Annotation

Major: 03.04.01 Прикладные математика и физика

specialization: Neural Networks and Neural Computers/Нейронные сети и нейронные компьютеры

Basics of Neuromathematic/Основы нейроматематики

Purpose of the course:

To provide students with basic knowledge and understanding of the Neuromathematic – methods and algorithms for basic mathematical tasks solving using Neural Networks with various architecture.

Tasks of the course:

Explore ways of solving mathematical problems using neural networks, including problems of approximation, classification, clustering, prediction (extrapolation), solving systems of linear equations.

List of the planned results of the course (training module)

As a result of studying the course the student should

know:

ways of Neural Networks with different structures applications in such mathematical tasks as classification, clustering, extrapolation, system of linear equations solving.

be able to:

- use knowledge to solve fundamental and applied mathematical problems, including approximation, classification, extrapolation, solving systems of linear equations

- to produce numerical estimates of the efficiency of solving the problem

- effective use of information technology and computer technology to achieve the necessary theoretical and practical results

- build modern applications of neural network algorithms for solving mathematical problems.

master:

- application of neural networks and neuromathematics

- skills of understanding of a large amount of information

- technic of statement, solutions and modeling of mathematical tasks

- technic of research and solution of theoretical and applied problems

Content of the course (training module), structured by topics (sections):

1. Introduction to neural networks

Brief introduction to neural networks. Neural networks structures – multilayer, CMAC, deep, spiking, cell, recurrent and other. Adjusting methods – gradient based, second order derivatives based, random and others. Plan of experiments.

2. Functions interpolation using neural networks

Neural network structures for function interpolations. One and multidimensional functions. Fitting and overfitting problem. Examples on functions interpolation.

3. Functions extrapolation using neural networks

Neural network structures for function extrapolations. Sliding windows. Planning horizon. Forgetting functions. Extrapolation variable parameters. Examples on functions extrapolation.

4. Data classification using neural networks

Neural network structures for data classification. Classification error. Loss matrix. Matlab examples on data classification. Convolutional neural networks. Deep Neural Network for image classifications.

5. Data clustering using neural networks

Neural network structures for data clustering. Clustering error estimation. Supervised, unsupervised and semi-supervised learning. Examples on data clustering.

6. Systems of linear algebraic equations solving using neural networks

Neural network structures for linear algebraic equations solving. Neural and classical iteration methods interrelation. Training and testing sets preparation. Examples on linear algebraic equations solving.

Annotation

Major: 03.04.01 Прикладные математика и физика

specialization: Neural Networks and Neural Computers/Нейронные сети и нейронные компьютеры

Basics of Theory of Probability and Statistiscs/Основы теории вероятности и статистики

Purpose of the course:

1) Reviewing of undergraduate courses in statistics and probability;

2) Learning statistics and probability in the field of computer science, especially data science and artificial intelligence;

3) Learning probabilistic thinking and probabilistic modeling;

4) Learning the basic applications of probability and statistics in computer science.

Tasks of the course:

To develop critical analytical and debate skills enabling students to engage in independent analysis based on credible sources of information in the area of Probability and Statistics.

List of the planned results of the course (training module)

As a result of studying the course the student should

know:

Students will gain basic understanding of the Theory of Probability and Statistics and their applications in Neural Network TheoryBasic understanding of the Theory of Probability and Statistics and their applications in Neural Network Theory.

be able to:

Apply analytical and numerical methods to solve typical applied problems of probability theory.

master:

Terminology of probability theory and skills in solving problems and presenting the results.

Content of the course (training module), structured by topics (sections):

1. Probability Theory

- Probability Space: Probabilistic model, Probability axioms, Discrete probability law, Discrete uniform probability law, Some properties of probability laws, Conditional probability, Total probability theorem, Independence of one and several variables, The counting principle.

- Discrete Random Variables: Basic concepts, PMF, Expectation, Variance, Properties of expectation and variance, Facts about joint PMFs, Conditional PMFs, Conditional expectations, Independent random variables

- Continuous Random Variables: PDF properties, Expectation of a continuous random variable, Properties of a CDF, Normal random variables, Conditional PDF an event and a random variable, Conditional expectations and Independence,

- Further Topics: Derived distributions, Covariance and correlation, Conditional expectation and variance revisited, Transforms, Transforms for common random variables, Laplace transform, Z-transform,

- Limit Theorems: Markov and Chebyshev inequalities, The weak law of large numbers, Convergence in probability, The central limit theorem, De Moivre-Laplace approximation, The strong law of large numbers.

- The Bernoulli and Poisson Processes: Random variables associated with the Bernoulli process and their properties, Alternative description of the Bernoulli process, Poisson approximation to the Binomial, Definition of the Poisson process

- Markov Chains: Discrete-Time Markov, Markov chain decomposition, Periodicity, Steady State behavior, Continuous-Time Markov chain

2. Statistical Theory

- Bayesian Statistical Inference: Review of basics concepts, Bayesian inference, The four versions of Bayes' rule, Point estimates, Bayesian least mean squares estimation, Linear LMS estimation formulas

- Classical Statistical Inference: Classical parameter estimation, Linear regression, Bayesian linear regression, Binary hypothesis testing.

3. Stochastic Theory

- Stochastic Matrices: Review of basics concepts, Random vectors, Mean vector, Covariance matrix, Cross-covariance matrix, correlation matrix, Some properties, Random matrices and their properties, Finite Markov chains

4. Application

Parameter estimation, control group selection, Routing in sparse networks, Random graphs and web graphs, Stochastic games, Applications of probability in data analysis and neural networks

and deep learning, Application of probability in cryptography and coding theory, Application of probability in image processing and text processing.

Annotation

Major: 03.04.01 Прикладные математика и физика

specialization: Neural Networks and Neural Computers/Нейронные сети и нейронные компьютеры

Computational Intelligence/Интеллектуальные вычисления

Purpose of the course:

To provide students basic knowledge and understanding of Soft Computing (SC) and their relationship with Neural Networks (NN), pros and cons, hybridization approaches.

Tasks of the course:

- the study of methods, algorithms, approaches to build SC;

- the acquisition of the ability to read and analyze scientific literature on Soft Computing, to understand relationship between various SC technology.

List of the planned results of the course (training module)

As a result of studying the course the student should

know:

- basic approaches to SC;

be able to:

- use SC jointly with NN;

- effective use of information technology and computer technology to achieve the necessary theoretical and practical results;

master:

- application of SC to practical tasks;

- skills of understanding of a large amount of special information;

Content of the course (training module), structured by topics (sections):

1. Fuzzy Sets and Fuzzy Networks

Crisp and fuzzy digits, membership function. Fuzzy sets, fuzzy inference, fuzzy sets logical operations: union, intersection, negotiation. Application of fuzzy sets. Fuzzy and neural networks, ANFIS network: inference and training, application examples.

