

G06N

COMPUTER SYSTEMS BASED ON SPECIFIC COMPUTATIONAL MODELS

Definition statement

This place covers:

Computing systems where the computation is not based on a traditional mathematical model of computer

G06N 3/00

Computer systems based on biological models

Definition statement

This place covers:

Computing systems where the computation is based on biological models (brains, intelligence, consciousness, genetic reproduction) or is using physical material of biological origin (biomolecules, DNA, biological neurons, etc.) to perform the computation. The computation can be digital, analogue or chemical in nature.

Relationships with other classification places

Classification in this group or its subgroups is expected only if the invention concerns the development of a computer. DNA and proteins biomaterials as such, should be classified in the relevant groups of (bio) chemistry.

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Computer systems using knowledge based models	G06N 5/00
Probabilistic networks	G06N 7/005
Computers systems using fuzzy logic	G06N 7/02
Machine Learning	G06N 20/00
Analogue computers simulating functional aspects of living beings	G06G 7/60
Memories whose operation depends upon chemical change	G11C 13/02
Bioinformatics	G16B

Synonyms and Keywords

In patent documents, the following words/expressions are often used as synonyms:

- "biocomputers", "biological computers", "nanocomputers", "neural networks" and "artificial life"

G06N 3/002

{**Biomolecular computers, i.e. using biomolecules, proteins, cells (using DNA [G06N 3/123](#); using neurons [G06N 3/061](#))**}

Definition statement

This place covers:

Computers using actual physical material of biochemical origin or material as used in carbon-based living systems, i.e. biomolecules, proteins, cells or other biochemicals to perform computation.

References**Limiting references**

This place does not cover:

Computers using real biological neurons integrated on chips	G06N 3/061
Computers using DNA	G06N 3/123

Informative references

Attention is drawn to the following places, which may be of interest for search:

Computation based on Inorganic chemicals	G06N 99/007
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Synonyms and Keywords

In patent documents, the following words/expressions are often used as synonyms:

- "biocomputers", "wetware", "biochemical computers", "biochips" and "living computers"

G06N 3/004

{**Artificial life, i.e. computers simulating life**}

Definition statement

This place covers:

Creation of synthetic life forms that are based on models of or are inspired by carbon-based life forms but are actually implemented on/or controlled by standard silicon-based computers.

References**Informative references**

Attention is drawn to the following places, which may be of interest for search:

Biological life forms that are created involving biological genetic engineering, e.g. clones	C12N 15/00
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Glossary of terms

In this place, the following terms or expressions are used with the meaning indicated:

Alife	Artificial life
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Synonyms and Keywords

In patent documents, the following words/expressions are often used as synonyms:

- "Alife", "artificial life", synthetic life" and "virtual creatures "

G06N 3/006

{based on simulated virtual individual or collective life forms, e.g. single "avatar", social simulations, virtual worlds or particle swarm optimisation}

Definition statement

This place covers:

Software simulations on standard silicon-based digital computers of systems exhibiting behaviour normally ascribed to life forms.

References

Application-oriented references

Examples of places where the subject matter of this place is covered when specially adapted, used for a particular purpose, or incorporated in a larger system:

ICT specially adapted for medical diagnosis, medical simulation or medical data mining; ICT specially adapted for detecting, monitoring or modelling epidemics or pandemics	G16H 50/00
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Informative references

Attention is drawn to the following places, which may be of interest for search:

Computer games	A63F 13/00
Information retrieval	G06F 16/00
Computer Aided Design [CAD]	G06F 17/50
Collaborative systems - Groupware	G06Q 10/00
Image processing for animations	G06T 13/00
Telecommunications for virtual worlds	H04L 29/06034

Synonyms and Keywords

In patent documents, the following words/expressions are often used as synonyms:

- "metaverse", "virtual reality", "virtual world", "virtual society", "social simulations", "particle swarm", "ant colony", "artificial immune systems"

G06N 3/008

{based on physical entities controlled by simulated intelligence so as to replicate intelligent life forms, e.g. robots replicating pets or humans in their appearance or behavior}

Definition statement

This place covers:

Physical computer controlled mechanical devices emulating/simulating existing biological life forms mainly implemented as physical robots in the form of animals (pets) or humans (humanoids or

androids). These robots can be standalone or work in groups (e.g. Robocup team of robotic football players).

