International Journal of Management and Fuzzy Systems
2017; 3(5): 57-66
http://www.sciencepublishinggroup.com/j/ijmfs
doi: 10.11648/j.ijmfs.20170305.11
ISSN: 2575-4939 (Print); ISSN: 2575-4947 (Online)

Cognitive Robots with Imitative Thinking for Digital Libraries, Banks, Universities and Smart Factories

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To cite this article:
Evgeniy Bryndin. Cognitive Robots with Imitative Thinking for Digital Libraries, Banks, Universities and Smart Factories. *International Journal of Management and Fuzzy Systems*. Vol. 3, No. 5, 2017, pp. 57-66. doi: 10.11648/j.ijmfs.20170305.11

Received: April 11, 2017; **Accepted**: April 27, 2017; **Published**: October 31, 2017

Abstract: The general approach to creation of cognitive adaptive robots with imitative thinking and adaptive behavior as assistant to the person in various spheres of activity is covered in article. Researches and the analysis of language thinking of the person allow simulate cogitative communicative and associative symbolical and language functions. The communicative and associative symbolical and language logic of thinking allows create cognitive adaptive robots for various spheres of activity. The robot with symbolical language thinking has system of recognition of the interlocutor, system of speech input of information requirements, system of realization of information requirements (system of imitation of imitative thinking), neural network system of synthesis of the speech in the text of realization of information requirement. The system of realization of information requirement contains system of assimilation of knowledge, system of symbolical and language communication, system of training, the knowledge base, base of abilities, the neural network system of reading printing system and system of graphic display. The system of training contains subsystems of machine translation. The system of recognition of interlocutors is neural network system. Information unit of communication between the robot and the interlocutor is information requirement. The interlocutor uses information requirements which contain in the knowledge base of the robot. He communicates with the robot by means of combinations of information requirements, enriching, thereby, the robot with information requirements. The robot receives new basic information requirements, elements of knowledge and realization during his training. Acquaintance of the robot to the person is carried out through neural network system of a face recognition. If the person is unknown to the robot, then the receptive system remembers his speech dictionary and the person. If he is known to the robot, then the system will customize system of speech input of information requirement on the speech dictionary of the interlocutor. After that information contact between the robot and the person begins. The system of speech input will transform speech information requirement to the text in a functional natural language. Specialization of cognitive adaptive robots is carried out on the basis of knowledge bases, bases of abilities and implementers of behavior. Cognitive adaptive robots with imitative thinking and adaptive behavior have prospect of broad practical application.

Keywords: Cognitive Adaptive Robot, Communicative and Associative Knowledge Base, Symbolical and Language Logic of Thinking

1. Introduction

Researches and the analysis of language thinking of the person allow to simulate cogitative functions. The communicative and associative symbolical and language logic of thinking allows to create cognitive adaptive robots for different spheres of activity [1-2].

The robot with symbolical language thinking has system of recognition of the interlocutor, system of speech input of information needs, system of implementation of information needs (system of simulation of imitative thinking), neural network system of synthesis of the speech in the text of implementation of information need.

The system of implementation of information need contains system of assimilation of knowledge, system of symbolical and language communication, system of training, the knowledge base, a basis of abilities, the neural network system of reading printing system and system of graphic display. The system of training contains subsystems of machine translation. The system of recognition of interlocutors is neural network system.

Information unit of communication between the robot and the interlocutor is information need. The interlocutor uses information needs which contain in the knowledge base of the robot. He communicates with the robot by means of combinations of information needs, enriching, thereby, the robot with information needs. The robot receives new basic information needs, elements of knowledge and implementation during its training.

Acquaintance of the robot to the person is carried out through neural network system of facial recognition. If the person is unknown to the robot, then the receptive system remembers its speech dictionary and the person. If it is known to the robot, then the system will customize system of speech input of information need on the speech dictionary of the interlocutor. After that information contact between the robot and the person begins. The system of speech input will transform speech information need to the text in the functional natural language.

The robot models imitative thinking on the basis of symbolical and language communicative and associative logic standard procedures for a network of implementation of information need and data domains of knowledge with the associative and communicative symbolical language elements [1-7]. Creation of the cognitive adaptive robot can be realized using GPU. Software packages of Caffe and Torch CPU of the server allow to train neural network models on Tesla M40 for hours, instead of days on the computing systems using only CPU.

