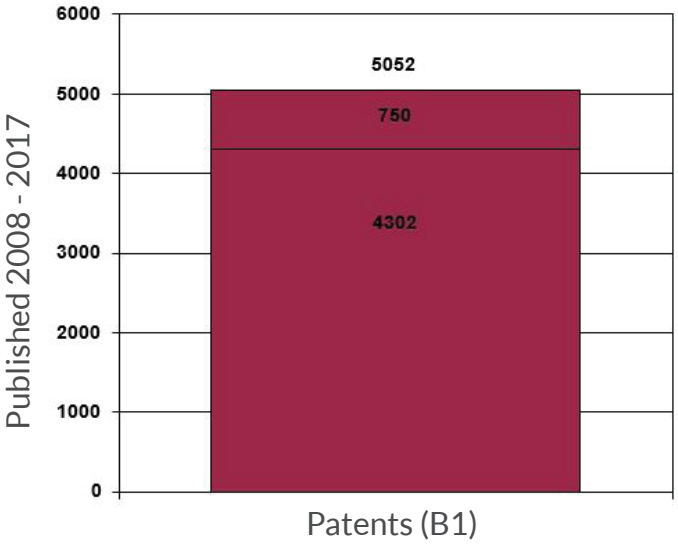
EPO review 2018 - Machine understanding: Neural networks, machine learning and artificial intelligence

A recent EPO report[1] talks about "A new era of technological development characterised by digital transformation", based on "information and communication technologies" ("ICT") and amounting to a "fourth industrial revolution". The present review looks at three specific aspects of ICT – neural networks, machine learning and artificial intelligence – which the EPO report groups together as "enabling machine understanding".

Developments of these aspects may relate to their implementing hardware and software or to any of the extensive range of their possible applications, for example from assisting medical diagnosis to image recognition to natural language understanding to operating wind turbines to playing the game of go. This means that capture of relevant patents and applications using the International Patent Classification (IPC) is challenging, as incidentally illustrated by the EPO report.

This review takes a simple and direct approach: using full texts[2] and keywords "neural network", "machine learning" and "artificial intelligence"[3], searches for European patents having patent (B1) publication dates over the 10-year period 2008 to 2017 were carried out.

5052 patents published (B1) in that 10-year period reference at least one keyword, 750 with references in claims.

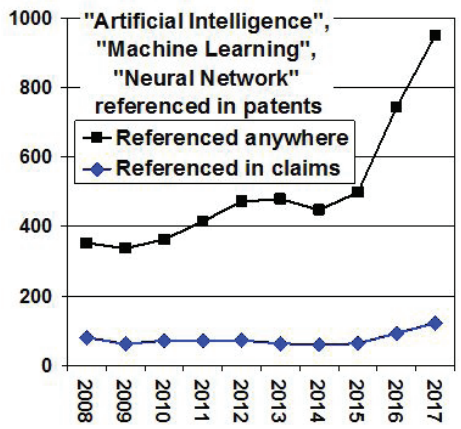


[1]"Patents and the Fourth Industrial Revolution: the inventions behind digital transformation" December 2017 *http://www.epo.org/service-support/publications.html?pubid=163#tab3*

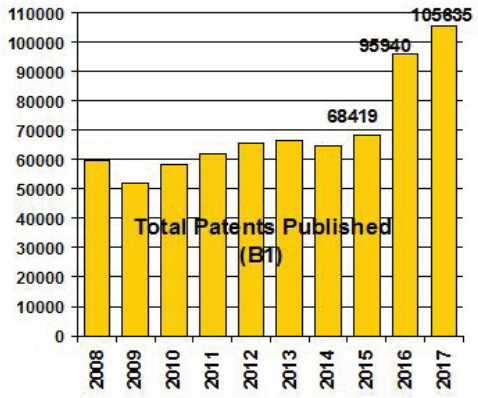
[2]As available on the EPO's online EP full text search database *(https://data.epo.org/expert-services/index-2-3-8.html)*

[3]The exact terms or near, in English, French and German

The chart below gives counts by year of patents referencing any of the keywords anywhere in titles, abstracts, descriptions or claims, and counts of those with references in claims. The counts increased significantly in 2016/2017.



The increase should be seen in the context of the overall increase in total grants (patents published) since 2015.



The top ten IPC subclasses of the keyword patents include A61B (Diagnosis; Surgery; Identification), C12Q (Measuring or Testing Processes involving Enzymes, Nucleic Acids or Microorganisms), A61K (Preparations for Medical, Dental, or Toilet Purposes) and C12N (Microorganisms or Enzymes; Compositions thereof), showing the growing importance of bioinformatics.

Rank	IPC Subclass	No. of Patents	Rank	IPC Subclass	No. of Patents
1	G06F	688	6	G06T	321
2	G01N	589	7	C12Q	317
3	A61B	473	8	A61K	287
4	G06K	375	9	G05B	279
5	H04L	354	10	C12N	264

Top patentees for patents referencing the keywords are listed in the table below.