Relationships with other classification places

This group does not cover purely mechanical devices: there should always be some computer involved.

It should act, or at least have as function to look like an animal or a human.

References

Application-oriented references

Examples of places where the subject matter of this place is covered when specially adapted, used for a particular purpose, or incorporated in a larger system:

Control of industrial robots	G05B 19/00
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Informative references

Attention is drawn to the following places, which may be of interest for search:

Toys or dolls	A63H 3/00 , A63H 11/00
Industrial robots or mechanical grippers	B25J 19/00

Synonyms and Keywords

In patent documents, the following words/expressions are often used as synonyms:

- "humanoid", "android", "robot", "robot pet ", "behaviour-based robots"

G06N 3/02

using neural network models

Definition statement

This place covers:

Computation simulating or emulating the functioning of biological brains mainly implemented in non-biological material, i.e. electronics or optical material. It can be in digital electronic or analogue electronic or biological technology.

Relationships with other classification places

Applications of whatever sort just using neural networks with no description of the neural network itself are to be classified in the relevant application field only.

Documents specifying an architecture and a learning method should be classified in the respective subgroups of [G06N 3/04](#) and [G06N 3/08](#).

References

Application-oriented references

Examples of places where the subject matter of this place is covered when specially adapted, used for a particular purpose, or incorporated in a larger system:

Adaptive control systems	G05B 13/00
Pattern recognition using neural networks	G06K 9/00

Image processing using neural networks	G06T 1/20
Speech recognition using artificial neural networks	G10L 15/16

Synonyms and Keywords

In patent documents, the following words/expressions are often used as synonyms:

- "neural network", "neuronal network", "neuromimetic network", "artificial brain" and "perceptron"

G06N 3/04

Architectures, e.g. interconnection topology

Definition statement

This place covers:

The specific architecture or layout of the neural network, how the neurons are interconnected. For the different architectures see the titles of the different subgroups.

Specific technologies for realizing these architectures are classified in [G06N 3/06](#), learning methods in the subgroups of [G06N 3/08](#) and for the physical realization in the subgroups of [G06N 3/06](#).

Synonyms and Keywords

In patent documents, the following words/expressions are often used as synonyms:

- "architecture", "topology", "layout" and "interconnection pattern"

G06N 3/0409

{Adaptive resonance theory [ART] networks}

Definition statement

This place covers:

Adaptive Resonance Theory (ART).

Adaptive Resonance Theory was a short live method of neural networks developed by Grossberg and Carpenter. This subgroup contains only documents on ART by Grossberg and Carpenter (obsolete technology).

G06N 3/0418

{using chaos or fractal principles}

Definition statement

This place covers:

Neural networks using some form of chaos or fractal technology or methods

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Chaos models per se	G06N 7/08
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Synonyms and Keywords

In patent documents, the following words/expressions are often used as synonyms:

- "fractal transform function", "fractal growth", "chaotic neural network" and "Mandelbrot"

G06N 3/0427

{in combination with an expert system}

Definition statement

This place covers:

Combinations of neural network technology and expert system technology.

Contains documents where expert systems and neural networks work together on the same level and also where expert systems are used to construct or control a neural network.

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Experts systems; Artificial intelligence per se	G06N 5/04
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Synonyms and Keywords

In patent documents, the following words/expressions are often used as synonyms:

- "rule-based neural network" and "knowledge-based neural network"

G06N 3/0436

{in combination with fuzzy logic}

Definition statement

This place covers:

Combinations of neural network technology and fuzzy logic system technology.

Contains documents where fuzzy logic and neural networks work together on the same level and also where fuzzy logic systems are used to construct or control a neural network

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Fuzzy logic per se	G06N 7/02
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Glossary of terms

In this place, the following terms or expressions are used with the meaning indicated:

ANFIS	Adaptive Neuro-Fuzzy Inference Systems
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Synonyms and Keywords

In patent documents, the following words/expressions are often used as synonyms:

- "ANFIS" and "neuro-fuzzy interference system"

G06N 3/0445

{Feedback networks, e.g. hopfield nets, associative networks}

Definition statement

This place covers:

Neural networks involving connections from the output of a neural network to the inputs of the same neural network.

