Factsheet: Digital, Machine Learning

A technology field created by ip-search

1   Definition

This field covers machine learning as an ubiquitous technology employed in a variety of technical applications, such as image, text or speech analysis in areas from digital data analysis, predictive maintenance to autonomous driving to name only few. In this technology field, machine learning is defined as signal and data processing algorithms, implementing devices and systems which involve schemes based on given observations and outcomes. Distinction to calibration and parametrization, as well as rule-based systems is made in that documents in this field explicitly aim at optimizing generalization abilities of the proposed invention. Thus, the field contains inventions solving classification, clustering and regression in high dimensional data spaces as well as patents describing artificial intelligence of any form. Modelling paradigms include biological inspired approaches, e.g. neural networks or genetic algorithms, kernelized methods such as support vector machines, reinforced or deep learning.

2   CPC / IPC

2.1.1   Cooperative Patent Classification (CPC)

CPC/IPC/FI Symbols	Description
A	HUMAN NECESSITIES
A61	MEDICAL OR VETERINARY SCIENCE; HYGIENE
A61B	DIAGNOSIS; SURGERY; IDENTIFICATION (analysing biological material G01N, e.g. G01N33/48; obtaining records using waves other than optical waves, in general G03B42/00)
A61B5/00	Detecting, measuring or recording for diagnostic purposes (radiation diagnosis A61B6/00; diagnosis by ultrasonic, sonic or infrasonic waves A61B8/00); Identification of persons
A61B5/72	. {Signal processing specially adapted for physiological signals or for diagnostic purposes (pattern recognition G06K9/00)}
A61B5/7235	.. {Details of waveform analysis (A61B5/0452 takes precedence)}
A61B5/7264	... {Classification of physiological signals or data, e.g. using neural networks, statistical classifiers, expert systems or fuzzy systems (neural networks per se G01N3/00; expert systems per se G06N5/00)}
A61B5/7267	.... {involving training the classification device}
B	PERFORMING OPERATIONS; TRANSPORTING
B23	MACHINE TOOLS; METAL-WORKING NOT OTHERWISE PROVIDED FOR (punching, perforating, making articles by processing sheet metal, tubes, or profiles B21D; wire-working B21F; making pins, needles, or nails B21G; making chains B21L; grinding B24)
B23K	SOLDERING OR UNSOLDERING; WELDING; CLADDING OR PLATING BY SOLDERING OR WELDING; CUTTING BY APPLYING HEAT LOCALLY, e.g. FLAME CUTTING; WORKING BY LASER BEAM (making metal-coated products by extruding metal B21C23/22; building up linings or coverings by casting B22D19/08; casting by dipping B22D23/04; manufacture of composite layers by sintering metal powder B22F7/00; arrangements on machine tools for copying or controlling B23Q; covering metals or covering materials with metals, not otherwise provided for C23C; burners F23D)
B23K31/00	Processes relevant to this subclass, specially adapted for particular articles or purposes, but not covered by only one of the preceding main groups (making tubes or profiled bars involving operations other than soldering or welding B21C37/04, B21C37/08)
B23K31/006	. {relating to using of neural networks}