2. Specialization of Cognitive Robots

Specialization of cognitive robots is carried out on the basis of knowledge bases, bases of abilities and implementers of behavior.

The knowledge base contains data domains of knowledge. Data domains of knowledge contain the intrinsic oriented dictionaries. Communicative words of the intrinsic oriented dictionaries generate phrases, communicative phrases generate sentences, communicative sentences generate opinions. Information needs are imperative and questions. They it is associative are connected in data domain of knowledge to the implementations. Implementation can be itself information need.

Data domains of knowledge represent networks communicatively and is associative the coupled symbolical language elements with a situational and character and language marking.

The network G (Xt, Gt, Vt) is conceptual representation of knowledge if Xt = U U where – a set of peaks of opinions with a situational and language marking, – a set of peaks of the sentences having a language and situational and character marking: { (a lexical meaning, a look) }, (a sign, a niche) }, – a set of peaks of phrases with a character and language marking, Vt – a set of communicative communications of set members of Xt, Gt – a set of the associative communications of set members of Xt, t – the discrete moments of appearance of new elements of knowledge, a sign – the sign of the representative of a reality specifying the semantic use of the word in the speech and in writing a look – the grammatical characteristic of a set of words which morphological value is created by the general rules of grammar a niche – uniform situational use of a set of words of different types in different syntax sentence structures (the niche can be subject and object, procedural, a circumstance, attributive, additional.

The associative communications connect peaks which are information need and its implementation. Communicative communications proceed from peaks of communicative elements of knowledge of which phrases of a sentence and an opinion are created.

The labeled morphological words of the information job of the person to the robot can be either a lexical meaning of the semantic oriented dictionary, or analytical action, or behavioral action. For example, <to add>, there can be a lexical meaning, behavioral action (to put things) or arithmetical action (+).

Let's consider network structure of addition of two numbers 10 and 15.

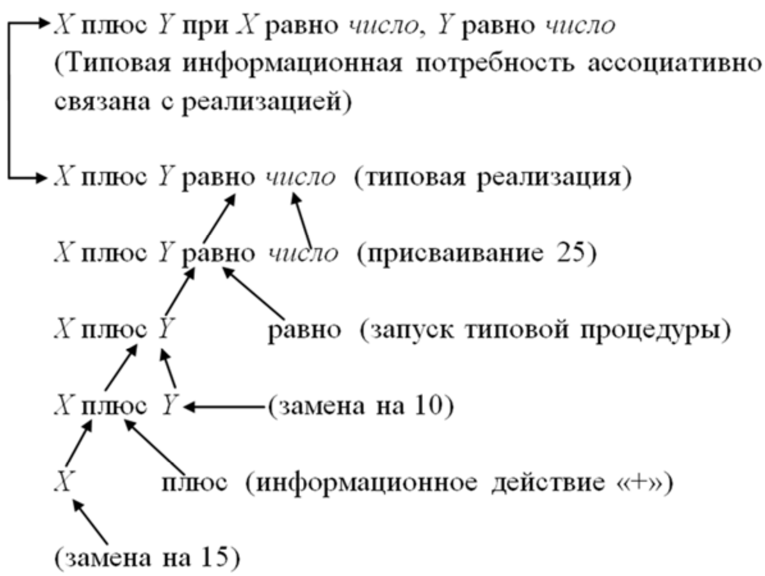

Figure 1. *Network structure of addition.*

With the knowledge base several users can interact. For them the administration directed to coordination and the accounting of different requirements, and the conflict resolution is entered. The administrative subsystem of management system of the knowledge base services its users and their and current requirements. Appearing as the intermediary between users, she will agree on appeals to elements of knowledge of data domain, and also input of new elements of knowledge. Standard information needs of users and their standard implementations are included in the knowledge base.

The management system the knowledge base will organize direct access to elements of knowledge in implementation process of information need and for development of the knowledge base new implementations.

The management system transfers by the knowledge base to a subsystem of language communication either implementation of information need of the user, or the message on absence of knowledge for its implementation.