Synonyms and Keywords

In patent documents, the following words/expressions are often used as synonyms:

- "feedback", "Hopfield nets" and "associative networks"

G06N 3/0454

{using a combination of multiple neural nets}

Definition statement

This place covers:

Architecture of multiple neural networks can be connected in a parallel or in a series fashion. They can cooperate on the same level or one neural network can control other neural network.

Parallel neural networks can also be used for fault tolerance when connecting to a voting system.

Several neural networks can also be trained in a different ways or with different training examples and then combined in parallel in order to increase the reliability or accuracy.

Synonyms and Keywords

In patent documents, the following words/expressions are often used as synonyms:

- "multiple neural networks", "parallel neural networks", "hierarchical neural networks" and "ensemble neural networks"

G06N 3/0463

{Neocognitrons}

Definition statement

This place covers:

Neocognitrons are an unique and specific architecture of neural network characterized by its name.

The neocognitron is a hierarchical multilayered neural network and is a natural extension of cascading models.

In the neocognitron, multiple types of cells such as S-cells and C-cells are used to perform recognition task.

Contains only documents if the type of neural network is specifically called neocognitron.

G06N 3/0472

{using probabilistic elements, e.g. p-rams, stochastic processors}

Definition statement

This place covers:

Neural networks having as special feature that the neurons individually or the weights or the architecture as a whole has a probabilistic or statistical aspect.

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Chaotic determination of the weights	G06N 3/0418
Neural network in combination with fuzzy logic	G06N 3/0436
Probabilistic functions not exclusively used for neural networks	G06N 7/005

Synonyms and Keywords

In patent documents, the following words/expressions are often used as synonyms:

- "probabilistic neural network", "statistical neuron function", "p-RAM" and "probabilistic RAM"

G06N 3/0481

{Non-linear activation functions, e.g. sigmoids, thresholds}

Definition statement

This place covers:

All aspects of non-linear activation functions used in neurons, e.g. sigmoids, simple stepwise threshold functions, approximated sigmoid functions

Only aspects of the non-linear activation function.

Synonyms and Keywords

In patent documents, the following words/expressions are often used as synonyms:

- "sigmoid", "non-linear activation function", "non-linear transfer function" and "approximated activation functions"

G06N 3/049

{Temporal neural nets, e.g. delay elements, oscillating neurons, pulsed inputs}

Definition statement

This place covers:

Neurons or neural networks having a temporal aspect e.g. spiking neurons or neural networks where the time-like dynamics are a specific aspect of the invention

This can be in digital but often in analogue technology.

These neurons are meant to be a more realistic simulation of real biological neurons

Synonyms and Keywords

In patent documents, the following words/expressions are often used as synonyms:

- "spiking", "timelike", "temporal" and "dynamical"

G06N 3/06

Physical realisation, i.e. hardware implementation of neural networks, neurons or parts of neurons

Definition statement

This place covers:

The technology used to physically construct the neurons or neural network : digital electronics, analog electronics, biochemical elements, optical elements

Special rules of classification

This head subgroups should contain no documents, all documents should fall in one of its lower subgroups

Synonyms and Keywords

In patent documents, the following words/expressions are often used as synonyms:

- "hardware", "technology", "implementation" and "physical"

G06N 3/061

{using biological neurons, e.g. biological neurons connected to an integrated circuit}

Definition statement

This place covers:

Using real biological neurons from a living being implemented on a substrate. These neurons can be externally activated and read-out. The interconnections can be fixed or the can be allowed to grow and evolve.

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Biomolecular computers	G06N 3/002
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Synonyms and Keywords

In patent documents, the following words/expressions are often used as synonyms:

- "neurochip", "biochip" and "wetware"

G06N 3/063**using electronic means****Definition statement**

This place covers:

Neurons or interconnections implemented in dedicated digital electronics.