CPC/IPC/FI Symbols	Description
B25	HAND TOOLS; PORTABLE POWER-DRIVEN TOOLS; MANIPULATORS
B25J	MANIPULATORS; CHAMBERS PROVIDED WITH MANIPULATION DEVICES ({manipulators specially adapted for use in surgery A61B34/70; manipulators used in cleaning hollow articles B08B9/04};manipulators associated with rolling mills B21B39/20; manipulators associated with forging machines B21J13/10; {manipulators associated with picking-up and placing mechanisms B23P19/007};means for holding wheels or parts thereof B60B30/00; {vehicles with ground-engaging propulsion means, e.g. walking members B62D57/02, B62D57/032; devices for picking-up and depositing articles or materials between conveyors B65G47/90, B65G47/91; manipulators with gripping or holding means for transferring packages B65H67/065}; cranes B66C; {manipulators used in the protection or supervision of pipe-line installations F17D5/00; walking equipment adapted for nuclear steam-generators F22B37/006}; manipulators specially adapted for, or associated with, nuclear reactors G21C; {apparatus used for handling wafers during manufacture or treatment of semiconductor H01L21/68})
B25J9/00	Programme-controlled manipulators
B25J9/16	. Programme controls (programme controls in general G05B19/00, e.g. numerical pogramme controls G05B19/18; {recording or playback systems G05B19/42})
B25J9/1602	.. {characterised by the control system, structure, architecture}
B25J9/161	... {Hardware, e.g. neural networks, fuzzy logic, interfaces, processor}
B29	WORKING OF PLASTICS; WORKING OF SUBSTANCES IN A PLASTIC STATE, IN GENERAL (processing doughs A21C; working chocolate A23G; casting of metals B22; working cement, clay B28; chemical aspects, see section C, particularly C08; working glass C03B; candle making C11C5/02; making soap C11D13/00; manufacture of artificial filaments, threads, fibres, bristles or ribbons D01D, D01F; manufacture of articles from cellulosic fibrous suspensions or from papier-mâchè D21J)
B29C	SHAPING OR JOINING OF PLASTICS; SHAPING OF MATERIAL IN A PLASTIC STATE, NOT OTHERWISE PROVIDED FOR; AFTER-TREATMENT OF THE SHAPED PRODUCTS, e.g. REPAIRING (making preforms B29B11/00; making laminated products by combining previously unconnected layers which become one product whose layers will remain together B32B37/00 - B32B41/00)
B29C66/00	{General aspects of processes or apparatus for joining preformed parts (means for handling the parts to be joined B29C65/78; testing the joint B29C65/82)}
B29C66/90	. {Measuring or controlling the joining process}
B29C66/96	.. {characterised by the method for implementing the controlling of the joining process}
B29C66/965	... {using artificial neural networks}
B29C2945/00	Indexing scheme relating to injection moulding, i.e. forcing the required volume of moulding material through a nozzle into a closed mould
B29C2945/76	. Measuring, controlling or regulating
B29C2945/76929	.. Controlling method (not used)
B29C2945/76979	... Using a neural network
B60	VEHICLES IN GENERAL
B60G	VEHICLE SUSPENSION ARRANGEMENTS (air-cushion vehicles B60V; {cycle suspensions B62K25/00})
B60G2600/00	Indexing codes relating to particular elements, systems or processes used on suspension systems or suspension control systems
B60G2600/18	. Automatic control means
B60G2600/187	.. Digital Controller Details and Signal Treatment
B60G2600/1878	... Neural Networks
B60T	VEHICLE BRAKE CONTROL SYSTEMS OR PARTS THEREOF; BRAKE CONTROL SYSTEMS OR PARTS THEREOF, IN GENERAL (electrodynamic brake systems for vehicle, in general B60L; brakes per se, i.e. devices where braking effect occurs, including ultimate brake actuators, F16D); ARRANGEMENT OF BRAKING ELEMENTS ON VEHICLES IN GENERAL; PORTABLE DEVICES FOR PREVENTING UNWANTED MOVEMENT OF VEHICLES; VEHICLE MODIFICATIONS TO FACILITATE COOLING OF BRAKES
B60T8/00	Arrangements for adjusting wheel-braking force to meet varying vehicular or ground-surface conditions, e.g. limiting or varying distribution of braking force (by changing number of effective brake cylinders in power brake systems B60T17/10)
B60T8/17	. Using electrical or electronic regulation means to control braking {(detecting or indicating faulty operation B60T8/885)}
B60T8/174	.. characterised by using special control logic, e.g. fuzzy logic {, neural computing}

CPC/IPC/FI Symbols	Description
B60T2210/00	Detection or estimation of road or environment conditions; Detection or estimation of road shapes
B60T2210/10	. Detection or estimation of road conditions
B60T2210/12	.. Friction
B60T2210/122	... using fuzzy logic, neural computing
B64	AIRCRAFT; AVIATION; COSMONAUTICS
B64G	COSMONAUTICS; VEHICLES OR EQUIPMENT THEREFOR (apparatus for, or methods of, winning materials from extraterrestrial sources E21C51/00)
B64G1/00	Cosmonautic vehicles
B64G1/22	. Parts of, or equipment specially adapted for fitting in or to, cosmonautic vehicles
B64G1/24	.. Guiding or controlling apparatus, e.g. for attitude control (jet-propulsion plants F02K; navigation or navigational instruments, see the relevant subclass, e.g. G01C; automatic pilots G05D1/00)
B64G2001/247	... {Advanced control concepts for autonomous, robotic spacecraft, e.g. by using artificial intelligence, neural networks or autonomous agents}
B65	CONVEYING; PACKING; STORING; HANDLING THIN OR FILAMENTARY MATERIAL
B65H	HANDLING THIN OR FILAMENTARY MATERIAL, e.g. SHEETS, WEBS, CABLES
B65H2557/00	Means for control not provided for in groups B65H2551/00 - B65H2555/00
B65H2557/30	. Control systems architecture or components, e.g. electronic or pneumatic modules; Details thereof
B65H2557/38	.. for neural adaptive control
E	FIXED CONSTRUCTIONS
E21	EARTH DRILLING; MINING
E21B	EARTH DRILLING, e.g. DEEP DRILLING (mining, quarrying E21C; making shafts, driving galleries or tunnels E21D); OBTAINING OIL, GAS, WATER, SOLUBLE OR MELTABLE MATERIALS OR A SLURRY OF MINERALS FROM WELLS
E21B41/00	Equipment or details not covered by groups E21B15/00 - E21B40/00
E21B2041/0028	. {Fuzzy logic, artificial intelligence, neural networks, or the like}
F	MECHANICAL ENGINEERING; LIGHTING; HEATING; WEAPONS; BLASTING
F02	COMBUSTION ENGINES (cyclically operating valves therefor, lubricating, exhausting, or silencing engines F01); HOT-GAS OR COMBUSTION-PRODUCT ENGINE PLANTS
F02D	CONTROLLING COMBUSTION ENGINES (cyclically operating valves for combustion engines F01L; controlling combustion engine lubrication F01M; cooling internal combustion engines F01P; supplying combustion engines with combustible mixtures or constituents thereof, e.g. carburettors, injection pumps F02M; starting of combustion engines F02N; controlling of ignition F02P; controlling gas-turbine plants, jet-propulsion plants, or combustion-product engine plants, see the relevant subclasses for these plants)
F02D41/00	Electrical control of supply of combustible mixture or its constituents (F02D43/00 takes precedence {; control of engine starters F02N11/08, electrical control of engine ignition timing F02P5/145})
F02D41/02	. Circuit arrangements for generating control signals
F02D41/14	.. Introducing closed-loop corrections
F02D41/1401	... {characterised by the control or regulation method (F02D41/1473, F02D41/1477 take precedence)}
F02D41/1405	.... {Neural network control}
F03	MACHINES OR ENGINES FOR LIQUIDS (for liquid and gases F01; positive-displacement machines for liquids F04); WIND, SPRING WEIGHT AND MISCELLANEOUS MOTORS; PRODUCING MECHANICAL POWER; OR A REACTIVE PROPULSIVE THRUST, NOT OTHERWISE PROVIDED FOR
F03D	WIND MOTORS
F03D7/00	Controlling wind motors
F03D7/02	. the wind motors having rotation axis substantially parallel to the air flow entering the rotor
F03D7/04	.. Automatic control; Regulation
F03D7/042	... {by means of an electrical or electronic controller}
F03D7/043	.... {characterised by the type of control logic}
F03D7/046	..... {with learning or adaptive control, e.g. self-tuning, fuzzy logic or neural network}
F05	INDEXING SCHEMES RELATING TO ENGINES OR PUMPS IN VARIOUS SUBCLASSES OF CLASSES F01-F04