The basis of abilities contains standard procedures of implementation of standard information actions, procedures of implementation of combined information actions, procedures of implementation analytical (mathematical, chemical and others) actions and the procedure of implementation of behavior of the robot.

The robot component realizing the adaptive behavior in the external environment includes sensor, controlling, executive motor systems and system of diagnostics [8-19].

The sensor system is intended for perception and information transform about a status of an external environment. It turns on television and optiko-laser devices, ultrasonic range finders, tactile and contact sensors, situation sensors, neural network devices of image identification of an external environment, etc.

The system of diagnostics exercises control of execution of simple movements of parts of motor system of the robot on each step of implementation of behavior, transmission of necessary information of the managing director to system about a status of motor system for its correlation with information from sensor system in real time, and also reports about the end of simple movements.

The executive motor system realizes procedures of behavior of the robot in the external environment realizing various movements. The motor system has mechanical hands (pointing devices), mechanical legs (pedipulators). The pointing device can take, turn, transfer, collect, bend hindrances, etc. The legged robot can move on unfamiliar terrain with a difficult relief, overcoming hindrances.

The procedure of implementation of behavior is built on type a situation action. In the mode of implementation of behavior the controlling system permanently processes information on a situation from sensor system and from system of diagnostics and launches executive system.

The robot determines model of the external environment by information need of the person and touch information. He determines behavior model by model of the external environment and information need of the person. Then he determines the sequence of the behavioural acts of motor system in the external environment on type a situation action realized from the point of view of the functional and touch opportunities by models of the external environment and behavior.

For a certain external environment at the robot the model of the external environment, behavior model and procedures of realization of behavior are set. In a certain external environment the robot on the information need of the person (INP), models of the external environment, behavior model realizes information need of the person procedures of realization of behavior. On IPCh the robot forms network of bit-by-bit realization of information requirement for subject domain. If the network is built, then the imitative thinking starts procedures of realization of IPCh. In the course of realization of IPCh the robot via touch devices controls a condition of the external environment. If the condition of the external environment on any circumstances doesn't correspond to a condition of model of the external environment, then the robot gives the message that it can't realize IPCh in connection with change of the external environment and waits for the following information requirement from the person. After realization of IPCh the robot reports to the person about the termination and results of the activity.

In the uncertain external environment the robot according to touch information forms model of the external environment (EE), selects standard behavior model for IPCh and consistently realizes IPCh procedures of realization of behavior: lays a safe route of the movement of the robot on the VS model, on behavior model the standard procedure builds the serial-parallel movements of manipulators, pedipulyator and other motor mechanisms of the robot.

The robot for work with the uncertain external environment has many various touch devices. The behavior model of the robot forms the procedure of realization of IPCh of a set of standard procedures. The behavior of the robot is implemented along a route of the movement and the sequence of intermediate configurations of the motive acts leading to realization of IPCh. The sequence of configurations of motive acts is built according to a route and IPCh.

The behavior model builds movements of motor mechanisms of the robot under the law of change of their generalized coordinates guaranteeing implementation of IPCh. Movement is determined by the vector of the generalized coordinates determining the current provision of degrees of mobility of its mechanical part. Working parts of motor mechanisms make rotations on the trajectory determined by a vector of phase coordinates.

Interaction with the external environment and its perception performs the robot by means of different sensors and touch systems. Real situations are described in memory of the robot by means of a set of indications of touch sensors. Touch information can be photographic, scanned, range - metric from optical and ultrasonic systems of technical sight.

In terms of indications of touch sensors primary description of model of the external environment is created. The analysis and handling of this information lead to the generalized description of a situation with the help of concepts. According to the generalized description of a situation and IPCh the behavior model of the robot and a set of standard procedures of implementation of IPCh are selected.

In behavior model functional properties of the robot, mobile opportunities of the robot are reflected in the external environment. Thanks to it the robot can render services in IPCh, according to mobile opportunities, the VS model and behavior model in the unfamiliar external environment.

The task of the analysis of touch information, recognition and the description of a situation is urgent for interaction of the robot with the uncertain environment. This problem by training of the robot is solved to distinguish objects of the external environment through systems of recognition of three-dimensional objects, to describe in a natural language elements of three-dimensional scenes on the basis of touch information by means of a full range of elementary situational signs. For example: further, more to the left, below, are disconnected, areas of different color, etc. The description of the external environment is set in a natural language by means of a full range of elementary situational signs.