References**Informative references**

Attention is drawn to the following places, which may be of interest for search:

Neurons implemented using standard electronic digital computers	G06N 3/10
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Synonyms and Keywords

In patent documents, the following words/expressions are often used as synonyms:

- "electronic neuron", "digital", "numeric", "neuromorphic" and "synaptronic"

G06N 3/0635**{using analogue means}****Definition statement**

This place covers:

Neurons or interconnections implemented in dedicated analog electronics.

References**Informative references**

Attention is drawn to the following places, which may be of interest for search:

Analog electronic computers in general	G06G 7/00
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Synonyms and Keywords

In patent documents, the following words/expressions are often used as synonyms:

- "analogue" and "analog"

G06N 3/067**using optical means****Definition statement**

This place covers:

Neurons or interconnections implemented in dedicated optical components..

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Optical computers in general	G06E 1/00 , G06E 3/00
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G06N 3/0675

{using electro-optical, acousto-optical or opto-electronic means}

Definition statement

This place covers:

Neurons or neural networks using electro-optical, acousto-optical or opto-electronic components.

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Hybrid optical computers in general	G06E 3/00
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Synonyms and Keywords

In patent documents, the following words/expressions are often used as synonyms:

- "electro-optical", "acousto-optical" and "opto-electronic"

G06N 3/08

Learning methods

Definition statement

This place covers:

Means and methods of training or learning the neural networks. For specific training methods or algorithms see the different subgroups.

Synonyms and Keywords

In patent documents, the following words/expressions are often used as synonyms:

- "training or learning neural network", "evolving or adapting neural network" and "optimizing neural network"

G06N 3/082

{modifying the architecture, e.g. adding or deleting nodes or connections, pruning}

Definition statement

This place covers:

During the learning or training process of the neural network not only are the weights of the synapses changed but also is the architecture of the neural network changed. This can involve adding/deleting neurons or adding/deleting connections. between the neurons.

When during the training process it becomes clear that the size/capacity of the neural network is not sufficient, additional neurons or connections can be added to the network after which the training can resume. When it is found that certain neurons are not used or have no influence, they can be removed (pruning).

G06N 3/084

{Back-propagation}

Definition statement

This place covers:

Training method whereby on the synapses of the neurons are adapted depending on the difference between the actual output of the neural network and the wanted output. This difference is used to adapt the weights of the synapses with an mathematical method that back-propagates from the higher layers to the lower layers of the neural network. Mainly used in multilayer neural networks. This implies a form of supervised learning.

Synonyms and Keywords

In patent documents, the following words/expressions are often used as synonyms:

- "backprop" and "backpropagation"

G06N 3/086

{using evolutionary programming, e.g. genetic algorithms}

Definition statement

This place covers:

The use of genetic algorithms for creating through a process of reproduction, mutation and fitness function an optimally functioning neural network using evolutionary techniques such as evolutionary programming, genetic algorithms, genetic programming, evolution strategies, etc.

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Genetic algorithms as such	G06N 3/126
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Synonyms and Keywords

In patent documents, the following words/expressions are often used as synonyms:

- "evolutionary", "Darwinistic", "genetic algorithm", "evolutionary programming", "genetic programming" and "evolution strategies"

G06N 3/088

{Non-supervised learning, e.g. competitive learning}

Definition statement

This place covers:

Learning without direct supervision from unlabelled data. Neural networks are created and then it is observed how they function in the real world, as a result of the global functioning is the neural network further adapted. No sets of training input pairs are necessary.

Synonyms and Keywords

In patent documents, the following words/expressions are often used as synonyms:

- "non-supervised neural network" and "unsupervised neural network"

G06N 3/10

Simulation on general purpose computers

Definition statement

This place covers:

Neural networks not implemented in specific special purpose electronics but simulated by a program on a standard general purpose digital computer

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Computer simulations in general	G06F 17/50
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Synonyms and Keywords

In patent documents, the following words/expressions are often used as synonyms:

- "purely-software neural network", "neural network program" and "simulation of neural networks"

G06N 3/105

{Shells for specifying net layout}

Definition statement

This place covers:

Specific software for specifying or creating neural networks to be simulated on a general purpose digital computer. Specific graphical user interfaces for this application.