CPC/IPC/FI Symbols	Description
F05B	INDEXING SCHEME RELATING TO MACHINES OR ENGINES OTHER THAN NON-POSITIVE-DISPLACEMENT MACHINES OR ENGINES, TO WIND MOTORS, TO NON-POSITIVE DISPLACEMENT PUMPS, AND TO GENERATING COMBUSTION PRODUCTS OF HIGH PRESSURE OR HIGH VELOCITY
F05B2270/00	Control
F05B2270/70	. Type of control algorithm
F05B2270/709	.. with neural networks
F16	ENGINEERING ELEMENTS AND UNITS; GENERAL MEASURES FOR PRODUCING AND MAINTAINING EFFECTIVE FUNCTIONING OF MACHINES OR INSTALLATIONS; THERMAL INSULATION IN GENERAL
F16H	GEARING
F16H61/00	Control functions within {control units of} change-speed- or reversing-gearings for conveying rotary motion {; Control of exclusively fluid gearing, friction gearing, gearings with endless flexible members or other particular types of gearing}
F16H2061/0075	. {characterised by a particular control method}
F16H2061/0084	.. {Neural networks}
G	PHYSICS
G01	MEASURING (counting G06M); TESTING
G01N	INVESTIGATING OR ANALYSING MATERIALS BY DETERMINING THEIR CHEMICAL OR PHYSICAL PROPERTIES (separating components of materials in general B01D, B01J, B03, B07; apparatus fully provided for in a single other subclass, see the relevant subclass, e.g. B01L; measuring or testing processes other than immunoassay, involving enzymes or microorganisms C12M, C12Q; investigation of foundation soil in situ E02D1/00; sensing humidity changes for compensating measurements of other variables or for compensating readings of instruments for variations in humidity, see G01D or the relevant subclass for the variable measured; testing or determining the properties of structures G01M; measuring or investigating electric or magnetic properties of materials G01R; systems or methods in general, using reception or emission of radiowaves or other waves and based on propagation effects, e.g. Doppler effect, propagation time, direction of propagation, G01S; determining sensivity, graininess, or density of photographic materials G03C5/02; testing component parts of nuclear reactors G21C17/00; {controlling or regulating non-electric variables G05D; measuring degree of ionisation of ionised gases, i.e. plasma H05H1/0006; testing electrographic developer properties G03G15/0848})
G01N29/00	Investigating or analysing materials by the use of ultrasonic, sonic or infrasonic waves; Visualisation of the interior of objects by transmitting ultrasonic or sonic waves through the object (G01N3/00 - G01N27/00 take precedence; measuring or indicating of ultrasonic, sonic or infrasonic waves in general G01H; systems using the reflection or reradiation of acoustic waves, e.g. acoustic imaging, G01S15/00; obtaining records by techniques analogous to photography using ultrasonic, sonic or infrasonic waves G03B42/06; {medical diagnosis by ultrasounds A61B8/00; generating or transmitting mechanical or acoustic waves B06B, G10K; seismic or acoustic prospecting or detecting G01V1/00})
G01N29/44	. Processing the detected response signal {, e.g. electronic circuits specially adapted therefor (digital signal processing per se G06F17/00)}
G01N29/4481	.. {Neural networks}
G01N33/00	Investigating or analysing materials by specific methods not covered by the preceding groups
G01N33/0004	. {Gaseous mixtures, e.g. polluted air (gaseous biological material G01N33/497; exhaust gas of internal combustion engines G01M15/102)}
G01N33/0009	.. {General constructional details of gas analysers, e.g. portable test equipment (G01N1/22 takes precedence)}
G01N33/0027	... {concerning the detector}
G01N33/0031	.... {comprising two or more sensors, e.g. a sensor array (electrochemical electrode arrays G01N27/27)}
G01N33/0034	..... {comprising neural networks or related mathematical techniques}
G01N2201/00	Features of devices classified in G01N21/00
G01N2201/12	. Circuits of general importance; Signal processing
G01N2201/129	.. Using chemometrical methods
G01N2201/1296	... using neural networks
G01R	MEASURING ELECTRIC VARIABLES; MEASURING MAGNETIC VARIABLES (measuring physical variables of any kind by conversion into electric variables, see Note (4) following the title of class G01; measuring diffusion of ions in an electric field, e.g. electrophoresis, electro-osmosis