2. Evolutionary and Genetic computing methods

Searching methods, evolution approach. Genetic algorithms: gene coding, crossover and mutation operation, selection process, fitness function. Particle Swarm Optimization method. Applications of Evolutionary Computing and other searching methods.

3. Wavelet Networks and Wavelet Analysis

Wavelets, mother wavelets, direct and inverse wavelet decomposition, wavelet coefficients. Relationship with Fourier transform in time-frequency domain. Wavelet networks: structures, inference, training. Applications of wavelets: signal compressing, reconstruction etc.

Annotation

Major: 03.04.01 Прикладные математика и физика

specialization: Neural Networks and Neural Computers/Нейронные сети и нейронные компьютеры

Fundamentals of Intelligent Cyber Security Management/Основы систем управления информационной безопасностью

Purpose of the course:

1.To develop the students to assess the current security landscape, including the general status of common vulnerabilities, and the likely consequences of security failures;

2.To develop the students critique and asses the strengths and weaknesses of general cyber security models, including CIA triad..

Tasks of the course:

1.To develop the students appraise the interrelationships among elements security system, including hardware, software, policies, and people.

2. To develop the students to understand how the organizations are managing cyber security concern, Designing and the Cyber security solution for Organization, Component .of devices, forming integrating technology for cyber security issues. The existing methods used for effective Cyber security solutions.

List of the planned results of the course (training module)

As a result of studying the course the student should

know:

1.The students will be able to understand in depth the cyber security overview and principles behind theory of risks.

2.The students will be able to understand the concept of implementing the cyber security solutions in the organization.

be able to:

the students would be able to assessment the risk posed by the threat landscape of cyber space.

master:

1.The students would be able to learn the anatomy of cyber-attack and this will help them in future to design new solutions.

2.The students would be able to learn the defense technology for cyber threat and will try to understand how it works.

Content of the course (training module), structured by topics (sections):

1. The concept of risk cyber-attacks

Setting the task of assessing the risk of an attack. Risk structure. Invariants, functions of security. Examples of programming security functions using neural networks in Matlab.

2. Logical-probabilistic approach to risk assessment

LP-polynomials. Comparative analysis of the security of the risk object. Examples of programming LP-polynomials in Matlab.

3. Destabilizing factors and security functions

Completeness and content nature of the system of security functions for any attack. Cause-and-effect diagram of security functions. Examples of programming a cause-and-effect diagram of risk object security functions in Matlab.

4. Criteria for the security of the cyber-attack object. Risk Assessment

Condition for the security of the risk object. Assessment of the security of the risk object. Examples of programming the algorithm for assessing the security of a risk object in Matlab.

5. Risks evaluation

Updated security condition for the risk object. New gradations of security functions. Examples of programming new gradations of risk object security functions in Matlab.

6. Enterprise Role and Structure

Platform as a service: current state, opportunities. Tools for tracking cyber-attacks. Examples of programming tools for tracking cyber-attacks in Matlab.

7. Security Metrics and Measurements

Risk assessment of a DDoS attack. Assessment of the risk of spam. Examples of programming the risk assessment of a specific cyber-attack in Matlab.

8. Cyber Security Anatomy

Secure private and public cloud models. Requirements for secure Hypervisors in cloud technologies. Examples of programming sensors for detecting malicious traffic in public clouds in Matlab.

9. Cyber Security Controls

Models for secure management of cloud systems. Examples of programming algorithms for event analysis in control procedures of cloud systems in Matlab.

10. Testing and Validation of Security Devices

Repelling cyber attacks. Providing guaranteed quality of service (QoS) in cloud infrastructures. Information security as a quality of service. Examples of programming algorithms for repelling cyber attacks in cloud infrastructures in Matlab.

Annotation

Major: 03.04.01 Прикладные математика и физика

specialization: Neural Networks and Neural Computers/Нейронные сети и нейронные компьютеры

History, Philosophy and Methodology of Natural Science/История, философия и методология естествознания

Purpose of the course:

To familiarize students with the historical experience of world philosophical thought, give a clear idea of the main stages, directions and problems of the history and philosophy of science, contribute to the formation of skills to work with extreme issues related to the boundaries and foundations of various sciences and scientific rationality, and mastery of the principles of a rational philosophical approach to processes and trends in the development of modern science.

Tasks of the course:

- systematic study of the philosophical and methodological problems of natural science, taking into account the historical and philosophical context and the current state of science;

- the acquisition by students of theoretical ideas about the diversity of forms of human experience and knowledge, the nature of thinking, the ratio of truth and error;

- understanding the role of science in the development of civilization, the relationship between science and technology and related modern social and ethical problems, the ability to distinguish between historical types of scientific rationality, to know the structure, forms and methods of scientific knowledge in their historical genesis, modern philosophical models of scientific knowledge;

- acquaintance with the main scientific schools, directions, concepts, with the role of the latest information technologies in the world of modern culture and in the field of humanities and natural sciences;

- understanding the meaning of the correlation of biological and social in man, man’s attitude to nature, discussions about the nature of changes taking place with man and humanity at the turn of the third millennium;

- knowledge and understanding of the dialectic of personality formation, its freedom and responsibility, the uniqueness of the intellectual, moral and aesthetic experience of different historical eras.

List of the planned results of the course (training module)

As a result of studying the course the student should

know:

- the structure of the natural and socio-humanitarian sciences, the specifics of their methodological appa-ratus;

- the ratio of principles and hypotheses in the construc-tion of scientific systems and theories;

- the foundations of a modern scientific picture of the world, the basic principles of scientific knowledge and key areas of interdisciplinary research;

- concepts of the development of science and different approaches to the problem of the cognitive status of scientific knowledge;

- the problem of matter and motion;

- concepts of energy and entropy;

- problems of space-time;

- modern problems of physics, chemistry, mathematics, biology, ecology;

- great scientific discoveries of the XX and XXI centu-ries;

- key events in the history of the development of science from ancient times to the present day;

- the relationship of worldview and science;

- the problem of forming a worldview;

- a system of interdisciplinary relations in science, the problem of reductionism in science;

- theoretical models of fundamental processes and phenomena in physics and its applications to the natural sciences;

- about the Universe as a whole as a physical object and its evolution;

- about the relationship between order and disorder in nature, about the problems of non-linear processes and self-organizing systems;

- dynamic and statistical patterns in nature;

- of the role of probabilistic descriptions in the scientific picture of the world;

- principles of symmetry and conservation laws;

- The latest discoveries of natural science for the creation of technical devices;

- Features of the biological form of organization of mat-ter, principles of reproduction and development of living systems;

- About the biosphere and the direction of its evolution.

be able to:

- effectively use in practice the theoretical components of science: concepts, judgments, conclusions, hypotheses, evidence, laws;

- - apply the methodology of science in the organization of specific research;

- - give a panorama of the most universal methods and laws of modern science.

master:

- - scientific methodology as the initial principle of cognition of the objective world;

- - the principles of choosing an adequate methodology for the study of specific scientific problems;

- - system analysis;

- - knowledge of the scientific picture of the world;

- - the conceptual and methodological apparatus of interdisciplinary approaches in science.