The robot, analyzing a situation of the external environment on standard model of the external environment, touch information, to the description of a scene of the external environment selects for IPCh behavior model, procedures of implementation of behavior, builds a route of movement and consistently creates motive acts of parts of motor mechanisms of the robot for requirement implementation. Differentiate cyclic and position systems of coordination of motive acts. In cyclic systems of a trajectory of motive acts are limited to 2-4 points of positioning on each of mobility degrees, and in position systems the number of these points can constitute several tens that allows to implement are difficult" e motive transactions.

Cyclic and position management provides movement of working body for a broken trajectory from a point to a point. The concept of relative mobile system of coordinates is central. Relative mobile systems of coordinates are connected with each position point of a part of the motor mechanism.

For each position point on each step is defined consistently at what size and in what direction to move her from the current situation to set. For each part of motor mechanisms connected with a position point is defined in what direction and on what corner it is necessary to turn.

Simultaneous turn and transfer of a part of motor system concerning the generalized system of coordinates are calculated on formulas [6].

For pneumatic parts of motor mechanisms it is set to increase or reduce the scale specifying in how many time the part size. The behavior model and procedures of realization of behavior are defined by the field of professional activity in which the robot has to realize IPCh.

The directing cosines of part P1P2 of motor system of the robot in own relative system of coordinates it is calculated on formulas [6].

The behavior model contains algorithms of adaptive integrated management of the movements, a route of movement of the robot and the sequence of motive acts of parts of motor mechanisms of the robot.

Procedures of realization of behavior are performed by the movements of parts of motor mechanisms of the robot according to a route of movement and the sequence of motive acts of parts of motor mechanisms of the robot. The route of the movement of the robot is under construction in classes of piecewise and polynominal functions.

Let the area represent the plane, obstacles by broken lines and coordinates of a starting point of the robot and target where the robot has to move are set.

It is necessary to construct an optimum route as the broken line from a starting point in target which doesn't cross obstacles and has the smallest length.

This problem is solved by a classical method of dynamic programming of consecutive approximations in functional space, using a recurrence relation of function f, the defining route length from a starting point target. The strategy of finding of the minimum route is defined by consecutive approach of the constructed any route to minimum.

After the optimum, safe route is constructed, by methods of the generalized, relative and phase coordinates motive acts of motor parts of the robot are under construction. Coordination of motive acts is consecutive – information coordinator ofbehavior model which is in the field of attention of memory of the robot in parallel carries out.

3. Touch Aspects of the Person and Robot

To touch of the person there correspond four distinct feelings: cold, heat, pain and pressure. On the robot it is possible to assign a maintenance task in admissible limits of the parameters of heat and cold, vital for the person. The robot capability equivalent to perception of pain at the person, can warn about an overload. Perception of pressure is function without which the robot can't do. This function can be entered in the robot by various methods depending on purpose of the robot. It is especially important when fingers of the robot take various, sometimes fragile, objects.

Touch sensors at the person are very sensitive and numerous that allows to use them for distinction of a form. It is very desirable to allocate with a similar capability the robot, but now this task is already not really difficult.

The main objective of reflex activities of the person is his viability. It is possible to allocate the robot with the similar capability providing its mobility. In certain cases it will be hard to be performed.

It is known how to reproduce human sense of smell technical means. So, in case of contact of combustible mix of gas and air with some catalysts, for example platinum or palladium, heat is generated and the electric resistance of the catalyst changes that can be found direct measurement. Similar detectors are very important for prevention of the fire and explosion. Oxygen can be found, using its paramagnetic properties, and some gases — using their heat conductivity, in the device called by the thermal detector. For detection of various gases it is possible to use also infrared absorption. Water vapor is found hygrometers of various types. Future researches will lead to emergence of more perfect detectors of a smell. Wright considers that the nervous system of an animal finds smells, catching molecular vibrations in distant infrared area. Gases possess a capability to change color of various chemicals that is often used in the gas analysis. The similar method could be applied also in the robot. In Japan developed gas-catching Taguchi Hydroelectric Power Station Sensor device. The solid-state technology allowed to manufacture the oxygen analyzer which can be used to determination of concentration of oxygen in furnace gases.