CPC/IPC/FI Symbols	Description
	G01N; investigating non-electric or non-magnetic properties of materials by using electric or magnetic methods G01N; indicating correct tuning of resonant circuits H03J3/12; monitoring electronic pulse counters H03K21/40; monitoring operation of communication systems H04)
G01R31/00	Arrangements for testing electric properties; Arrangements for locating electric faults; Arrangements for electrical testing characterised by what is being tested not provided for elsewhere ({measuring superconductive properties G01R33/1238;} testing or measuring semiconductors or solid state devices during manufacture {H01L22/00};testing line transmission systems H04B3/46)
G01R31/36	. Apparatus for testing electrical condition of accumulators or electric batteries, e.g. capacity or charge condition (accumulators combined with arrangements for measuring, testing or indicating condition H01M10/48; circuit arrangements for charging, or depolarising batteries or for supplying loads from batteries H02J7/00; {Coulomb meters G01R22/00; indicating the condition of the power supply in clocks or watches G04C10/04; methods for controlling fuel cells H01M8/04298})
G01R31/3644	.. {Various constructional arrangements}
G01R31/3648	... {comprising digital calculation means, e.g. for performing an algorithm}
G01R31/3651	.... {Software aspects, e.g. battery modeling, using look-up tables, neural networks}
G01S	RADIO DIRECTION-FINDING; RADIO NAVIGATION; DETERMINING DISTANCE OR VELOCITY BY USE OF RADIO WAVES; LOCATING OR PRESENCE-DETECTING BY USE OF THE REFLECTION OR RERADIATION OF RADIO WAVES; ANALOGOUS ARRANGEMENTS USING OTHER WAVES ({for special applications, see the relevant subclasses, e.g. A61B, G01F, G01N, G02B; measuring dimensions or angles of objects G01B; navigation in general G01C; measuring infrasonic, sonic or ultrasonic vibrations in general G01H; measuring infra-red, visible, or ultra-violet radiation in general G01J; transducers per se, see the relevant subclasses, e.g. G01L, H01L, H04R; measuring direction or velocity of flowing fluids by reception or emission of radiowaves or other waves and based on propagation effects caused in the fluid itself G01P; measuring electric or magnetic variables in general G01R}; detecting masses or objects by methods not involving reflection or radiation of radio, acoustic or other waves G01V; {time-interval measuring G04F}; aerials H01Q)
G01S7/00	Details of systems according to groups G01S13/00, G01S15/00, G01S17/00 {(apparatus for measuring unknown time-intervals by electronic means, e.g. Vernier method G04F10/00)}
G01S7/02	. of systems according to group G01S13/00
G01S7/41	.. using analysis of echo signal for target characterisation; Target signature; Target cross-section
G01S7/417	... {involving the use of neural networks}
G05	CONTROLLING; REGULATING (specially adapted to a particular field of use, see the relevant place for that field, e.g. A62C37/00, B03B13/00, B23Q)
G05B	CONTROL OR REGULATING SYSTEMS IN GENERAL; FUNCTIONAL ELEMENTS OF SUCH SYSTEMS; MONITORING OR TESTING ARRANGEMENTS FOR SUCH SYSTEMS OR ELEMENTS (fluid-pressure actuators or systems acting by means of fluids in general F15B; valves per se F16K; characterised by mechanical features only G05G; sensitive elements, see the appropriate subclass, e.g. G12B, subclass of G01, H01; correcting units, see the appropriate subclass, e.g. H02K)
G05B13/00	Adaptive control systems, i.e. systems automatically adjusting themselves to have a performance which is optimum according to some preassigned criterion (G05B19/00 takes precedence; details of the computer G06F15/18)
G05B13/02	. electric
G05B13/0265	.. {the criterion being a learning criterion}
G05B13/027	... {using neural networks only}
G05B13/0285	... {using neural networks and fuzzy logic}
G05B13/029	... {using neural networks and expert systems}
G05B23/00	Testing or monitoring of control systems or parts thereof (monitoring of programme-control systems G05B19/048, G05B19/406)
G05B23/02	. Electric testing or monitoring
G05B23/0205	.. {by means of a monitoring system capable of detecting and responding to faults}
G05B23/0218	... {characterised by the fault detection method dealing with either existing or incipient faults}
G05B23/0224	.... {Process history based detection method, e.g. whereby history implies the availability of large amounts of data}
G05B23/024	..... {Quantitative history assessment, e.g. mathematical relationships between available data; Functions therefor; Principal component analysis [PCA]; Partial least square [PLS]; Statistical classifiers, e.g. Bayesian networks, linear regression or correlation analysis; Neural networks}
G05B23/0243	.... {model based detection method, e.g. first-principles knowledge model}