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

General graphical user interfaces	G06F 3/048
Program for computer aided design	G06F 17/50

G06N 3/12

using genetic models

Definition statement

This place covers:

Computation based on the principles of biological genetic processing (mutation, recombination, reproduction, selection of the fittest).

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Genetic algorithms for training neural networks	G06N 3/086
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Synonyms and Keywords

In patent documents, the following words/expressions are often used as synonyms:

- "evolutionary programming", "Darwinistic programming", "evolutionary programming", "genetic programming", and "evolution strategies"

G06N 3/123

{DNA computers, i.e. information processing using biological DNA}

Definition statement

This place covers:

Using actual biological DNA molecules in test tubes. The problem is transcribed onto real DNA, biological reproduction, crossover, mutation is performed. The fitness is tested, the best scoring DNA molecules are selected and used for further iterative processing until the optimally performing DNA molecule is retrieved and the information on this DNA molecule is read out and transcribed back to a readable result.

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Biological genetic engineering in general	C12N 15/00
Computer memory using DNA	G11C 13/02

Synonyms and Keywords

In patent documents, the following words/expressions are often used as synonyms:

- "DNA computer" and "DNA chips"

G06N 3/126

{Genetic algorithms, i.e. information processing using digital simulations of the genetic system}

Definition statement

This place covers:

Software simulations using the principles of mutation, crossover as exhibited in real biological genetic systems in the reproduction of biological cells or living beings e.g. humans.

This process involves the creation of a number of possible solutions, testing the different solutions (fitness), selecting the best performing ones, starting from these create a new set of possible solutions using reproduction and mutation, and reiterate through this process until an optimal or sufficiently performing solution is found.

Relationships with other classification places

Classification in this group is not expected when genetic algorithms are used in training neural networks. Applications of whatever sort just using genetic algorithms with no description of the genetic algorithm itself are to be classified in the relevant application field only.

References

Application-oriented references

Examples of places where the subject matter of this place is covered when specially adapted, used for a particular purpose, or incorporated in a larger system:

Genetic algorithms used in training of neural networks	G06N 3/086
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Synonyms and Keywords

In patent documents, the following words/expressions are often used as synonyms:

- "evolutionary programming", "Darwinistic programming", "genetic programming", "evolution strategies", "differential evolution", "estimation of distribution algorithm", "gene expression programming", "memetic algorithm", "co-evolution", "learning classifier systems", "cellular genetic algorithm", "parallel, distributed, fine-grained or coarse-grained genetic algorithm"

G06N 5/00

Computer systems using knowledge-based models

Definition statement

This place covers:

Computer systems using knowledge bases or creating knowledge bases.

In particular, specific subjects are classified in the subgroups as it follows:

- Knowledge representation is classified in group [G06N 5/02](#);
- Use of knowledge bases for reasoning is classified in group [G06N 5/04](#).

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Information retrieval; Database structures therefor; File system structures therefor	G06F 16/00
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Glossary of terms

In this place, the following terms or expressions are used with the meaning indicated:

knowledge base	set of representations of facts about the system to be controlled and its environment
knowledge-based agent	a software module that uses a knowledge base to implement control decisions

Synonyms and Keywords

In patent documents, the following words/expressions are often used as synonyms:

- "knowledge base", "knowledge model", "knowledge graph", "semantic network", and "reasoning model"

G06N 5/003

{Dynamic search techniques; Heuristics; Dynamic trees; Branch-and-bound}

Definition statement

This place covers:

Systems using knowledge empirically, Heuristics. Systems based on empirical models are normally used when classic methods fail to find an exact solution in a short time

References

Application-oriented references

Examples of places where the subject matter of this place is covered when specially adapted, used for a particular purpose, or incorporated in a larger system:

Use of these techniques in computer games	A63F 13/00
Use of these techniques for solving equations	G06F 17/10
Forecasting or optimisation specifically adapted for administration or management	G06Q 10/04
ICT specially adapted for medical diagnosis, medical simulation or medical data mining; ICT specially adapted for detecting, monitoring or modelling epidemics or pandemics	G16H 50/00