Content of the course (training module), structured by topics (sections):

1. The formation of science and philosophy in the West and in the East.

The problem of the emergence of science in antiquity. Prescription and applied nature of knowledge in the Ancient East. The birth of philosophy. Scientific programs of Plato, Aristotle and Democritus. The origin of ancient science: mathematics, physics, astronomy and biology. The problem of the social organization of ancient science. "Musical" cult and scientific and philosophical schools. The Alexandrian Museyon and the further development of Hellenistic science. The science of ancient Rome. Arab medieval science.

Science in Europe in the Middle Ages. Christianity and science The dispute of faith and reason. Rethinking Antique Heritage. Medieval empiricism. Nikolay Kuzansky and the concept of infinity. The ideological turn of the Renaissance.

2. The main periods and basic forms of the development of science

The emergence of modern science: basic concepts and key personalities. Key research programs in modern European science. The triumph of Newtonian physics and the formation of mathematical science. Central theoretical postulates and methods of classical science.

3. Rationalistic and empiricist traditions in the philosophy of the Modern Times

The dispute of rationalism and empiricism Rationalistic direction: the method of deduction and the concept of intellectual intuition in the philosophy of Descartes and Spinoza. Cartesian probabilism. The theory of innate ideas. Leibniz’s teaching on the “truths of fact” and “truths of the mind”, on the types of knowledge, on analysis and synthesis. Rationalist interpretation of the thesis of the correspondence of being and thinking.

The tradition of English empiricism: Bacon's doctrine of experience, the role of induction, the “idols” of knowledge. Locke's model of scientific knowledge. Berkeley thesis: to be means to be perceived. Humeian skepticism and psychologism, criticism of the concept of causality.

4. Kant’s solution of the problem of knowledge

Kant's solution to the problem of knowledge. The question of the possibility of knowledge. Space and time as forms of sensuality. The construction of objectivity in the process of cognition. Reason as a legislator. The specifics of Kant's understanding of thinking. Critique of the possibility of supersensory knowledge The concept of "things in themselves." Antinomies of the mind.

5. The approach to knowledge in neokantian philosophy

Interpretation of knowledge in neo-Kantianism. Marburg and Baden schools of neo-Kantianism. Neo-Kantian development of the theory of knowledge. Division of sciences into nomothetic and idiographic. The problem of values in the Baden school.

6. Positivism

Positivism and postpositivism. The first and second positivism of the XIX century. Analytical philosophy of B. Russell and L. Wittgenstein. Logical positivism and the “linguistic turn”. Postpositivism of K. Popper, T. Kuhn and I. Lakatos.

7. Critique of positivism from the point of view of logic. Critical rationalism of Karl Popper

Logical criticism of positivism by K. Popper: problems of induction and demarcation; falsification principle; attitude to the truth. K. Popper's concept of science growth: fallibilism and likelihood theory. The development of modern cosmology and elementary particle physics.

8. Historical criticism of positivism. Historical approach in the philosophy of science.

Historical criticism of positivism. Are there “crucial experiments”? The thesis of the "incommensurability of theories." The Kuhn’s model of the development of science: the scientific community and the scientific paradigm, “normal” and “abnormal” phases in the history of science. The model of research programs by I. Lakatos: “hard core” and “protective belt of hypotheses”; “Progressive problem shift” as a criterion for rejecting research programs. Historical Relativism of P. Feyerabend.

The dispute between realism and antirealism in modern philosophy of science. Sociologization of modern philosophy of science. The debate about the model of the "external" and "internal" history of Lakatos. Laboratory place in science. The relationship of science and technology in the second half of the XX - beginning of the XXI century.

9. The structure of scientific knowledge

The structure of science. Place of mathematics and measurements. Place of foundations and theories of phenomena. Place of methodological principles.

10. Philosophical problems of natural sciences

The concept of dynamic and statistical laws and probability as an objective characteristic of natural objects. Place of principles of symmetry and conservation laws.

Synergetics, selforganization and the ratio of order and disorder. Model of global evolutionism.

Specific features of life sciences. Question of the reduction of biology and chemistry to physics. Contradictions between nature and man today. Global problems of modern civilization, the

possibility of environmental disaster. Biosphere, noosphere, ecology and the problem of sustainable development.

Interdisciplinary approaches in modern science.

Annotation

Major: 03.04.01 Прикладные математика и физика

specialization: Neural Networks and Neural Computers/Нейронные сети и нейронные компьютеры

Image Processing/Обработка изображений

Purpose of the course:

1. To provide students with in-depth knowledge and understanding of the Image Processing using neural networks and intelligent computations.

2. To develop critical analytical and debate skills enabling students to engage in independent analysis based on credible sources of information.

Tasks of the course:

1. Acquisition of practical skills in the use of classical algorithms for image processing.

2. Acquisition of practical skills in the use of neural networks for image processing.

3. Acquisition of the ability to interpret the results obtained to build plans for experimental research in solving practical tasks.

List of the planned results of the course (training module)

As a result of studying the course the student should

know:

- Students will gain solid understanding of the Image Processing using neural networks and intelligent computations.

be able to:

- use classical and neural networks algorithms for image processing;

- to produce numerical estimates of the efficiency of solving the problem;

- effective use of information technology and computer technology to achieve the necessary theoretical and practical results;

- build modern applications of neural network algorithms for solving image processing tasks.

master:

- application of classical and neural networks algorithms for image processing;

- technic of statement and solutions of image processing tasks;

- technic of theoretical research and applied tasks.

Content of the course (training module), structured by topics (sections):

1. Classical Image processing tasks algorithms

Basic terminology and image processing steps. White balance. Histograms of digital image: the color and contrast. Often met image distortion. Classification. Feature extraction. Pattern recognition. Projection. Multi-scale signal analysis.

2. Neural networks for Image processing

Neural networks structures for image processing. Multilayer neural networks. Convolution neural networks. Face recognition examples.

3. Neural network software for Image processing

OpenCV library. CUDA libraries for image processing. cuDNN. Nvidia Digits.

Annotation

Major: 03.04.01 Прикладные математика и физика

specialization: Neural Networks and Neural Computers/Нейронные сети и нейронные компьютеры

Intelligent Technology for Information Security/Интеллектуальные технологии в информационной безопасности

Purpose of the course:

1. To provide students skills of development of methods for the generation of hypotheses about risk-models web-attacks in a highly dynamic web systems.