CPC/IPC/FI Symbols	Description
G05B23/0254	..... {based on a quantitative model, e.g. mathematical relationships between inputs and outputs; functions: observer, Kalman filter, residual calculation, Neural Networks}
G05B23/0259	... {characterized by the response to fault detection}
G05B23/0275	.... {Fault isolation and identification, e.g. classify fault; estimate cause or root of failure}
G05B23/0281	..... {Quantitative, e.g. mathematical distance; Clustering; Neural networks; Statistical analysis}
G05B2219/00	Program-control systems
G05B2219/20	. Pc systems
G05B2219/21	.. Pc I-O input output
G05B2219/21002	... Neural classifier for inputs, groups inputs into classes
G05B2219/25	.. Pc structure of the system
G05B2219/25255	... Neural network
G05B2219/30	. Nc systems
G05B2219/32	.. Operator till task planning
G05B2219/32193	... Ann, neural base quality management
G05B2219/32335	... Use of ann, neural network
G05B2219/33	.. Director till display
G05B2219/33013	... Higher order multilayer artificial neural network ANN, input terms has square, cubic terms of input, output
G05B2219/33014	... BAM bidirectional associative memory artificial neural network
G05B2219/33021	... Connect plural macrocircuits, neural network modules in a larger network
G05B2219/33024	... RAM artificial neural network, several lookup tables addressed by input section, output summed
G05B2219/33025	... Recurrent artificial neural network
G05B2219/33027	... Artificial neural network controller
G05B2219/33029	... ANNS artificial neural network with sigmoid function
G05B2219/33033	... Identification neural controller copies weight to system neural controller
G05B2219/33035	... Slow learning combined with fast learning artificial neural network, two time scale ann
G05B2219/33039	... Learn for different measurement types, create for each a neural net
G05B2219/33041	... Structure optimization and learning of artificial neural network by genetic algorithm
G05B2219/33044	... Supervised learning with second artificial neural network
G05B2219/34	.. Director, elements to supervisory
G05B2219/34066	... Fuzzy neural, neuro fuzzy network
G05B2219/39	.. Robotics, robotics to robotics hand
G05B2219/39284	... NSC neural servo controller
G05B2219/39286	... Forward inverse, dynamics model, relaxation neural network model firm
G05B2219/39292	... Neural brain based controller based on simplified model of vertebrate nervous system
G05B2219/39385	... Hybrid control system with neural brain based controller and classical ctrler
G05B2219/41	.. Servomotor, servo controller till figures
G05B2219/41054	... Using neural network techniques
G06	COMPUTING; CALCULATING; COUNTING (score computers for games A63B71/06, A63D15/20, A63F1/18; combinations of writing implements with computing devices B43K29/08)
G06F	ELECTRIC DIGITAL DATA PROCESSING (computer systems based on specific computational models G06N)
G06F11/00	Error detection; Error correction; Monitoring (error detection, correction or monitoring in information storage based on relative movement between record carrier and transducer G11B20/18; monitoring, i.e. supervising the progress of recording or reproducing G11B27/36; in static stores G11C29/00)
G06F11/07	. Responding to the occurrence of a fault, e.g. fault tolerance
G06F11/14	.. Error detection or correction of the data by redundancy in operation (G06F11/16 takes precedence)
G06F11/1476	... {in neural networks}
G06F11/22	. Detection or location of defective computer hardware by testing during standby operation or during idle time, e.g. start-up testing
G06F11/2263	.. {using neural networks}
G06F2207/00	Indexing scheme relating to methods or arrangements for processing data by operating upon the order or content of the data handled