Synonyms and Keywords

In patent documents, the following words/expressions are often used as synonyms:

- "dynamic search", "adaptive search", "branch and bound", "constraint solver", "constraint optimization", "empirical optimization", and "decision trees"

G06N 5/006

{Automatic theorem proving}

Definition statement

This place covers:

Automatic theorem proving; constraint satisfaction; probability consistency check in a decision problem

Synonyms and Keywords

In patent documents, the following words/expressions are often used as synonyms:

- "logical consistency", "verification", "automatic proving", "determination of provability", "formula checker" and "formula converter"

G06N 5/02

Knowledge representation

Definition statement

This place covers:

Knowledge based systems defined by the specific knowledge representation formalisms, knowledge engineering, knowledge acquisition and extraction, update of knowledge base, maintenance.

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

indexing in information and retrieval	G06F 16/00
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Synonyms and Keywords

In patent documents, the following words/expressions are often used as synonyms:

- "formalisation of a problem", "formalism for knowledge representation", "expressivity", "semantics of a formalism", "elicitation of knowledge action", "rules, ontologies, frames, logics", "description logic", "semantic web", "declarative", "formula converter", "knowledge graph", and "semantic network"

G06N 5/027

{Frames}

Definition statement

This place covers:

Knowledge systems using frames as knowledge representation including attributes and slots

Special rules of classification

Rule systems for specific applications are classified in the field of application, unless the invention is still about the rules formalism and/ or extraction and maintenance process itself.

Synonyms and Keywords

In patent documents, the following words/expressions are often used as synonyms:

- rules extraction", "elcitation", "knowledge discovery", "rules engine", "rules maintenance", "rules consistency" and "rules priority"

G06N 5/04

Inference methods or devices

Definition statement

This place covers:

Symbolic inference methods and devices. Programs with symbolic reasoning capabilities using knowledge. Inference systems.

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Adaptive control	G05B 13/00
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Synonyms and Keywords

In patent documents, the following words/expressions are often used as synonyms:

- "inference", "reasoning", "expert system", "instantiate, explanation, recommendation", "aid to diagnosis", "pattern matching", "case-based reasoning", "deduction", "analogy", "abnormal condition detection", "problem solving, planning" and "question answering"

G06N 5/041

{Abduction}

Definition statement

This place covers:

Kind of logical inference that refers to the process of arriving at an explanatory hypothesis.

Abduction is about the most probable explanation for a fact given the sufficient premises

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Empirical guesses or heuristics	G06N 5/003
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Synonyms and Keywords

In patent documents, the following words/expressions are often used as synonyms:

- "hypothetical reasoning", "explanatory hypothesis", "disambiguation", "reasonable guess" and "most possible explanation"

G06N 5/042

{Backward inferencing}

Definition statement

This place covers:

An inference mechanism that works backwards from the conclusion

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Automatic theorem proving	G06N 5/006
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Special rules of classification

Game-theory based applications are classified in their field of application when possible.

Synonyms and Keywords

In patent documents, the following words/expressions are often used as synonyms:

- "backwards chaining, backwards reasoning, backwards induction", "retrograde analysis", "goal, hypothesis, goal driven", "conclusion, premises", "consequent, antecedent", "game theory", "modus ponens" and "depth-first strategy"

G06N 5/043

{Distributed expert systems; Blackboards}

Definition statement

This place covers:

Expert system implemented in distributed programming units or multiple interacting intelligent autonomous components for example multi-agents systems.

Synonyms and Keywords

In patent documents, the following words/expressions are often used as synonyms:

- "multi-agents", "cognitive agent", "autonomous", "decentralization", "self-steering", "software agents" and "swarm"

G06N 5/045

{Explanation of inference steps}

Definition statement

This place covers:

Inference system that provides explanations of the inferences to the user in the context of diagnostic or decision support

Synonyms and Keywords

In patent documents, the following words/expressions are often used as synonyms:

- "explanation", "decision", "diagnostic", "fault", "abnormal" and "alarm"

G06N 5/046

{Forward inferencing; Production systems}

Definition statement

This place covers:

Inference system that starts with the available data and makes inferences to derive more data. the inferences are performed forwards towards a goal by repetitive application of the modus ponens.