2. Acquisition of skills of analyzing the applicability of neuro-fuzzy and Bayesian approaches (combining a priori and observed data) to the synthesis of intellectual systems of decision making on information security incidents and development of mechanisms for web programming in Hadoop.

Tasks of the course:

The formation of practical skills of application of the studied methods and schemes of reasoning when making decisions on combating web-based attacks in conditions of multiple choice.

List of the planned results of the course (training module)

As a result of studying the course the student should

know:

The students mastering approaches, methods and models for the analysis of the dynamics of the processes of information warfare different nature.

be able to:

The acquisition of practical skills of application of risk models and methods of the multidimensionality of the data for identifying the parameters of web-based attacks, and retrieval of knowledge in information warfare.

master:

The acquisition of the ability to interpret the results obtained to build scenarios, forecasts, decision making with the aim of countering web injection attacks and explain the nature of arising in information and communication systems information security incidents.

Content of the course (training module), structured by topics (sections):

1. The methodology of a systematic risk analysis of Infocommunications.

Historical information about formation of scientific discipline – a systematic analysis of risks of Infocommunications. Basic Concepts of information warfare on the Internet.

Examples of programming information warfare in Matlab.

2. Examples of information warfare. The formal statement of the research problem.

Characteristics features of complex systems: uniqueness, weak structuring of theoretical and factual knowledge about the systems, the composite character

(multi protocols), the heterogeneity of subsystems and elements, randomness and uncertainty factors operating in the systems, the multicriteriality assessment processes (games with conflicting interests), large dimension, continuity of variables and non-monotonicity in the dynamics, the subjectivity in the description of complex systems. Integral characteristics. General property.

Examples of programming infocommunications in Matlab.

3. Overviev: globalism and the case of Azia and Africa blocs.

The limits of applicability of probabilistic risk assessment approaches attacks. Completeness, invariance of casual diagram risk attack. Examples of programming a value at risk of object of risk in Matlab.

4. Criteria for the security of the cyber-attack object. Risk Assessment.

Condition for the security of the risk object. Assessment of the security of the risk object. Examples of programming the algorithm for assessing the security of a risk object in Matlab.

5. Risks evaluation.

Updated security condition for the risk object. New gradations of security functions. Examples of programming new gradations of risk object security functions in Matlab.

6. Risks analysis methods and mathematical techniques used in intelligent systems information security.

Extreme risk assessment. Metrics for risk assessment. Maximization, extremal problems, multi extremal problems. Examples of programming tools for risk assessmant in Matlab.

7. Modeling web-based attacks

Class of models. The process of identification in a system-oriented modeling in the cloud. Examples of programming bot-attacks in Matlab, Hadoop.

8. Premodernity analysis: goal setting.

Modeling steps, setting goals, building an information structural-functional environment, the construction of the logical DBMS environment. verification. Examples of programming logical DBMS environment in Matlab, Hadoop.

Annotation

Major: 03.04.01 Прикладные математика и физика

specialization: Neural Networks and Neural Computers/Нейронные сети и нейронные компьютеры

Neural Network Based Intrusion Detection System/Нейросетевые системы обнаружения компьютерных атак

Purpose of the course:

To provide students development skills of methods for the generation of hypotheses about risk-models web-attacks in a highly dynamic web systems.

Tasks of the course:

1. The formation of practical skills of application of the studied methods and schemes of reasoning when making decisions on combating web-based attacks in conditions of multiple choice.

2. Acquisition of skills of analyzing the applicability of neuro-fuzzy and Bayesian approaches (combining a priori and observed data) to the synthesis of intellectual systems of decision making on information security incidents and development of mechanisms for web programming in Hadoop.

List of the planned results of the course (training module)

As a result of studying the course the student should

know:

- Students mastering approaches, methods and models for the analysis of the dynamics of the processes of information warfare different nature.

be able to:

1. The acquisition of practical skills of application of risk models and methods of system analysis in terms of the multidimensionality of the data for identifying the parameters of web-based attacks, and retrieval of knowledge in information warfare;

2. Optimize the code using the features and methods of system analysis in terms of the multidimensionality of the data for identifying the parameters of web-based attacks.

master:

- The acquisition of the ability to interpret the results obtained to build scenarios, forecasts, decision making with the aim of countering web injection attacks and explain the nature of arising in information and communication systems information security incidents.

Content of the course (training module), structured by topics (sections):

1. Own risk analysis methods and mathematical techniques used in intelligent systems information security

Extreme risk assessment. Metrics for risk assessment.Traditional methods of system analysis of complex systems: a matrix, systematisations, graph, stochastic models.

Maximization, extremal problems, multiextremal problems. Search methods of local and global extrema of functions.

Linear programming - formulation of the problem. The algorithm of the simplex method. The concept of the method of ellipsoids. The algorithm is an internal point. Linearization of mathematical programming problems.

Other methods of system analysis:

1) cluster analysis;

2) minimax, multi-objective optimization;

3) operations research;

4) decision-making and decision-making processes, decision support (dss), the comparison and selection criteria, comparison of alternatives;

5) the mathematical theory of experiment planning;

6) the task network planning and analysis of graphic designs.

2. Practical examples of the applicability of the models.

Practical examples of the applicability of the models.

3. Modeling web-based attacks

Main tasks and methods. System modeling botnet attacks. Components of system modeling: mathematical modeling, computer modeling, information modeling, modeling of decision making, simulation, optimization models, probabilistic (stochastic) simulation. System-integrated modeling. Principles. Class of models. The process of identification in a system-integrated modeling in the cloud. Environment of web programming, Hadoop.

4. The use of ITU experience.

The use of ITU experience.

5. Premodernity analysis: goal setting.

Modeling steps: setting goals, building an information structural-functional environment, the construction of the logical DBMS environment, verification.

Goals and objectives depending on the purpose of the model: a generic model of problem-based model, global and local model. Accuracy, time horizon, objects, functional connectivity, species descriptions (logical and probabilistic equations, neuro-fuzzy design of decision-making on security incidents).

Annotation

Major: 03.04.01 Прикладные математика и физика

specialization: Neural Networks and Neural Computers/Нейронные сети и нейронные компьютеры

Neural Network Technology/Нейросетевые технологии

Purpose of the course:

To provide students with in-depth knowledge and understanding of the Neural Network Technology – methods and algorithms for tasks solving using Neural Networks with various architecture.

Tasks of the course:

- the study of ways of implementing artificial neural networks;

- the acquisition of practical skills in the application of artificial neural networks to solve practical problems using multi-dimensional data, with the presence of errors and noise;

- the acquisition of the ability to interpret the results for building plans of experimental research and the selection of optimal parameters of neural networks for solving practical problems.