CPC/IPC/FI Symbols	Description
G06F2207/38	. Indexing scheme relating to groups G06F7/38 - G06F7/575
G06F2207/48	.. Indexing scheme relating to groups G06F7/48 - G06F7/575
G06F2207/4802	... Special implementations
G06F2207/4818	.... Threshold devices
G06F2207/4824	..... Neural networks
G06K	RECOGNITION OF DATA; PRESENTATION OF DATA; RECORD CARRIERS; HANDLING RECORD CARRIERS
G06K7/00	Methods or arrangements for sensing record carriers, {e.g. for reading patterns} (G06K9/00 takes precedence)
G06K7/10	. by electromagnetic radiation, e.g. optical sensing; by corpuscular radiation
G06K7/14	.. using light without selection of wavelength, e.g. sensing reflected white light {(G06K7/10831 - G06K7/1097 take precedence)}
G06K7/1404	... {Methods for optical code recognition}
G06K7/146	.... {the method including quality enhancement steps}
G06K7/1482	..... {using fuzzy logic or natural solvers, such as neural networks, genetic algorithms and simulated annealing}
G06K9/00	Methods or arrangements for reading or recognising printed or written characters or for recognising patterns, e.g. fingerprints (processing or analysis of tracks of nuclear particles G01T5/02 {; information retrieval G06F17/30; recognition of molecular sequences G06F19/70; radio frequency identification G06K7/00; recognition of barcodes and similar code images G06K7/10; computer systems based on specific computational models G06N; image analysis, inspection, positioning or tracking G06T7/00; recognition of acoustic speech signals G10L15/00; acoustic speaker identification G10L17/00})
G06K9/00624	. {Recognising scenes, i.e. recognition of a whole field of perception; recognising scene-specific objects (image retrieval G06F17/30244; video retrieval G06F17/30781; image analysis and image segmentation, e.g. pixel labelling G06T7/00; alarm systems G08B; traffic control G08G; pictorial communication H04N)}
G06K9/00973	. {Hardware and software architectures for pattern recognition, e.g. modular organisation}
G06K9/62	. Methods or arrangements for recognition using electronic means (learning machines G06F15/18; digital correlation G06F17/15; analogue correlation G06G7/19)
G06K9/6267	.. {Classification techniques}
G06K9/6268	... {relating to the classification paradigm, e.g. parametric or non-parametric approaches}
G06K9/6269	.... {based on the distance between the decision surface and training patterns lying on the boundary of the class cluster, e.g. support vector machines}
G06K9/6277	.... {based on a parametric (probabilistic) model, e.g. based on Neyman-Pearson lemma, likelihood ratio, Receiver Operating Characteristic [ROC] curve plotting a False Acceptance Rate [FAR] versus a False Reject Rate [FRR] (segmentation of touching or overlapping patterns involving probabilistic approaches G06K9/34; image connectivity analysis involving probabilistic approaches, e.g. Markov Random Fields techniques, G06K9/4638; segmentation involving probabilistic approaches for general image processing G06T7/143)}
G06K9/6278	..... {Bayesian classification}
G06K9/6285	... {relating to the decision surface}
G06N	COMPUTER SYSTEMS BASED ON SPECIFIC COMPUTATIONAL MODELS
G06N3/00	Computer systems based on biological models (analogue computers simulating functional aspects of living beings G06G7/60)
G06N3/02	. using neural network models (for adaptive control G05B13/00; for image pattern matching G06K9/00; for image data processing G06T1/20; for phonetic pattern matching G10L15/16)
G06N3/08	.. Learning methods
G06N3/12	. using genetic models
G06N3/126	.. {Genetic algorithms, i.e. information processing using digital simulations of the genetic system}
G06T	IMAGE DATA PROCESSING OR GENERATION, IN GENERAL
G06T9/00	Image coding, e.g. from bit-mapped to non bit-mapped (bandwidth or redundancy reduction for static pictures H04N1/41; coding or decoding of static colour picture signals H04N1/64; methods or arrangements for coding, decoding, compressing or decompressing digital video signals H04N19/00)
G06T9/002	. {using neural networks}
G06T2207/00	Indexing scheme for image analysis or image enhancement
G06T2207/20	. Special algorithmic details

