2.072	0	5	5	19.743
Transport	**49.591**	7.943	3.884	38.764	1.118	11.489	106	60	6.634	139.891
Furniture, games	**43.162**	10.284	14.852	28.450	3.784	1.144	7.974	101	**78.892**	212.688
Other consumer goods	**4.638**	5	0	4.184	3.018	252	0	5	2.638	19.150
Civil engineering	6.596	7.806	**18.842**	7.396	312	162	10.296	10	2.986	70.715
n.a.	0	191	0	282	5	0	0	6	**640**	2.099
All	**1.940.396**	313.392	951.152	1.775.538	109.679	174.878	62.075	17.902	1.129.614	7.517.640

Based on the average value of the patent families the analysis is as follows:

	European Patent Office	Australia	Canada	China	Japan	Korea (South)	Russian Federation	Taiwan	United States of America
WIPO	AVERAGE PATENT VALUES								
Electrical machinery, apparatus, energy	**449**	193	441	39	38	176	236	2	297
Audio-visual technology	329	121	241	56	86	92	**1.436**	16	98
Telecommunications	730	286	354	113	33	170	132	4	600
Digital communication	**1.107**	535	712	146	33	210	235	115	512
Basic communication processes	125	64	**280**	21	8	0	0	0	0
Computer technology	**380**	164	279	58	44	98	88	40	295
IT methods for management	135	82	206	24	22	60	472	18	144
Semiconductors	539	0	3	92	11	17	3	31	515
Optics	231	0	214	54	80	163	5	883	92
Measurement	470	201	190	40	71	76	3	94	354
Analysis of biological materials	705	181	37	50	0	240	997	0	254
Control	341	245	142	42	20	7	36	12	219
Medical technology	490	148	438	38	161	107	96	2	545
Organic fine chemistry	774	638	236	69	33	0	0	0	125
Biotechnology	704	197	185	80	132	10	0	0	166
Pharmaceuticals	**1.168**	123	0	58	0	0	82	0	1.922
Macromolecular chemistry, polymers	0	0	0	55	0	13	0	0	54
Food chemistry	656	4	481	25	0	3	0	0	0
Basic materials chemistry	42	19	0	80	20	0	0	0	0
Materials, metallurgy	339	15	0	25	0	6	5	0	0
Surface technology, coating	652	0	82	20	47	0	0	0	472
Micro-structural and nano-technology	0	0	0	2	0	0	0	0	0
Chemical engineering	576	26	49	19	0	8	0	5	57
Environmental technology	223	189	11	23	14	20	920	0	5
Handling	573	60	17	14	62	11	406	5	31
Machine tools	323	0	9	31	332	8	3	20	111
Engines, pumps, turbines	381	0	126	50	23	23	1	0	10
Textile and paper machines	1.645	12	39	9	0	10	35	0	0
Other special machines	160	85	**252**	19	1	6	4	7	237
Thermal processes and apparatus	295	39	67	26	42	4	0	3	**309**
Mechanical elements	239	5	164	43	0	**414**	0	5	2
Transport	**577**	209	78	41	25	191	7	4	166
Furniture, games	469	180	179	34	37	8	**886**	4	438
Other consumer goods	155	1	0	20	116	5	0	5	188
Civil engineering	244	173	239	23	28	8	**858**	3	213
All	**513**	186	306	53	51	87	192	40	307

4. Results – Corporate level

The companies having the most alive patents are (Top 20):

	Company name	No of Patents
1	SAMSUNG ELECTRONICS CO.,LTD.	1.932
2	QUALCOMM INC	1.786
3	MICROSOFT CORPORATION	1.602
4	GUO JIA DIAN WANG YOU XIAN GONG SI	975
5	AVAYA HOLDINGS CORP.	448
6	SONY CORPORATION	438
7	GENERAL ELECTRIC COMPANY	382
8	KONINKLIJKE PHILIPS N.V.	379
9	INTERNATIONAL BUSINESS MACHINES CORP	344
10	SIEMENS AG	290
11	BAIDU INC.	281
12	SOUTH CHINA UNIVERSITY of TECHNOLOGY	279
13	ZHEJIANG UNIVERSITY	268
14	AT&T INC.	258
15	ROCKWELL AUTOMATION, INC.	250
16	SZ DJI TECHNOLOGY CO., LTD.	224
17	INTEL CORP	220
18	ALPHABET INC.	219
19	BOEING COMPANY (THE)	219
20	APPLE INC.	198