List of the planned results of the course (training module)

As a result of studying the course the student should

know:

- practical application of artificial neural networks of different architectures (multi-layer perceptron, self-organizing Kohonen map, Hopfield network, convolutional neural networks, LSTM networks, etc.) to solve a wide range of problems (approximation, SLAE solution, classification, pattern recognition, etc.).

be able to:

- use knowledge to solve fundamental and applied practical problems;

- to produce numerical estimates of the efficiency of solving the problem;

- effective use of information technology and computer technology to achieve the necessary theoretical and practical results;

- build modern applications of neural network algorithms for solving practical problems.

master:

- implementation of artificial neural networks;

- skills of understanding of a large amount of information;

- technic of statement, solutions and modeling of practical tasks;

- technic of research and solution of theoretical and applied problems.

Content of the course (training module), structured by topics (sections):

1. Solving of tasks of approximation

Neural network architectures (multilayer perceptron, Radial basis function network) used to solve this type of problem. Learning algorithms and examples of problem solving in the Python programming language.

2. Solving classification tasks

Neural network architectures (multilayer perceptron, convolutional neural network) used to solve this type of problem. Learning algorithms and examples of problem solving in the Python programming language.

3. Solving clasterization problems

Neural network architectures (Self-organizing map) used to solve this type of problem. Learning algorithms and examples of problem solving in the Python programming language.

4. Solving of pattern recognition tasks

Neural network architectures (multilayer perceptron, convolutional neural network) used to solve this type of problem. Learning algorithms and examples of problem solving in the Python programming language.

5. Solving associative memory tasks

Neural network architectures (Hopfield network) used to solve this type of problem. Learning algorithms and examples of problem solving in the Python programming language.

6. Solving speech and text recognition problem

Neural network architectures (recurrent neural network) used to solve this type of problem. Learning algorithms and examples of problem solving in the Python programming language.

Annotation

Major: 03.04.01 Прикладные математика и физика

specialization: Neural Networks and Neural Computers/Нейронные сети и нейронные компьютеры

Neural Network Theory Basics/Основы теории нейронных сетей

Purpose of the course:

1.To provide students with basic knowledge and understanding of the Neural Networks Technology – methods, algorithms and their realization and applications in complex problems.

2. To develop critical analytical and debate skills enabling students to engage in independ based on credible sources of informatics.

Tasks of the course:

To teach students basic principles of neural network theory.

To introduce students to the history of development of neural network technology in Russia and abroad.

List of the planned results of the course (training module)

As a result of studying the course the student should

know:

students will gain basic understanding of the Neural Network Theory in Russia and abroad, will be acquainted with leading scientist′s works in Neural Networks Theory and history of its development,

be able to:

students will be able to analyze current and future fields of applications of neural network trends,

master:

students will have information about basic principles of neural networks theory.

Content of the course (training module), structured by topics (sections):

1. Basics of Neural Network Theory

- probabilistic view on world,

- main principles of theory of probability,

- nonlinear and dynamic nature of processes and relationships between their parameters,

- connectionist approach to highly parallel structures of neural networks and oth.

2. History of Neural Network Theory

History of Neural Network Theory introduce the history of development of neural network technology in Russia and abroad. Show relationship between theory and practice of neural networks, how hardware restriction led to new theoretical constructions in neurocomputers and neurochips. Discuss current and future fields of application of neural network theory and trends.

3. Leading scientists in Neural Network Theory

Students will be acquainted with Leading scientists in Neural Network Theory including works of Warren McCulloch and Walter Pitts, Donald Hebb, Frank Rosenblatt, Paul Werbos, Marvin Minsky and Seymour Papert, Alexander Galushkin and many others.

Annotation

Major: 03.04.01 Прикладные математика и физика

specialization: Neural Networks and Neural Computers/Нейронные сети и нейронные компьютеры

Neurocomputers/Нейрокомпьютеры

Purpose of the course:

To provide students with in-depth knowledge and understanding of the Neurocomputers – hardware architectures for speed up a computations of Neural Networks.

Tasks of the course:

To develop critical analytical and debate skills enabling students to engage in independent analysis based on credible sources of information.

List of the planned results of the course (training module)

As a result of studying the course the student should

know:

ways of hardware realization of Neural Networks with different structures.

be able to:

Tto produce numerical estimates of the efficiency of hardware realizations

master:

- skills of understanding of a large amount of information

- treatments for hardware realization

Content of the course (training module), structured by topics (sections):

1. Basics of neural hardware

Current approaches to neural network emulation. CPU vs GPU. FPGA. Digital and analog neurochips and neurocomputers. History of neurocomputers. Russian neurocomputers and transputers.

2. Analog neurocomputers

Principles of analog computers. ETANN neurocomputer. Spiking neurocomputers and neural networks

3. Digital neurocomputers

Principles of digital computers and signals. ZISC and CM1K neurocomputer. Darwin neurochip.

IBM Truenorth

Annotation

Major: 03.04.01 Прикладные математика и физика

specialization: Neural Networks and Neural Computers/Нейронные сети и нейронные компьютеры

Neurocontrol/Нейроуправление

Purpose of the course:

To provide students with in-depth knowledge and understanding of the Neurocontrol – methods and algorithms for object control using Neural Networks with various architecture.

Tasks of the course:

- the study of approaches, methods and models of neural networks to solve control problems;

- the acquisition of practical skills in the application of neural networks to solve control problems for multi-dimensional objects, with the presence of errors and noise;

- the acquisition of the ability to interpret the results for building plans of experimental research and the selection of optimal parameters of neural networks for solving control problems.

List of the planned results of the course (training module)

As a result of studying the course the student should

know:

ways of Neural Networks with different structures applications for control of various dynamic objects.

be able to:

- use knowledge to solve fundamental and applied control problems, including estimation, identification, diagnosis and control.

- to produce numerical estimates of the efficiency of solving control problems

- effective use of information technology and computer technology to achieve the necessary theoretical and practical results

- build modern applications of neural network algorithms for solving control problems.

master:

- application of neural networks for control

- skills of understanding of a large amount of information

- technic of statement, solutions and modeling of control tasks

- technic of research and solution of theoretical and applied problems

Content of the course (training module), structured by topics (sections):

1. Basics of control theory

Contorol task definition . Matlab examples of various object control.

2. Linear filters

FIR and IIR filters. Wiener filter. LMS filter. Modifications of LMS filters. Matlab examples of filtration using linear filters.

3. Nonlinear neural filters and controllers

Neural network structures for filtering and control. Recurrent NN. Direct and inverse scheme of control.

Annotation

Major: 03.04.01 Прикладные математика и физика

specialization: Neural Networks and Neural Computers/Нейронные сети и нейронные компьютеры

Neuromathematics/Нейроматематика

Purpose of the course:

To provide students with in-depth knowledge knowledge and understanding of the Neuromathematic – methods and algorithms for mathematical tasks solving using Neural Networks with various architecture.