CPC/IPC/FI Symbols	Description
G06T2207/20084	.. Artificial neural networks [ANN]
G10	MUSICAL INSTRUMENTS; ACOUSTICS
G10H	ELECTROPHONIC MUSICAL INSTRUMENTS (electronic circuits in general H03)
G10H2250/00	Aspects of algorithms or signal processing methods without intrinsic musical character, yet specifically adapted for or used in electrophonic musical processing (methods with intrinsic musical character G10H2210/00)
G10H2250/311	. Neural networks for electrophonic musical instruments or musical processing, e.g. for musical recognition or control, automatic composition or improvisation (musical analysis G10H2210/031; neural networks G06N3/02)
G10L	SPEECH ANALYSIS OR SYNTHESIS; SPEECH RECOGNITION; SPEECH OR VOICE PROCESSING; SPEECH OR AUDIO CODING OR DECODING
G10L15/00	Speech recognition (G10L17/00 takes precedence)
G10L15/08	. Speech classification or search
G10L15/16	.. using artificial neural networks
G10L25/00	Speech or voice analysis techniques not restricted to a single one of groups G10L15/00-G10L21/00
G10L25/27	. characterised by the analysis technique
G10L25/30	.. using neural networks
G11	INFORMATION STORAGE
G11B	INFORMATION STORAGE BASED ON RELATIVE MOVEMENT BETWEEN RECORD CARRIER AND TRANSDUCER ({producing carriers of sound records for needle playback B29C39/00};recording measured values in a way that does not require playback through a transducer G01D; photosensitive materials or processes for photographic purposes G03C; electrography, electrophotography, magnetography G03G; recording or playback apparatus using mechanically marked tape, e.g. punched paper tape, or using unit records, e.g. punched or magnetically marked cards, G06K; transferring data from one type of record carrier to another G06K1/18; printing of data from record carriers G06K3/00; arrangements for producing a permanent visual presentation of the output data G06K15/00; arrangements or circuits for control of indicating devices using static means to present variable information G09G; coding, decoding or code conversion, in general H03M; circuits for coupling output of reproducer to radio receiver H04B1/20; circuits {or arrangements} specially adapted for {pictorial or} television signal recording {H04N1/21} , H04N5/76, H04N9/79; loudspeakers, microphones, gramophone pick-ups or like acoustic electromechanical transducers or circuits therefor H04R)
G11B20/00	Signal processing not specific to the method of recording or reproducing; Circuits therefor
G11B20/10	. Digital recording or reproducing (digital computers in which at least part of the computation is effected electrically, arrangements for handling digital data G06F; transmission of digital information H04L)
G11B20/10009	.. {Improvement or modification of read or write signals}
G11B20/10481	... {optimisation methods}
G11B20/10518	.... {using neural networks}
H	ELECTRICITY
H02	GENERATION; CONVERSION OR DISTRIBUTION OF ELECTRIC POWER
H02H	EMERGENCY PROTECTIVE CIRCUIT ARRANGEMENTS (indicating or signalling undesired working conditions G01R, e.g. G01R31/00, G08B; locating faults along lines G01R31/08; emergency protective devices H01H)
H02H1/00	Details of emergency protective circuit arrangements
H02H1/0092	. {concerning the data processing means, e.g. expert systems, neural networks}
H02P	CONTROL OR REGULATION OF ELECTRIC MOTORS, ELECTRIC GENERATORS OR DYNAMO-ELECTRIC CONVERTERS; CONTROLLING TRANSFORMERS, REACTORS OR CHOKE COILS
H02P21/00	Arrangements or methods for the control of electric machines by vector control, e.g. by control of field orientation
H02P21/0003	. {Control strategies in general, e.g. linear type, e.g. P, PI, PID, using robust control}
H02P21/0014	.. {using neural networks}
H02P23/00	Arrangements or methods for the control of AC motors characterised by a control method other than vector control
H02P23/0004	. {Control strategies in general, e.g. linear type, e.g. P, PI, PID, using robust control}
H02P23/0018	.. {using neural networks}

CPC/IPC/FI Symbols	Description
H03	BASIC ELECTRONIC CIRCUITRY
H03H	IMPEDANCE NETWORKS, e.g. RESONANT CIRCUITS; RESONATORS (measuring, testing G01R; arrangements for producing a reverberation or echo sound G10K15/08; impedance networks or resonators consisting of distributed impedances, e.g. of the waveguide type, H01P; control of amplification, e.g. bandwidth control of amplifiers, H03G; tuning resonant circuits, e.g. tuning coupled resonant circuits, H03J; networks for modifying the frequency characteristics of communication systems H04B)
H03H17/00	Networks using digital techniques
H03H17/02	. Frequency selective networks {(digital computers for complex mathematical operations G06F17/10)}
H03H17/0202	.. {Two or more dimensional filters; Filters for complex signals (multidimensional convolutions G06F17/153)}
H03H2017/0208	... {using neural networks}
H03H2222/00	Indexing scheme relating to digital filtering methods
H03H2222/04	. using neural networks
H04	ELECTRIC COMMUNICATION TECHNIQUE
H04L	TRANSMISSION OF DIGITAL INFORMATION, e.g. TELEGRAPHIC COMMUNICATION (typewriters B41J; order telegraphs, fire or police telegraphs G08B; visual telegraphy G08B, G08C; teleautographic systems G08C; ciphering or deciphering apparatus per se G09C; coding, decoding or code conversion, in general H03M; arrangements common to telegraphic and telephonic communication H04M; selecting H04Q)
H04L12/00	Data switching networks (interconnection of, or transfer of information or other signals between, memories, input/output devices or central processing units G06F13/00)
H04L12/54	. Store-and-forward switching systems (packet switching systems H04L12/56)
H04L12/56	.. {Packet switching systems}
H04L12/5601	... {Transfer mode dependent, e.g. ATM}
H04L2012/5686	.... {Use of neural networks}
H04L25/00	Baseband systems
H04L25/02	. Details (circuits in general for handling pulses H03K; in line transmission systems in general H04B3/02); {Arrangements for supplying electrical power along data transmission lines (systems for transmitting signals via power distribution lines H04B3/54)}
H04L25/0202	.. {Channel estimation}
H04L25/024	... {channel estimation algorithms}
H04L25/0254	.... {using neural network algorithms}
H04L25/03	.. Shaping networks in transmitter or receiver, e.g. adaptive shaping networks (impedance networks per se H03H); {Receiver end arrangements for processing baseband signals}
H04L25/03006	... {Arrangements for removing intersymbol interference}
H04L25/03165	.... {using neural networks}
H04L2025/03433	.... {characterised by equaliser structure}
H04L2025/03439	..... {Fixed structures}
H04L2025/03445	...... {Time domain}
H04L2025/03464	.... {Neural networks}
H04L45/00	{Routing or path finding of packets in data switching networks (specially adapted for wireless routing H04W40/00)}
H04L45/08	. {Learning-based routing, e.g. neural networks}
H04N	PICTORIAL COMMUNICATION, e.g. TELEVISION (measuring, testing G01; systems for autographic writing, e.g. writing telegraphy, which involve following an outline {G08C21/00};information storage based on relative movement between record carrier and transducer G11B; coding, decoding or code conversion, in general H03M; broadcast distribution or the recording of use made thereof H04H)
H04N21/00	Selective content distribution, e.g. interactive television, VOD [Video On Demand] (broadcast communication H04H; arrangements, apparatus, circuits or systems for communication control or processing being characterised by a protocol H04L29/06; {broadcast or conference over packet-switching networks H04L12/18,} real-time bi-directional transmission of motion video data H04N7/14)
H04N21/40	. Client devices specifically adapted for the reception of or interaction with content, e.g. set-top-box [STB]; Operations thereof {(arrangements for distribution where lower stations, e.g. receivers,