Various elements, including chloride and lithium (Danmor sensor), carbon, elements based on polyelectrolytic resistance, ceramic elements, capacitor devices and elements based on an aluminum oxide are applied to perception of humidity. These developments can be used in robotics.

In certain cases the robot it is necessary to allocate with a capability to measurement of level of temperature either in itself, or in the environment. For this purpose use any of well-known methods of electric determination of temperature.

The method of exact indication of position of the robot is implemented by the navigation equipment, based on comparison of provisional regulations of impulses with provisional regulations of reference impulses. Indication of position of the robot is important for his orientation in space. Mapping and localization of an image of an object is carried out with use of the scanning laser range finders. For measurement of distance use ultrasonic sonars, infrared sensors, laser sensors. Achievement of an object is carried out on the received coordinates. Procedures of realization of behavior are performed by the movements of parts of motor mechanisms of the robot according to a route of movement and the sequence of motive acts of parts of motor mechanisms of the robot. The route of the movement of the robot is under construction in classes of piecewise and polynominal functions.

Cybernetic methods realize functions, to touch human organs and allow to create robots with adaptive behavior on the basis of imitative thinking.

4. Informing Robots for Digital Libraries, Banks, Universities and Smart Factories

In the course of cogitative activities of the person the communicative associative neural semantic network of information requirements and their implementations is created. Mental energy on the basis of communicative associative neural semantic network realizes speech acoustical dialogue and communicative semantic synthesis [1-2].The cognitive robot models speech acoustical dialogue and communicative semantic synthesis on the basis of symbolical language communicative logic over symbolical language elements of knowledge of communicative and associative network of bit-by-bit implementation of information requirements.

Implementation of information requirement it is associative contacts the information need for network of subject domain of knowledge. The network is under construction of elements of knowledge, information actions and standard procedures of implementation.

The realization of information requirement on network of bit-by-bit implementation is enabled by system of implementation. The system of implementation of information requirement uses from base of abilities of the procedure of the circuit, morphological, syntactic and semantic analysis, splitting and merge of elements of knowledge of information requirement and subject domain of the knowledge base, and also the procedure of a specification of schemes and structures semantic value.

In the course of the circuit, morphological, syntactic and semantic analysis, merge and splitting schemes and structures, and also grammatical and semantic meanings for their specification come to light. The revealed values concretize syntactic structures of phrases, offers, judgments.

The network of bit-by-bit development of knowledge is the SPRZ set = (EZ, ERZ, S, R0) where EZ – elements of knowledge, ERZ – implementation elements, S – communications of elements of knowledge and implementation, R0 – an initial marking of network.

Elements of implementation and knowledge are connected in network hierarchically. An element of implementation are either the procedure of the analysis, or the procedure of merge, or the standard procedure of implementation of requirement, or the procedure of splitting. Each element of implementation is connected with several sets of entrance elements of knowledge. For each set of elements of knowledge the element of implementation generates a resultant element of knowledge. In network elements of implementation and elements of knowledge have a marking. Elements of knowledge have a morphological, syntactic and semantic annotation, and also circuit and structural situational признаковую.

Entrance top of network is the communicative phrase of the first level which generates the first act of implementation of requirement. Each element of implementation corresponds to the semantic act of the person. After execution of each element of implementation the system of implementation adjusts a marking of network.

After each act merge or words in phrases, or phrases in offers, or offers in judgments, or judgments in judgments is performed. The sequence of starts of procedures of merge of offers or judgments generates judgment.

Offers are created on their syntactic structure of a necessary and sufficient set of phrases by procedures of morphological, syntactic and their semantic synthesis and merge. Elementary associative judgments are created on its syntactic structure of communicative offers by procedures of morphological, syntactic and their semantic analysis and merge.

Difficult judgments are created on its syntactic structure of elementary associative judgments by procedures of morphological, syntactic and their semantic analysis and merge from communicative offers.