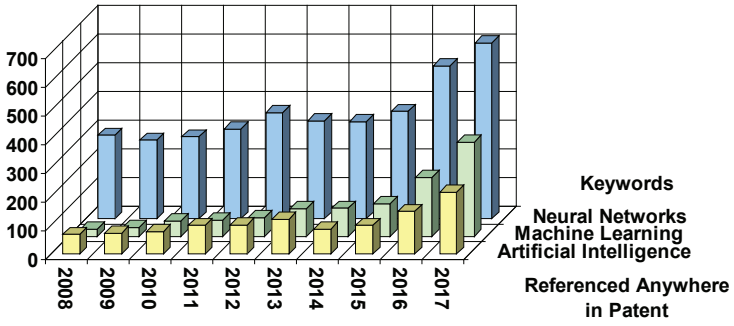
Patentee	Keyword Patents Publd (B1) 2008-2017	Keyword(s) in Patents claims
Qualcomm	121	3
Siemens	119	47
Philips	111	12
Microsoft	102	23
Honda	66	14
Samsung	64	7
Sony	54	8
Roche	51	2
GE	50	6
Ericsson	46	0
Rockwell Automation	43	13
Robert Bosch	40	4
ABB	39	12
Celera Corp	34	0
Fraunhofer Ges	33	3
Alcatel Lucent	32	6
BASF Enzymes	32	0
Nokia	32	7
Canon	30	5
Xerox	29	3
Google	27	1
Deutsche Telekom	26	0
Novozymes	25	0
LG	22	2
Panasonic	22	7
Huawei	21	2
BP	20	1
Honeywell	20	6
Astute Medical	19	0
Fisher Rosemount	19	1
Verenium Corp	19	0
British Telecomms	18	1
Fujifilm	18	3
Nestec	18	3
IBM	17	5
Telecom Italia	17	3
Volkswagen	17	3
Avaya	16	0
Fujitsu	16	1
Harman Becker Auto	16	4
Agensys	15	0
Blackberry	15	1
Boeing	15	3
Commissariat A L Energie Atomique ETC	15	3
Medimmune	14	0
United Technologies	14	1

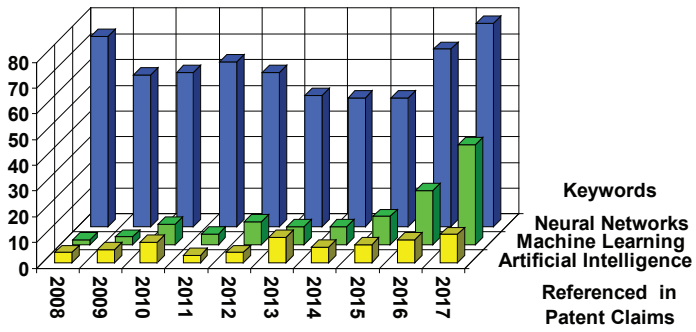
The charts on the right give counts by year of patents referencing each of the keywords anywhere in titles, abstracts, descriptions or claims, and counts of those with references in claims.

As also seen above, the levels of patents referencing the keywords in claims are a fraction (ca. 15%) of the levels of patents referencing the keywords anywhere in titles, abstracts, descriptions or claims. Overall, of patents referencing the keywords in claims only around 30% reference the keywords in claim 1.

This might suggest that inventions involved are less often focused on developments to "neural network", "machine learning" or "artificial intelligence" devices or processes as such, but rather more often concerned with developments which may incidentally or optionally involve such devices or processes as component parts or steps in something aimed at achieving some further "technical" goal (e.g. operating wind turbines or image recognition). This may reflect an expectation that claiming developments to "neural network", "machine learning" or "artificial intelligence" devices or processes per se could challenge the limits of what the EPO regards as "technical" (as opposed to unpatentably "non-technical", e.g. "as such" programs for computers or mathematical methods). However, an improved AI system per se, if functioning as operational layer software which improves the way a computer itself operates, may well be seen as technical by the EPO. Otherwise, directing claims to a further "technical" goal employing the "neural network", "machine learning" or "artificial intelligence" might be expected to mitigate problems at the EPO.

In any event, the trend for patents linked to machine understanding through the keywords "neural network", "machine learning" and "artificial intelligence" has recently been upwards, though the levels of patents concerned are as yet very small fractions still of total European patents.





Haseltine Lake is coming to Tokyo!

Our 2018 Tokyo seminar on 15 November 2018 will include expert commentary and case studies in the area of Computer Implemented Inventions and AI, as well as an introduction to the new section of the Guidelines for Examination in the EPO on AI and mathematical methods, which is to be released on 1 October 2018.

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