Synonyms and Keywords

In patent documents, the following words/expressions are often used as synonyms:

- "modus ponens", "iterations", "if-then clause", "data driven" and "Rete algorithm"

G06N 5/048

{Fuzzy inferencing}

Definition statement

This place covers:

Transformation of exact inputs in fuzzy inputs with membership functions. The fuzzified inputs are processed in a fuzzy inference machine with fuzzy if-then rules. Depending on the degree of membership, several rules are fired in parallel. The consequents of each rule are aggregated into fuzzy outputs which are de-fuzzified or not de-fuzzified.

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Tuning of fuzzy parameters	G06N 7/02
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Synonyms and Keywords

In patent documents, the following words/expressions are often used as synonyms:

- "membership function", "fuzzification, fuzzy rules, fuzzy expert system", "parallel rules evaluation" and "degree of membership"

G06N 7/00

Computer systems based on specific mathematical models

Definition statement

This place covers:

Computer systems based on mathematical models that cannot be classified in their application field.

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Neural networks	G06N 3/00
Complex mathematical operations	G06F 17/10

Special rules of classification

When other types of Machine Learning are involved, also classify in [G06N 20/00](#).

Synonyms and Keywords

In patent documents, the following words/expressions are often used as synonyms:

- "probabilities", "statistics", "stochastic", "chaos", "non-linear function", "fuzzy logic", "formalism", "applied mathematics" and "systems simulation"

G06N 7/005

{Probabilistic networks}

Definition statement

This place covers:

Inference system representing the probability dependencies between causes and effects in a directed acyclic graph model in which the inferences are modelled as the propagation of probabilities.

Relationships with other classification places

Classification in this group is not expected when probabilistic networks are used in neural networks (e.g. Boltzmann machines).

Applications of whatever sort just using Bayesian or Markov models with no description of the Bayesian or Markov model itself are to be classified in the relevant application field.

Learning of unknown parameters of the network to be classified also in [G06N 20/00](#)

References

Application-oriented references

Examples of places where the subject matter of this place is covered when specially adapted, used for a particular purpose, or incorporated in a larger system:

Game playing	A63F 13/00
Digital data processing	G06F
Documents classification and information retrieval	G06F 16/00
Pattern recognition	G06K 9/00
Speech recognition	G10L 15/00

Informative references

Attention is drawn to the following places, which may be of interest for search:

Feedback neural networks, e.g. Boltzmann machines	G06N 3/0445
Neural networks having a probabilistic aspect	G06N 3/0472

Synonyms and Keywords

In patent documents, the following words/expressions are often used as synonyms:

- "Bayesian network", "Bayes network", "belief network", "directed acyclic graphical model", "beliefs propagation", "random variables", "conditional dependencies", "probability function", "probability nodes", "generalized Bayesian networks", "influence diagrams", "probability density function", "Bayes theorem", "Markov model", "Markov chain", "Markov network", "Markov random field", "Markov decision process", "probabilistic graphical model", "conditional random fields", and "Monte Carlo"

G06N 7/02

using fuzzy logic (computer systems based on biological models [G06N 3/00](#); computer systems using knowledge-based models [G06N 5/00](#))

Definition statement

This place covers:

Computer systems based on fuzzy logic

Relationships with other classification places

Classification in this group is not expected when fuzzy logics is used in combination with neural networks, nor when fuzzy logic is used in fuzzy inferencing.

Applications of whatever sort just using fuzzy logic with no description of the fuzzy logic itself are to be classified in the relevant application field.