The compulsory provision of feasibility of information requirement is completeness of the knowledge base and base of abilities, that is existence of necessary and sufficient set of elements of knowledge and abilities of cross-disciplinary subject domain for training in a healthy lifestyle [20-22]. The healthy lifestyle of the person is under construction on the basis of high-quality regularities. High-quality regularities are described by causes and effect relationships. The communicative and associative network of knowledge of the cross-disciplinary subject domain concerning a healthy lifestyle contains causes and effect relationships between elements of knowledge describing useful effects and the corresponding improving investigations generated by them.

The realization of a healthy lifestyle is enabled by useful habits. Purity of an organism is reached by a habit of daily hygiene.

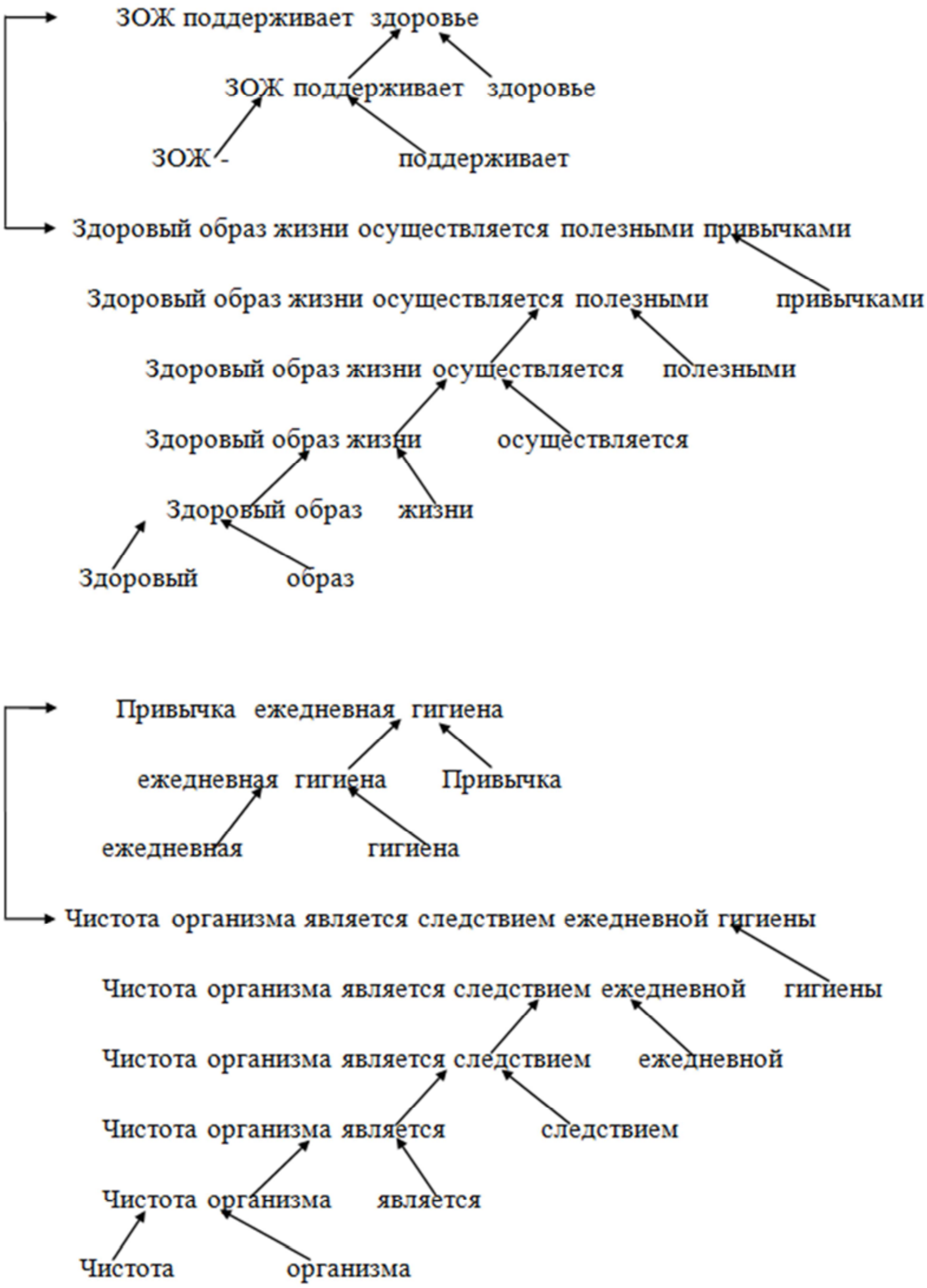

__Figure 2.__ Communicative-associative network structures.

Consultation of the robot in communicative and associative network of elements of knowledge of subject domain is based as a chain of relationships of cause and effect. For example, in the mode short consultation: (a habit daily hygiene) – (purity of an organism).