Tasks of the course:

- the study of approaches, methods and models of neural networks to solve mathematical problems;

- the acquisition of practical skills in the application of neural networks to solve mathematical problems using multi-dimensional data, with the presence of errors and noise;

- the acquisition of the ability to interpret the results for building plans of experimental research and the selection of optimal parameters of neural networks for solving mathematical problems.

List of the planned results of the course (training module)

As a result of studying the course the student should

know:

ways of Neural Networks with different structures applications in such mathematical tasks as solution of system of linear and nonlinear differential equations (ordinary and partial), integral and functional equations.

be able to:

- use knowledge to solve fundamental and applied mathematical problems, including solution of equations (differential, integral, functional, etc.)

- to produce numerical estimates of the efficiency of solving the problem

- effective use of information technology and computer technology to achieve the necessary theoretical and practical results

- build modern applications of neural network algorithms for solving mathematical problems.

master:

- application of neural networks and neuromathematics

- skills of understanding of a large amount of information

- technic of statement, solutions and modeling of mathematical tasks

- technic of research and solution of theoretical and applied problems

Content of the course (training module), structured by topics (sections):

1. Ordinary differential equations solving using neural networks

Neural network structures for ordinary differential equations solving. Recurrent neural networks training algorithms. Matlab examples on ordinary differential equations solving.

2. Partial differential equations solving using neural networks

Neural network structures for partial differential equations solving. Cellular neural networks training algorithms. Matlab examples on partial differential equations solving.

3. Integral and functional equations solving using neural networks

Neural network structures for integral and functional equations solving. Matlab examples on integral and functional equations solving.

Annotation

Major: 03.04.01 Прикладные математика и физика

specialization: Neural Networks and Neural Computers/Нейронные сети и нейронные компьютеры

Professional Task Solutions Base on CUDA Toolbox/Решение профессиональных задач на базе пакета CUDA

Purpose of the course:

To provide students with in depth knowledge and understanding of the CUDA applications in various professional tasks solutions in neural networks area.

Tasks of the course:

1. To develop practical skills in CUDA programming language.

2. Acquisition of the ability to interpret the results obtained to build plans for experimental research in solving practical tasks.

List of the planned results of the course (training module)

As a result of studying the course the student should

know:

- Students will develop their practical skills in CUDA programming language for various professional tasks solution in area on neural networks, linear algebra, optimization problem and oth.

be able to:

1. Compile the CUDA code using the NVCC compiler;

2. Convert serial code to parallel on CUDA;

3. Assess the ability to use different types of memory;

4. Optimize the code using the features of the hardware graphics accelerator device.

master:

- applied skills of using CUDA;

- technic of formulating, analyzing and solving mathematical and applied tasks that require the use of parallel computing on CUDA.

Content of the course (training module), structured by topics (sections):

1. Introduction to GPU computing

GPU computing overview. Nvidia GPUs. CUDA Documentation System. CUDA Installing. Preferences and initialization. Data types in CUDA. Command syntax. Kernels. Devices and hosts. Grids, blocks, threads.

2. Linear algebra in CUDA

cuBlas library. Vector and Matrix operators. Matrix multiplication. Linear equations solving.

Standard BLAS routines. Single and double data types. Support for CUDA streams. Support for multiple GPUs and concurrent kernels. Batched GEMM API. Device API that can be called from CUDA kernels. Batched LU factorization API. Batched matrix inverse API. New implementation of TRSV (Triangular solve).

3. Neural Network in CUDA

cuDNN library. High performance building blocks for deep neural network applications. Forward and backward convolution routines, including cross-correlation, designed for convolutional neural nets. Arbitrary dimension ordering, striding, and sub-regions for 4d tensors. Forward and backward paths for many common layer types such as pooling, ReLU, Sigmoid, softmax and Tanh. Tensor transformation functions. Context-based API for easy multithreading.

4. CUDA parallel programming

Introduction. Programming Model. Programming Interface. Hardware Implementation. Performance Guidelines. CUDA-Enabled GPUs. C Language Extensions. CUDA Dynamic Parallelism.

Mathematical Functions. C/C++ Language Support. Texture Fetching. Compute Capabilities. Driver API. CUDA Environment Variables. Unified Memory Program.

5. Computing in CUDA

CUDA Runtime API. CUDA Driver API. CUDA Math API. CUDA libraries: The cuBLAS library - implementation of BLAS (Basic Linear Algebra Subprograms) on top of the NVIDIA CUDA runtime. NVBLAS library - a multi-GPUs accelerated drop-in BLAS. cuFFT. cuRAND. cuSPARSE. NPP - library of functions for performing CUDA accelerated processing. NVRTC (Runtime Compilation) - a runtime compilation library for CUDA C++. Thrust. CUDA Samples. cuSOLVER

6. CUDA program compiling, debugging and optimization

NVCC -CUDA compiler driver. CUDA-GDB tool for debugging CUDA applications CUDA-MEMCHECK - suite of run time tools capable of precisely detecting out of bounds and misaligned memory access errors, checking device allocation leaks, reporting hardware errors and identifying shared memory data access hazards. Nsight Eclipse Edition. Profiler. CUDA Binary Utilities.

Annotation

Major: 03.04.01 Прикладные математика и физика

specialization: Neural Networks and Neural Computers/Нейронные сети и нейронные компьютеры

Professional Task Solutions Base on Matlab Toolbox/Решение профессиональных задач на базе пакета Матлаб

Purpose of the course:

1. To provide students with deep practical skills to work in Matlab and Simulink for the solution of professional tasks.

Tasks of the course:

Teach students to solve basic mathematical and special problems in the Matlab package (with Simulink), including problems of linear algebra, differential equations, optimization. Professional tasks solutions in the field of neural networks, fuzzy systems, digital signal filtering, etc.

List of the planned results of the course (training module)

As a result of studying the course the student should

know:

Basic problem statements and solutions in the field of linear algebra, differential equations, optimization, and professional problems in the field of neural networks, fuzzy systems, digital signal filtering, etc.

be able to:

Work with Matlab (and Simulink) and write computationally efficient programs for solving given tasks.

Integrate programs with external data sources and recipients.

master:

principles for writing effective programs based on the hardware used, including GPUs.

Content of the course (training module), structured by topics (sections):

1. Introduction to Matlab and Simulink.

Matlab Simulink Interface, Live Editor, Toolboxes, helping systems and materials. General principles of work. Program syntax: data types, control commands. The effectiveness of programs, Profiler.

2. Basic mathematical tasks solution.

The solution of problems of linear algebra. Optimization. Differentiation and integration, solving systems of equations. Symbolic calculations.

3. Special tasks solution in Matlab

Toolboxes for neural networks, fuzzy computing, evolutionary computing, digital signal processing, radar, control, cryptography, etc. Examples of solutions to special problems.