The companies having the highest patent value are (Top 20):

	Company name	No of Patents	Aggregated patents value th EUR
1	SAMSUNG ELECTRONICS CO.,LTD.	1.932	1.390.547
2	QUALCOMM INC	1.786	530.881
3	MICROSOFT CORPORATION	1.602	189.111
4	GUO JIA DIAN WANG YOU XIAN GONG SI	975	155.071
5	AVAYA HOLDINGS CORP.	448	150.620
6	SONY CORPORATION	438	128.745
7	GENERAL ELECTRIC COMPANY	382	125.401
8	KONINKLIJKE PHILIPS N.V.	379	111.777
9	INTERNATIONAL BUSINESS MACHINES CORP	344	110.367
10	SIEMENS AG	290	101.959
11	BAIDU INC.	281	93.731
12	AT&T INC.	258	49.930
13	ROCKWELL AUTOMATION, INC.	250	39.039
14	SZ DJI TECHNOLOGY CO., LTD.	224	27.996
15	INTEL CORP	220	25.788
16	ALPHABET INC.	219	24.485
17	BOEING COMPANY (THE)	219	23.401
18	APPLE INC.	198	22.313
19	BEIJING GUANGNIAN WUXIAN SCIENCE AND TECHNOLOGY CO., LTD.	195	21.853
20	HUAWEI INVESTMENT & HOLDING CO., LTD. LABOR UNION COMMITTEE	192	21.070

The companies having the highest **average** patent value are:

	Company name	No of Patents	Aggregated patents value in th EUR	Average value per patent in EUR
1	APPLE INC.	198	155.071	783.187
2	QUALCOMM INC	1.786	1.390.547	778.581
3	GOOGLE LLC	155	92.632	597.623
4	INTEL CORP	220	111.777	508.077
5	ALPHABET INC.	219	101.959	465.566
6	SONY CORPORATION	438	189.111	431.760
7	KONINKLIJKE PHILIPS N.V.	379	150.620	397.414
8	MICROSOFT CORPORATION	1.602	530.881	331.386
9	INTERNATIONAL BUSINESS MACHINES CORP	344	110.367	320.834
10	AVAYA HOLDINGS CORP.	448	128.745	287.376
11	AT&T INC.	258	70.674	273.928
12	NOKIA OYJ	150	39.039	260.257
13	BOEING COMPANY (THE)	219	55.363	252.797
14	LG ELECTRONICS INC.	104	25.788	247.962
15	GENERAL ELECTRIC COMPANY	382	93.731	245.368
16	XEROX CORP	93	22.313	239.919
17	SZ DJI TECHNOLOGY CO., LTD.	224	52.761	235.538
18	FUJITSU LIMITED	105	24.485	233.186
19	HALLIBURTON CO	126	27.996	222.187
20	TOSHIBA CORPORATION	99	21.853	220.737

The research centers having the most alive patents are (Top 20):

	Research Center	No of Patents
1	SOUTH CHINA UNIVERSITY of TECHNOLOGY	279
2	ZHEJIANG UNIVERSITY	268
4	SOUTHEAST UNIVERSITY	187
5	NANJING UNIVERSITY of POSTS AND TELECOMMUNICATIONS	180
6	TIANJIN UNIVERSITY	168
7	TSINGHUA UNIVERSITY	168
8	BEIJING UNIVERSITY OF TECHNOLOGY	162
9	WUHAN UNIVERSITY	135
10	CHINESE ACADEMY of SCIENCES	132
11	HUAZHONG UNIVERSITY of SCIENCE AND TECHNOLOGY	129
12	CHONGQING UNIVERSITY	122
13	ZHEJIANG UNIVERSITY of TECHNOLOGY	117
14	SHANGHAI JIAOTONG UNIVERSITY	115
15	GUANGDONG UNIVERSITY of TECHNOLOGY	112
16	NANJING UNIVERSITY of AERONAUTICS AND ASTRONAUTICS	111
17	CHONGQING UNIVERSITY of POSTS AND TELECOMMUNICATIONS	104
18	SHANDONG UNIVERSITY	99
19	NORTH CHINA ELECTRIC POWER UNIVERSITY	89
20	TONGJI UNIVERSITY	89