Realization of information requirement can be information requirement. In this case on a communicative tree of lexical meanings of the reason by their synthesis we reach associative top. Then we determine realization by associative communication.

The robot can train along with consultations in physical exercises. To physical culture for normalization of a tone of an organism. To gymnastics for normalization of rhythms of functioning of an organism. To charging on normalization of a power system.

5. System of Realization of Information Requirement

Information requirement is formed from elements of knowledge. Information requirements happen incentive and interrogative. Incentive information requirement consists of information action and information condition. If information requirement interrogative, then is obviously specified in it the phrase of question defining the direction of realization. The system of realization includes the knowledge base and base of abilities. Realization of information requirement undertakes or from the knowledge base, or is developed by a standard procedure of realization of base of abilities for the current information requirement, or the network of bit-by-bit realization on the combined information requirement is formed. Schemes of realization of information requirement are received from a research of educational practice of formation of imitative thinking [23-25]. Scheme of realization of situational information requirement. The scheme of realization of the combined information requirement. Scheme of realization of new information requirement.

The combined information requirements are developed by an investment, a variation and a combination of information requirements which implementations are in the knowledge base of system. New information requirements are under construction either consecutive merge existing, or an investment of one in another, or merge and an investment at the same time.

After implementation new information requirement is entered in the knowledge base and is associative contacts an element of knowledge which is its implementation. The variation of similar information requirements is performed in a variable part which are implemented on general for them regularity by standard procedures.

6. Conclusion

The general approach to creation of cognitive adaptive robots with imitative thinking and adaptive behavior as assistant to the person in various spheres of activity is covered in article. The imitative thinking carries out the robot on the basis of communicative associative logic. The adaptive behavior goes imitative thinking on the instructions of the person and is carried out on models of the environment and behavior. Specialization of the robot is set by the subject knowledge base and base of abilities, and the mechatronics equipment (sensors, sensors, manipulators, pedipulyator, motor systems and other devices). An example of imitative thinking of the cognitive robot of the consultant for a healthy lifestyle is reviewed. Schemes of imitative thinking for cognitive adaptive robots depending on the accumulated cognitive experience are output from student educational teaching. Cognitive adaptive robots with imitative thinking and adaptive behavior have the prospect of broad practical application in creation of the digital smart companies of robots of consultants with servicing by their robots online by retailers like Amazon.com.

Now in a pattern in many spheres of activity robots are used. Use of robots is also urgent also in university educational activities. Cognitive robots with imitative thinking can be lecturers and train in creation of robots for different spheres of life. Consortia with digital universities can organize a production cycle robots themselves.

Development of technologies carries to the fact that new robots appear. They become independent subjects of the work and social environment. In Japan robots become subjects of the construction sphere. Attract women to control of robots

The robotic technology directly participates in human life. The modern artificial limbs of extremities are able to move fingers. Their control is directly connected to the electrical impulses transferred by a body. By means of medical robotic technology perform hi-tech operations. New technologies will allow to research health of the person. Medical robots, in the miniature chip, trace at the nano level of a disease, it allows to diagnose an illness still before the person experiences his symptoms.

Robots can find environmental pollution. Robots find fire-dangerous situations and successfully prevent them. Robots are capable to carry out the long tracking the objects causing suspicion in law enforcement bodies.

Robots execute a set of the most different operations on production. Generally are the actions requiring repeated repetition and high accuracy. Their application allows to increase considerably labor productivity, having released at the same time human resources.

Automotive industry — the most automated type of production, is the share of 10000 workers from 400 to 700 robots here (for comparing, by production of electronics 100-200 robots are the share of the same number of workers, in the food industry — less than 50.

Stationary robots execute the monotonic operation on package and loading of goods quicker and cheaper than people long ago. A few years ago there were also mobile robots able to be guided in space. The Kiva Systems company makes automatic systems for warehouses. Robots transporters receive a command from the operator to deliver the necessary goods, find the appropriate rack in a warehouse and bring to the packer.