4. Parallel computing in Matlab

Principles of parallel computing. Implementation of a computing cluster. Graphical processing units and their programming in Matlab. Code generation. Integration with external systems.

Annotation

Major: 03.04.01 Прикладные математика и физика

specialization: Neural Networks and Neural Computers/Нейронные сети и нейронные компьютеры

Program Orientation Course/Введение в специальность

Purpose of the course:

1. To provide students with basic knowledge and understanding of the Neural Networks Technology – methods, algorithms and their realization and applications in complex problems.

2. To develop critical analytical and debate skills enabling students to engage in independent analysis based on credible sources of information.

Tasks of the course:

To give students understanding of the Neural Networks Technology including Theory of Neural Networks, Neuromathematics, Neurocontrol, Neurocomputers and their applications in Image and Text Processing, Information Security and oth.

List of the planned results of the course (training module)

As a result of studying the course the student should

know:

Students will gain basic understanding of the Neural Networks Technology including Theory of Neural Networks, Neuromathematics, Neurocontrol, Neurocomputers and their applications in Image and Text Processing, Information Security and oth.

be able to:

Students will be able to explain the role of Neuromathematics, Neurocontrol, Neurocomputing in practical applications, such as Image and Text Processing, Information Security and oth.

master:

Students will be able to use the basic principles of neural network technology, to understand terms and concepts of neural network approach.

Content of the course (training module), structured by topics (sections):

1. Introduction to Neural Network Theory

The main types of neurons and neural networks, learning methods, testing. Methods of synthesis of structures of neural networks

2. Introduction to Neuromathematics

Basic math problem and their solution using neural networks, including the approximation of functions, extrapolation of time series and others.

3. Introduction to Neurocontrol

Main schemes of neurocontrol, types and examples of controlled objects

4. Introduction to Neurocomputers

Types of neurocomputers. History of neurocomputers. Modern neurocomputers and neurochips.

5. Introduction to neural networks applications

Examples of neural network applications in image, text, sound processing, in communication networks and others.

Annotation

Major: 03.04.01 Прикладные математика и физика

specialization: Neural Networks and Neural Computers/Нейронные сети и нейронные компьютеры

Russian as a Foreign Language/Русский язык как иностранный

Purpose of the course:

The Russian as a foreign language (A2) course is aimed at the formation of intercultural professionally oriented communicative competence from the zero level to the elementary level (according to the European scale of foreign language proficiency levels) for solving social and communicative tasks in various areas of everyday, cultural, professional and scientific activities in the Russian language, as well as for further self-education.

Tasks of the course:

The tasks of the formation of intercultural, professionally oriented communicative competence consist of the gradual mastery by students of a set of competences, the main of which are:

– linguistic competence, i.e. the ability to adequately perceive and correctly use language units based on knowledge of phonological, grammatical, lexical, stylistic features of the studied language;

– sociolinguistic competence, i.e. the ability to adequately use realities, background knowledge, situationally conditioned forms of communication;

– sociocultural competence, i.e. the ability to consider during the communication speech and behavioral models adopted in the relevant culture;

– social competence, i.e. the ability to interact with communication partners, to make contact and maintain it, owning the necessary strategies;

– strategic competence, i.e. the ability to apply different strategies to maintain successful interaction in oral/written communication;

– discursive competence, i.e. the ability to understand and generate foreign language discourse considering cultural differences;

– general competence, including, along with knowledge about the country and the world, about the features of the language system, also the ability to expand and improve their own picture of the world, to be guided by the media sources of information;

– intercultural competence, i.e. the ability to achieve mutual understanding in intercultural contacts, using the entire set of skills to realize the communicative intention;

– compensatory competence, i.e. the ability to avoid misunderstandings, to overcome the communication barrier through the use of well-known speech and metalanguage means.

List of the planned results of the course (training module)

As a result of studying the course the student should

know:

– The main facts, realities, names, attractions, traditions of Russia;

– some achievements, discoveries, events in the field of Russian science, culture, politics, social life;

– basic phonetic, lexical-grammatical, stylistic features of the Russian language and its difference from the native language;

– the main differences in writing and speaking.

be able to:

– Generate adequate oral and written texts in a specific communication situation;

– to realize the communicative intention with the purpose of influencing the communication partner;

– adequately understand and interpret the meaning and intention of the author in the perception of oral and written authentic texts;

– identify similarities and differences in the systems of native and foreign languages;

– show tolerance, empathy, openness and friendliness when communicating with representatives of another culture.

master:

– Intercultural professionally oriented communicative competence in different types of speech activity at the level of A2;

– social and cultural competences for successful mutual understanding in terms of communication with representatives of another culture;

– various communication strategies;

– learning strategies for organizing the learning activities;

– strategies of reflection and self-evaluation for self-improvement of personal qualities and achievements;

– different methods of memorization and structuring digestible material;

– Internet technologies to select the optimal mode of obtaining information.

Content of the course (training module), structured by topics (sections):

1. My World

Communicative tasks. To talk about your everyday activity. To tell the time. To make an appointment. To talk about your family. To fill the registration form.

Vocabulary. Verbs describing everyday activity. Time. Parts of the day. Numbers 10-100. Events. Family. Registration form.

Grammar. 1st conjugation of verbs. 1 час, 2-4 часа, 5-20 часов. Consolidate conjugation of verbs. Possessive adjectives: мой/моя, твой/твоя.

Phonetics. Pronunciation of sounds: т, ть. Pronunciation of [ц], unstressed «я», «е». Pronunciation of [ж], [ш]. Devocalization of sound «ж» at the end of words.

2. Our Lesson

Communicative tasks. To understand your teacher's instructions in Russian. To ask people if they have something. To indicate something. To set a meeting. To talk about your plans for a week.

Vocabulary. Verbs describing activities at the lesson. Personal things. Numbers 100-1000. Days of week. Events.

Grammar. Imperative form of verbs - читайте, слушайте etc. Construction "у меня есть". Gender of nouns. Construction "У меня + событие". Nouns in plural. Days of week.

Phonetics. Pronunciation of "o" in unstressed position. [ж], [ш]. Devocalization of sound «ж» at the end of words. Pronunciation of у, г.

3. In the City

Communicative tasks. To talk about your city. To ask where to go. To understand signs of a city. To buy a ticket for metro. To order in a restaurant. To refuse an offer. To say where you were yesterday.

Vocabulary. Places in town (parks, restaurants, museums etc.). Words for ordering in a café or buying a ticket for metro. Russian way to say "last/next week".

Grammar. Endings of adjectives. Possessive pronouns. The prepositional case for locations. The past tense of the verb "to be".

Phonetics. Devocalization "д" at the end of words and in front of voiced consonants. Practicing the phrase "к сожалению". Words where "ч" is pronounced as [ш].