CPC/IPC/FI Symbols	Description
	interact with the broadcast H04H20/38; arrangements specially adapted for receiving broadcast information H04H40/00)}
H04N21/45	.. Management operations performed by the client for facilitating the reception of or the interaction with the content or administrating data related to the end-user or to the client device itself, e.g. learning user preferences for recommending movies, resolving scheduling conflicts
H04N21/466	... Learning process for intelligent management, e.g. learning user preferences for recommending movies {(monitoring of user activities for profile generation for accessing a video database G06F17/30843; computer systems using learning methods G06N3/08; services using the results of monitoring in broadcast systems H04H60/61)}
H04N21/4662	.... {characterized by learning algorithms}
H04N21/4666	..... {using neural networks, e.g. processing the feedback provided by the user}
H04Q	SELECTING (switches, relays, selectors H01H; electronic switches H03K17/00)
H04Q2213/00	Indexing scheme relating to selecting arrangements in general and for multiplex systems
H04Q2213/13343	. Neural networks
Y	GENERAL TAGGING OF NEW TECHNOLOGICAL DEVELOPMENTS; GENERAL TAGGING OF CROSS-SECTIONAL TECHNOLOGIES SPANNING OVER SEVERAL SECTIONS OF THE IPC; TECHNICAL SUBJECTS COVERED BY FORMER USPC CROSS-REFERENCE ART COLLECTIONS [XRACs] AND DIGESTS
Y10	TECHNICAL SUBJECTS COVERED BY FORMER USPC
Y10S	TECHNICAL SUBJECTS COVERED BY FORMER USPC CROSS-REFERENCE ART COLLECTIONS [XRACs] AND DIGESTS
Y10S128/00	Surgery
Y10S128/92	. Computer assisted medical diagnostics
Y10S128/925	.. Neural network

The complete description of the CPC classes with IPC- and FI-concordances can be found in the Internet at http://web2.wipo.int/classifications/ipc/ipcpub?notion=scheme&fipcpc=yes&indexes=yes.

3   Keywords

The following keyword concepts were used:

ï   Machine learning, deep learning, reinforced learning, autonomous learning, adaptive learning, support vector machine, SVM, artificial intelligence, hyperplane, convolutional network, neural network, genetic algorithm, kernel function, decision trees, deep forest, classification algorithm, K-means,
NLP, natural language processing, ANN, CNN, linear regression, non-linear regression, Markov, Bayesian model, predictive model, LLM , Extensive language model, Large scale language model, Advanced linguistic model, Deep language model, Natural language neural network, Generative AI, Transformer, autoencoder…

4   Confidence Interval for Precision

Precision is expressed in percent of relevant counts. The 92 % confidence interval for the precision of a technology field is accessed on a mix of 100 randomly selected patent families based on a binomial distribution.

Precision Confidence Interval: 90 – 98 %

5   History

Version	latest update	Comment
_03_25	25.03.2025	Update of all the search queries in the Workbook: new keywords added. Narrow of the number of documents by limiting the search to the claims, title and abstract. Determination of the precision.
_09_24	12.09.2024	No changes to search queries.
_03_24	25.03.2024	No changes to search queries.
_09_23	22.09.2023	Update of the search queries with the new syntax; c
_03_23	23.03.2023	No changes to search queries; determination of the precision.
_09_22	28.09.2022	No changes to search queries; determination of the precision.
_03_22	15.03.2022	No changes to search queries; determination of the precision.
_09_21	05.08.2021	No changes to search queries; determination of the precision.
_03_21	02.03.2021	New keywords included. Redefinition of the search queries to increase the precision.
_09_20	18.08.2020	No changes
_12_19	03.12.2019	No changes
_05_19	24.05.2019	Including key word queries for AI

6   Contact

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