The research centers having the highest patent value are:

	Research Center	Aggregated patents value th EUR
1	ZHEJIANG UNIVERSITY	10.780
2	SOUTH CHINA UNIVERSITY of TECHNOLOGY	10.464
3	BEIJING UNIVERSITY OF TECHNOLOGY	9.048
4	TSINGHUA UNIVERSITY	8.933
5	SOUTHEAST UNIVERSITY	7.283
6	SHANGHAI JIAOTONG UNIVERSITY	7.034
7	NANJING UNIVERSITY of POSTS AND TELECOMMUNICATIONS	6.867
8	SHANDONG UNIVERSITY	5.892
9	WUHAN UNIVERSITY	5.876
10	TIANJIN UNIVERSITY	5.523
11	NORTH CHINA ELECTRIC POWER UNIVERSITY	5.466
12	NANJING UNIVERSITY of AERONAUTICS AND ASTRONAUTICS	5.209
13	CHINESE ACADEMY of SCIENCES	5.029
14	ZHEJIANG UNIVERSITY of TECHNOLOGY	4.143
15	CHONGQING UNIVERSITY of POSTS AND TELECOMMUNICATIONS	4.036
16	HUAZHONG UNIVERSITY of SCIENCE AND TECHNOLOGY	3.820
17	CHONGQING UNIVERSITY	3.605
18	GUANGDONG UNIVERSITY of TECHNOLOGY	2.208
19	TONGJI UNIVERSITY	1.919

Research centers comparison: Amount on patents, patent value and average value per patent family (the coloured arrow indicates the difference between amount on patents and generated value):

	Research Center	Ranking Amount on patents	Ranking Patent value	Ranking Average patent value
↑	NORTH CHINA ELECTRIC POWER UNIVERSITY	18	11	1
↑	SHANGHAI JIAOTONG UNIVERSITY	13	6	2
↑	SHANDONG UNIVERSITY	17	8	3
↑	BEIJING UNIVERSITY OF TECHNOLOGY	7	3	4
↑	TSINGHUA UNIVERSITY	6	4	5
↑	NANJING UNIVERSITY of AERONAUTICS AND ASTRON	15	12	6
→	WUHAN UNIVERSITY	8	9	7
↓	ZHEJIANG UNIVERSITY	2	1	8
↓	SOUTHEAST UNIVERSITY	3	5	9
↓	CHONGQING UNIVERSITY of POSTS AND TELECOMMU	16	15	10
↓	NANJING UNIVERSITY of POSTS AND TELECOMMUNIC	4	7	11
↓	CHINESE ACADEMY of SCIENCES	9	13	12
↓	SOUTH CHINA UNIVERSITY of TECHNOLOGY	1	2	13
→	ZHEJIANG UNIVERSITY of TECHNOLOGY	12	14	14
↓	TIANJIN UNIVERSITY	5	10	15
↓	HUAZHONG UNIVERSITY of SCIENCE AND TECHNOLO	10	16	16
↓	CHONGQING UNIVERSITY	11	17	17
→	TONGJI UNIVERSITY	19	19	18
↓	GUANGDONG UNIVERSITY of TECHNOLOGY	14	18	19

The patent transactions[3] have been done from one company to another are:

Vendor	Byer
Advanced Micro Devices, Inc.	GLOBALFOUNDRIES INC
Alpiq InTec AG	Various buyers
American Express Company	Wells Fargo & Company Inc.
Anki, Inc.	SILICON VALLEY BANK
ARCELORMITTAL FRANCE	PAUL WURTH S.A
AT&T	SAMSUNG ELECTRONICS CO
Atlas Elektronik GmbH	Thyssenkrupp
August Home Inc.	Assa Abloy AB
AVAYA INC.	CITIBANK, N.A.
Bally Technologies Inc.	Scientific Games Corporation
BANK OF AMERICA	GENESYS TELECOMMUNICATIONS LABORATORIES, INC
BANK OF AMERICA	ACTIVISION BLIZZARD INC
Blue Coat Systems, Inc.	SYMANTEC CORPORATION
BodyMedia Inc.	AliphCom Inc.
Bonsai AI Inc.	Microsoft Corporation
CA Inc.	Broadcom Inc.
CHINA ELECTRIC POWER RES INST	STATE ELECTRIC NET CROP.
CyberSource Corporation	Visa Inc.
CYPRESS SEMICONDUCTOR CORPORATION,	MONTEREY RESEARCH, LLC
Definiens AG	MedImmune LLC
Electro Scientific Industries Inc.	MKS Instruments Inc.
Electronic Arts Inc.	Microsoft Corporation
EnerNOC Inc.	Enel Green Power North America Inc.
Excitor A/S	Soliton Systems KK
Fundamo (Pty) Ltd	Visa Inc.
HipCricket Inc.	Upland Software Inc.
Illumina Inc.	Roche Holding AG
Incyte Corporation	Gilead Sciences Inc.
Intralinks Holdings Inc.	SS&C Technologies Holdings Inc.
InvenSense Inc.	TDK Corporation
ITERIS, INC.	CLEARAG, INC.
Kofax Ltd	Lexmark International Inc.
L3 Technologies Inc.	Harris Corporation
Metaio GmbH	Apple Inc.
MST Medical Surgery Technologies Ltd	TransEnterix Israel Ltd
Q-TEC SYSTEMS LLC	KONINKLIJKE PHILIPS N.V.
Telair International GmbH	TransDigm Group Inc.
Time Warner Inc.	AT&T Corporation
VEYANCE TECHNOLOGIES, INC.	TRELLEBORG INDUSTRI AB

[3] Minimum 5 patent families between vendor and buyer. Transaction is between 3rd parties, not intracorporate.

The Top 20 inventors in these companies and research centers are:

	Inventor name	No. of Patents	Aggregated patents value in th EUR	Average value in €
1	MONTOJO JUAN	59	176.163	2.985.805
2	MALLADI DURGA PRASAD	76	187.697	2.469.697
3	WANG JUN	67	31.884	475.873
4	BARNICKEL, Donald J.	86	15.881	184.663
5	GERSZBERG, Irwin	128	23.588	184.277
6	BENNETT, Robert	119	20.433	171.706
7	HENRY, Paul Shala	115	19.236	167.265
8	BARZEGAR, Farhad	121	19.984	165.157
9	WILLIS III, Thomas M.	55	8.867	161.209
10	ZHANG WEI	100	10.461	104.605
11	SIRPAL, Sanjiv	63	6.342	100.659
12	LI BO	65	4.491	69.092
13	WANG YONG	50	2.899	57.970
14	WANG LEI	81	4.647	57.370
15	WU JUN	49	2.804	57.214
16	LI YANG	48	2.004	41.750
17	LI YAN	51	2.013	39.461
18	WANG WEI	122	4.506	36.934
19	ZHANG TAO	48	1.667	34.719
20	WANG HUI	71	2.373	33.423

5. Results – Patent level

The Top 10 of the most valuable patent families are:

Patent no	Ceased latest date	Title	Applicant	Average value 2018-09-30
CA2792570C	10.01.2031	PARAPHRASING OF USER REQUESTS AND RESULTS BY AUTOMATED DIGITAL ASSISTANT	APPLE INC.	55.448.500 €
US9830121B2	30.12.2031	Image capture modes for dual screen mode	Z124	51.482.500 €
WO2009140438A1	21.11.2028	COMMERCE AND SERVICES IN A FEMTOCELL NETWORK	AT&T MOBILITY	26.907.000 €
CA2667023C	31.10.2027	METHOD AND APPARATUS FOR CELL SEARCH IN AN ORTHOGONAL WIRELESS COMMUNICATION SYSTEM	Qualcomm Inc	17.674.500 €
CA2560386C	05.02.2025	A DIGITAL MAPPING SYSTEM	GOOGLE INC.	17.305.500 €
US9070252B2	13.03.2034	System and method of revealing sponsored and other items through mock reveals	Game Play Network, Inc.	14.157.500 €
US9107064B1	22.06.2030	Mobile device security	Amazon Technologies, Inc.	14.129.000 €
EP1642687B9	28.06.2024	CONTROL DEVICE FOR LEGGED MOBILE ROBOT	HONDA MOTOR CO., LTD.	13.063.000 €
CA2698348C	28.08.2027	SYSTEM AND METHOD FOR ACTIVE POWER LOAD MANAGEMENT	CONSERT INC.	12.693.000 €
CN100433785C	18.07.2023	A system and process for generating high dynamic range images from multiple exposures of a moving scene	Microsoft Corp.	12.444.000 €
CN101158886B	28.10.2023	User interface system based on pointing device	Koninklijke Philips Electronics N.V.	10.715.500 €
EP2367345B1	15.03.2030	Image pickup apparatus and its control method	CANON KABUSHIKI KAISHA	9.980.500 €
EP2889782A1	30.12.2028	Shared virtual memory	INTEL CORPORATION	9.368.000 €
EP2206559B1	01.07.2024	Optical cell for a separation chamber of a density centrifuge blood processing system	Terumo BCT, Inc.	8.978.000 €
CA2740800A1	21.10.2029	PREDICTED PIXEL VALUE GENERATION PROCEDURE AUTOMATIC PRODUCING METHOD,IMAGE ENCODING METHOD	Nippon Telegraph and Telephone Corporation	8.196.000 €
CN100472600C	20.12.2024	Virtual keyboard system with automatic text input correction	AMERICA ONLINE SERVICE, INC.	7.686.000 €
AU2009203095B2	07.02.2023	Systems and methods for enhancing electronic communication security	Secure Computing Corporation	5.302.500 €
WO03100643A1	31.07.2022	DYNAMIC PLAYER MANAGEMENT	SONY INC.	5.148.500 €

The top 10 patent families with highest technology impact[4] are:

Patent no.	Assignee	Title
WO2014153201A1	ALTERG, INC.	Apparatus for passive exercising (A61H0005000000 takes precedence);;Vibrating apparatus; Chiropractic devices, e.g. body impacting devices, external devices for briefly extending or aligning unbroken bones
WO2011016857A2	ELLIOTT, James C.	Measuring arrangements or details thereof in so far as they are not adapted to particular types of measuring means of the other groups of this subclass
WO2012100092A2	SERVICEMESH, INC.	Security arrangements for protecting computers or computer systems against unauthorised activity by restricting access to, or manipulation of, programmes or processes
CN104194334A	CHONGQING INST GREEN & INTELLIGENT TECHNOLOGY CAS	Compositions of macromolecular compounds obtained by reactions forming in the main chain of the macromolecule a linkage containing nitrogen with or without oxygen, or carbon only, not provided for in groups ;
WO2016109820A1	HAQ, Mohamed, M.	Systems or methods specially adapted for a specific business sector, e.g. utilities or tourism:Education
CN101574970B	VIMICRO CO LTD BEIJING	Purposes of road vehicle drive control systems not related to the control of a particular sub-unit, e.g. of systems using conjoint control of vehicle sub-units
CN101732858B	SHENGLE INF TECH SHANGHAI CO	Digital computing or data processing equipment or methods, specially adapted for specific applications
CN104845300A	CHENGDU NEW KELI CHEM SCI CO	Compositions of polyesters obtained by reactions forming a carboxylic ester link in the main chain (of polyester-amides C08L0077120000; of polyester-imides C08L0079080000); Compositions of derivatives of such polymers:Polyesters derived from hydroxy carboxylic acids, e.g. lactones (C08L0067060000 takes precedence);
CN105430767A	LUO YI	Network topologies: Self-organising networks, e.g. ; ad hoc networks or sensor networks
WO2012035149A1	CONNECTED ZINKING S.L.	Arrangements, apparatus, circuits or systems, not covered by a single one of groups H04L0001000000-H04L0027000000; (interconnection of, or transfer of information or other signals between, memories, input/output devices or central processing units G06F0013000000):Transmission control procedure, e.g. data link level control procedure