References

Limiting references

This place does not cover:

Computer systems based on biological models	G06N 3/00
Computer systems using knowledge based models	G06N 5/00

Application-oriented references

Examples of places where the subject matter of this place is covered when specially adapted, used for a particular purpose, or incorporated in a larger system:

Adaptive control systems	G05B 13/00
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Synonyms and Keywords

In patent documents, the following words/expressions are often used as synonyms:

- "fuzzy logic" and "tuning parameters"

G06N 7/04

Physical realisation

Definition statement

This place covers:

Physical realizations of computer systems based on mathematical models

Synonyms and Keywords

In patent documents, the following words/expressions are often used as synonyms:

- "analogue" and "implementation"

G06N 7/06

Simulation on general purpose computers

Definition statement

This place covers:

Fuzzy systems simulated on general purpose computers

References

Application-oriented references

Examples of places where the subject matter of this place is covered when specially adapted, used for a particular purpose, or incorporated in a larger system:

Simulation in game playing	A63F 13/00
Computer aided design (CAD)	G06F 17/50
Simulation for the purpose of Optimisation	G06Q 10/00
Telecom applications using simulation	G10L 15/00
Computer aided chemistry components design	G16C
Computer simulation of physical phenomena	H04L 29/00

G06N 7/08

using chaos models or non-linear system models

Definition statement

This place covers:

Computer-based systems using chaos or non-linear models

Relationships with other classification places

Classification in this group is not expected when chaos models or non-linear models are used in neural networks.

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Neural networks using chaos or fractal principles	G06N 3/0418
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Synonyms and Keywords

In patent documents, the following words/expressions are often used as synonyms:

- "chaos theory", "non-linear", "stochastic" and "fractal"

G06N 10/00

Quantum computers, i.e. computer systems based on quantum-mechanical phenomena

Definition statement

This place covers:

Computation performed by a combination of atomic or subatomic particles where the interactions are no longer described by macroscopic physics but by the theory of quantum mechanics.

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Manufacture or treatment of nanostructures	B82B
Nanotechnology for information processing, storage or transmission, e.g. quantum computing or single electron logic	B82Y 10/00
Optical computing devices for processing non-digital data	G06E 3/00
Devices using superconductivity	H01L 39/00
Photonic quantum communication	H04B 10/70

Glossary of terms

In this place, the following terms or expressions are used with the meaning indicated:

quantum-mechanical phenomena	covers the quantum phenomena of superposition, coherence, decoherence, entanglement, nonlocality and teleportation
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Synonyms and Keywords

In patent documents, the following words/expressions are often used as synonyms:

- "quantum computer", "qubit", "quantum bit", "superconducting bits", "Josephson junction" and "SQUID"

G06N 20/00

Machine learning

Definition statement

This place covers:

Methods or apparatus giving a machine (in its broadest sense) the ability of adapting or evolving according to experience gained by the machine. A machine in its broadest sense is understood as either an "abstract machine" or a physical one (i.e. a computer).

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Computer systems using neural networks	G06N 3/02
Computer systems using knowledge based models	G06N 5/00

Computer systems using fuzzy logic	G06N 7/02
Adaptive control systems	G05B 13/00
Pattern recognition using learning	G06K 9/66
Image processing using neural networks	G06T 1/20
Speech recognition using artificial neural networks	G10L 15/16

G06N 20/20

Ensemble learning

Definition statement

This place covers:

Machine learning processes where multiple learners (i.e. learning algorithms) are trained to solve the same problem, to obtain better predictive performance than could be obtained from any of the constituent learning algorithms alone.

G06N 99/00

Subject matter not provided for in other groups of this subclass

Definition statement

This place covers:

This group is residual to the whole of the subclass, i.e. it covers subject matter which falls under the scope of [G06N](#) and which is not covered by its groups.

Therefore this main group should be rarely used or not used for classification.

Whenever a new computing technology is identified, which is not covered by the other main groups of [G06N](#), it is recommended to create a new subgroup here for that new subject.

G06N 99/007

{Molecular computers, i.e. using inorganic molecules (using biomolecules [G06N 3/002](#))}

Definition statement

This place covers:

Systems where the computational elements are implemented on the molecular level using inorganic molecules e.g. molecular switches.

Relationships with other classification places

Classification in this group is not expected when computational elements implement quantum computers.

References

Limiting references

This place does not cover:

Computing based on bio molecules	G06N 3/002
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Informative references

Attention is drawn to the following places, which may be of interest for search:

Quantum computers	G06N 10/00
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