In agriculture mobile robots can is dosed to water or fertilize a specific plant, visually analyzing its status, to delete each weed in the field and to work 24 hours 365 days in a year with breaks for priming and maintenance.

The KUKA KR 3 AGILUS robot is used for sensitive mounting in electronic industry with an accuracy of millimeter.

Create robots and train them for operation in the social sphere, in hospitals as nurses who look after elderly and sick people, in life as the robot vacuum cleaner, the lawn-mower and others.

The trucks of the Otto company controlled by the trained robot from San Francisco reduce a possibility of accident. Cars have the equipment for off-line control which turns on four video cameras follow-up the road ahead, the radar, a set of accelerometers, a laser locator which tracks a surrounding of the truck, and also the powerful computer analyzing the data collected by instruments. Robots for driving have the self-trained neural networks with a reinforcement. These are the dynamic neural networks having connections of back coupling which allow them to show dynamic behavior of the sequential and changing in time objects.

The self-trained neural network system with a reinforcement allowed the Alpha Go computer created by subdividing of Google — Deep Mind, to master very difficult strategic board game ro and in March, 2016 to beat in it one of the best players of the world — Korean Lie Sedol.

Big Blue (the blue giant) — the neural network system trained in a game in chess developed by the IBM company benefited on May 11, 1997 a match from 6 batches against the world champion in chess of Garry Kasparov.

In a pattern many robots of different function are created. From them the customer can create smart robotic factories on production, stacking and transportation of goods. Robots managers and lawyers can sign contracts with customers and service them.

In the fourth quarter 2016 the Sberbank developed a prototype of the robot lawyer which can write statements of claim. All standard claims will be translated in the long term to an automated format that will exempt lawyers from routine operation and will allow to be focused on the solution of difficult legal questions. At the beginning of January the deputy chairman of Sberbank Vadim Kulik reported that the Sberbank can release in 2017 about 3 thousand jobs because implemented robots lawyers for design of claims to retail clients.

Robots can be lecturers. The Japanese expert of robotic technology of Hiroshi Ishiguro created the robot lecturer.

Japan created the robot teacher. The droid was made similar to the famous writer Natsume Soseki which is one of founders of the modern Japanese literature. The robot will give lectures on literature and to quote fragments from works of the writer. At the same time researchers also plan to monitor response of students to the lecturer robot and a possibility of coexistence of people and androids.

The teacher Jill Watson helped about five months students of Institute of technology of Georgia with operation over projects on design of programs. The nuance is that Jill is a robot, the system of an artificial intelligence working at IBM Watson basis, but none of students, discussing operations with the teacher, for all this time suspected nothing. And someone from students before this opening was even going to call her "the outstanding teacher". It were students from a class on a study of an artificial intelligence.

The VANI robot (Variety, Ability and Intimacy) is created by the Korean Institute of Science and Technology (KIST - Korea Institute of Science & Technology) together with the CTS company (Creative Technical Services) for independent training of children in English. Developers widely implement the VANI robot in process of school training in mathematics, physics, chemistry.

Cognitive adaptive robots with imitative thinking and the adaptive behavior have perspective of broad practical application as digital smart robots of lecturers and consultants in educational activities for training of students on the basis of online courses. Cognitive robots with imitative thinking and the program interface it is possible to program on control of smart factories.

In the next years all labor market will change unrecognizably and irrevocably. Implementation of robotic technology will increase labor productivity many times, having multiply reduced costs of business and will cause essential abbreviations of low qualified personnel.

Innovative processes redistribute cumulative expenses of work to more hi-tech areas. More and more demanded are engineering professions. Demand for highly qualified intellectual work with creativity elements increases. All plants on production of mass standard production work as robots with the minimum human involvement. The considerable part of human resources goes to a services sector with creative activity and the creative industries.

The industry which appears in plus is development, production, programming and service of robots. An important factor of development of activity in the sphere of creation of cognitive intelligent robots is quality of labor. Higher quality of labor which is characterized by higher level of education, qualification of workers leads to more effective use of robots. Educational level reflects creative ability of workers to perceive the new ideas which appeared in the market.

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