4. My Home

Communicative tasks. To describe your house. To call for a master to fix broken things at home. To explain location of things in the house. To talk about your free time and ways to rest at home.

Vocabulary. Furniture. Rooms. Verbs (to sleep, to want, to see, to watch, to hate). Parts of a house (wall, floor etc.). Outside the house (garden, forest). Verbs describing activities at home.

Grammar. Neuter gender nouns in plural. Masculine gender nouns in plural. Exceptions. The prepositional case, exceptions. The past tense. The accusative case for objects.

Phonetics. Pronunciation of the names of the rooms. Pronunciation of words with a change of stress in the prepositional case (в лесу, на полу, etc.). Pronunciation of [х]. Being surprised by the word "ух ты!"

5. Tasty Food

Communicative tasks. To explain what you need to buy. To talk about food preferences. To order and pay in a restaurant. To talk about recipes. To invite friends for dinner. To express admiration or criticism.

Vocabulary. Phrases for shopping. Phrases for restaurants. Phrases for inviting and accepting invitations.

Grammar. Personal pronouns with “нужно”, “надо”, “нравится”. The instrumental case after the preposition “с”. The future tense.

Phonetics. Pronunciation [ы], [и]. Devocalization of the voiced consonants at the end of words (б, д, в, з, ж, г). Intonation of admiration: “Как хорошо!”

6. Health

Communicative tasks. To talk to a doctor. To talk about health. To give recommendations. To talk about mood (I am sad, happy etc.). To agree/disagree.

Vocabulary. Parts of body. Health. Можно/нельзя. Emotions. Mood.

Grammar. Construction “у меня был”. Personal pronouns of with age, “можно”, “нельзя”. Short forms of adjectives.

Phonetics. Intonation of the interjection "ай!" when expressing pain. Pronunciation of ь, ъ.

7. People

Communicative tasks. To talk about people’s character. To describe appearance. To compare things. To buy clothes. To agree to do something.

Vocabulary. Adjectives. Describing a person. Adjectives. Appearance. Clothes. Colors. Size.

Grammar. Endings of adjectives. The comparative and superlative degree. The genitive case in possessive constructions. Endings of adjectives.

Phonetics. Pronunciation of [ш], [щ]. Combination «дж». Intonation of admiration urprise using the word “так”. Pronunciation of “ё” after the hushing sounds.

8. Transport

Communicative tasks. To talk with a taxi driver (price, address, etc.). To order a taxi. To cancel, reschedule or confirm a meeting. To talk about your trip. To describe cities.

Vocabulary. Transport. Dates. Verbs: перенести, отменить, подтвердить, прийти/приехать, уйти/уехать. The compass. Words for travelling.

Grammar. The prepositional case for transport. Ordinal numbers. The accusative case for directions with prepositions “в”, “на”.

Phonetics. Practicing the difference of pronunciation between "е" and "ё" in the conjugation of the verbs "идти", "ехать". Words where the letter "г" is pronounced as "в" (его, сегодня). Devocalization "з" in the preposition "из".

9. My Family

Communicative tasks. To talk about family. To accept the invitation. To talk about hobbies. To refuse the invitation. To ask and tell about biography.

Vocabulary. Family. Relatives. Activities during the holidays. Verb “уметь”. Verbs: пожениться, родиться, случиться, познакомиться.

Grammar. The genitive case. Possession. Reflexive verbs (the present tense). Заниматься + the instrumental case. Reflexive verbs (the past tense).

Phonetics. Devocalization of sound “ж” at the end of words. Pronunciation of тс, тьс = [ц]. Pronunciation of и = [ы] after ш, ж, ц.

10. Holidays

Communicative tasks. To congratulate with holidays. To tell about traditions. To sign postcards. To say wishes. To suggest the idea of gifts. To express surprise.

Vocabulary. Name of the holidays. Verbs: праздновать, поздравлять, прощаться, гулять. Wishes (happiness, love, luck, etc.). Gifts.

Grammar. Поздравлять + the instrumental case. The genitive case with the verb желать. The genitive case after prepositions.

Phonetics. Words with an unpronounceable "д". Words where г = [в]. Intonation of the phrase "Да ладно?!"

11. Shopping

Communicative tasks. To understand the information on the labels of cosmetic products. To buy groceries. To communicate in the store. To buy clothes.

Vocabulary. Body parts. Cosmetic. Stores. Numbers and time. Fruits and vegetables. Clothes, shoes, accessories. In the store.

Grammar. The genitive case. Plural. The genitive case with numbers. The genitive case.

Phonetics. Devocalization of "в" at the end of words. Devocalization of paired voiced consonants before voiceless consonants. The difference in pronunciation between "большой" and "больше".

12. Countries and Nationalities

Communicative tasks. To ask a person where he he is from. To talk about countries. To talk about the weather. To talk about the season. To talk about traditions and nationalities.

Vocabulary. Countries. Months. Weather. Season. Verbs (to love, to call, to speak). Traditions and nationalities.

Grammar. Months in the prepositional case (when?). 2nd conjugation of verbs. Nationalities.

Phonetics. Pronunciation of р, рь, ю. Pronunciation of the names of nationalities.

Annotation

Major: 03.04.01 Прикладные математика и физика

specialization: Neural Networks and Neural Computers/Нейронные сети и нейронные компьютеры

Text Processing/Обработка текстов

Purpose of the course:

1. To provide students with in-depth knowledge and understanding of the Text Processing using neural networks and machine leaning.

2. To develop critical analytical skills enabling students to engage in independent analysis based on credible sources of information.

Tasks of the course:

1. Acquisition of practical skills in the use of classical algorithms for text processing.

2. Acquisition of practical skills in the use of neural networks for text processing.

3. Acquisition of the ability to interpret the results obtained to build plans for experimental research in solving practical tasks.

List of the planned results of the course (training module)

As a result of studying the course the student should

know:

- Students will gain solid understanding of the Text Processing using neural networks and machine leaning.

be able to:

- use classical and neural networks algorithms for text processing;

- to produce numerical estimates of the efficiency of solving the problem;

- effective use of information technology and computer technology to achieve the necessary theoretical and practical results;

- build modern applications of neural network algorithms for solving text processing tasks.

master:

- application of classical and neural networks algorithms for text processing;

- technic of statement and solutions of text processing tasks;

- technic of theoretical research and applied tasks.

Content of the course (training module), structured by topics (sections):

1. Classical Tasks of text processing

Basic terminology and text processing steps. Text representation. Annotations. Text classification. Keywords definition

2. Neural networks and Word2vec applications

Neural networks structures for text processing. Word representation as a vector. Operations with vectors. Applications of word2vec

3. Advanced text processing tasks

Recurrent NN with memory. Examples of text processing tasks