[4] The technology impact is calculated based on different indicators that point to the core of the invention itself like technical coverage, detectability of infringement, the differentiation to state of the art, the technical relevance etc. are summed up in this key figure.

The best 10 patent families with highest market attractiveness impact[5] are:

Patent no.	Assignee	Title
CN106122778A	SHANGHAI KOITO AUTOMOTIVE LAMP	Elastic OLED (Organic Light Emitting Diode) connecting structure and elastic OLED connecting method
CN104440926A	UNIV CHONGQING POSTS & TELECOM	Mechanical arm somatic sense remote controlling method and mechanical arm somatic sense remote controlling system based on Kinect
WO2017024185A1	INNOSYS INC	Solid State Lighting Systems
CN103219405A	MH SOLAR COMPANY LTD	Solar energy aggregator
CN103633938A	UNIV CHINA MINING	Photovoltaic array fault positioning method
CN102101812A	TIANJIN JIN OU FERTILIZER CO LTD	Method for realizing industrialization of environmentally-friendly sustained-release and sustained-release fertilizers
CN105082153A	XINGUANG NUMERICAL CONTROL TECHNOLOGY CO LTD	Large intelligent sweeping robot
KR101095544B1	JMCENGINEERING CO LTD	THE SOLAR CELL BOARD
CN104647350A	XI'AN DAYU PHOTOELECTRIC TECHNOLOGY CO., LTD.	Small domestic robot
CN204997684U	ZHEJIANG JIETAI ELECTRONIC TECH CO LTD	Gripping heads:having finger members

[5] The market attractiveness is determined by analysing the amount on applications and grants per IPC class and characterization the applicant

6. Conclusion

Different metrics - different results. The current analysis is based on patent assets (value) and not on costs (amount on patents or similar metrics). The results show that although there is a very strong push in China in AI patents from local universities and filed from big international corporates the highest values are generated in Europe with as well some other "surprising" countries like Canada, Brazil, Russia or Mexico. We hope that with this study we could prove that "mass is not class" and are very curious to receive your feedback and questions upon that study.

7. Outlook

Intracom will replicate the current study for the year 2018 as soon as the patent valuation data for Dec. 2018 are ready and processes in Orbis IP. If you wish to receive the updated study please drop us an email to: zagos@intracomgroup.de

8. About the Author

Prof. Dipl.-Ing. Andreas Zagos is founder and management Partner of the Bonn based InTraCoM Group (Germany). He was participating in the first standard for patent valuation and is doing research in patent valuation for more than 24 years.

He is guest professor at the Technical University of Cluj-Napoca in the field of innovation management and internationally recognized patent valuation expert.

He is board member of IP Business Information B.V. in Netherlands and advisor to IPR Strategies Ltd. in Ireland [6].

InTraCoM Group is a patent valuation boutique with a long list of patent valuation customers.

InTraCoM Group is performing patent valuations for M&A, patent transactions, licensing value determination, internal balancing purposes, sale and lease back, transfer pricing and many more valuation scopes. Their customers are international big blue chip companies, governmental organisations, fund management, SMEs, Universities and big research organisations.

InTraCoM Group is supported by different international partners offering patent valuation -specific data and business information. Within these partnerships also software and patent valuation-specific data can be offered based the InTraCoM-patent valuation methodology. With all these approaches, patent values can be determined within unbeatable precision, time and cost.

6 https://www.youtube.com/watch?v=OofI3RATlnQ