

MINISTRY OF SCIENCE AND HIGHER EDUCATION OF THE RUSSIAN FEDERATION
FEDERAL STATE AUTONOMOUS EDUCATIONAL
INSTITUTION OF HIGHER EDUCATION
"NORTH CAUCASUS FEDERAL UNIVERSITY"

SUGGESTIONS FOR TEACHING

on the organization and conduct of independent work
in the discipline "Artificial intelligence in the professional sphere"
for students of the field of study
11.03.02 Infocommunication Technologies and Communication Systems
Profile
"Intelligent Data Processing in Infocommunication Systems and Networks"

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1. Purpose and objectives of mastering the discipline (module)

The purpose of the discipline is to form, according to the educational program, the competencies of the UK-1 student.

To achieve this goal, the following tasks are solved in the process of studying the discipline: familiarization with the basic concepts, history of the formation and directions of development of artificial intelligence technology; study of methods of uninformed and informed search in state space, including implementation in Python using the NetworkX library; mastering the methods of local search and genetic algorithms, understanding their application in various tasks; mastering the principles of adversarial search, including minimax and alpha-beta clipping algorithms; acquaintance with the concept of intelligent agents and inference based on the logic of statements; study of approaches to natural language processing, including working with transformers and large language models using the transformers library and Ollama, YandexGPT or GigaChat platforms; mastering the basics of reinforcement learning and obtaining skills in building agent-based models with elements of adaptive behavior; studying the basics of computer vision, including image processing, object recognition and three-dimensional scene reconstruction; developing the ability to apply the learned AI methods as part of project and research activities in the professional field; formation of skills for analysis, interpretation and presentation of results, including the formulation of solutions and their presentation in the form of presentations and public speeches.

2. Place of the discipline (module) in the structure of the educational program

The discipline belongs to optional disciplines.

3. List of planned learning outcomes in the discipline (module) correlated with the planned results of the development of the educational program

Code, formulation of competence	Indicator code, wording	Planned learning outcomes in the discipline (module), characterizing the stages of the formation of competencies, indicators
UK-1. Able to search, critically analyze and synthesize information, apply a systematic approach to solving problems	ID-1 UK-1 identifies a problem situation, carries out its multifactorial analysis and diagnosis based on a systematic approach;	Analysis of the implementation of requirements; Development of options for the implementation of requirements; assessment and justification of recommended solutions; selection of means for implementing software requirements; use of existing standard solutions and software design templates; development of technical specifications for software components and their interaction.
	ID-2 UK-1 searches, selects and systematizes information to determine alternative options for strategic solutions in a problem situation;	Understanding of the methods of classical system analysis; Understanding of the theory of business process management;

		Understanding of conceptual design methods; Understanding of methods for assessing the quality of software systems.
	ID-3 ^{UK-1} determines and assesses the risks of possible solutions to a problem situation, chooses the best option for its solution.	Ability to schedule control activities; develop business requirements for the system; be able to identify key features and constraints of the system; identify subsystems of the system

4. Scope of the academic discipline (module) and forms of control

Scope of classes: total: 3 EC 108 academic hours.	OFO, In acad. hours
Contact work:	
Lectures/from them practical training	
Laboratory work/from them practical training	36.00
Practical training/of which practical training	
Independent work	54.00
Forms of control	
Credit with a grade	Yes

INDEPENDENT WORK AS THE MOST IMPORTANT FORM OF THE EDUCATIONAL PROCESS

Independent work of students is an integral part of the development of the discipline "Artificial Intelligence in the Professional Field" and contributes to the formation of key professional competencies. In the context of the rapid development of AI technologies and their implementation in various sectors of the economy and social sphere, the ability to independently master new tools, approaches and methods is of paramount importance.

The study of the discipline requires students to be actively involved in the educational process: search and analysis of information, performance of practice-oriented tasks, work with software, analysis of applied cases. Independent work contributes to the development of analytical and systemic thinking, the ability to make decisions in conditions of uncertainty, formulate requirements for intelligent systems, as well as apply AI technologies in a specific professional environment.

Of particular importance is the development of skills in designing intelligent solutions taking into account the specifics of the subject area, which requires students to have a deep understanding of the context, study industry examples and the ability to make an informed choice of algorithms and models.

Thus, independent work of students forms a stable basis for professional self-development, flexibility of thinking and readiness to solve problems that go beyond typical scenarios, which is especially important for specialists who interact with artificial intelligence technologies in practice.

Independent work is the planned educational, research, research work of students, performed in extracurricular (classroom) time on the assignment and under the methodological guidance of the teacher, but without his direct participation (with the partial direct participation of the teacher, leaving the leading role behind the work of students).

Independent work of students at the university is an important type of educational and scientific activity of the student. Independent work of students plays a significant role in the rating technology of education. Education at the university includes two parts that are almost the same in volume and mutual influence - the process of learning and the process of self-study. Therefore, the SRS should become an effective and purposeful work of the student.

The concept of modernization of Russian education defines the main tasks of vocational education - "training a qualified worker of the appropriate level and profile, competitive in the labor market, competent, responsible, fluent in his profession and oriented in related fields of activity, capable of effective work in the specialty at the level of world standards, ready for constant professional growth, social and professional mobility."

The solution of these problems is impossible without increasing the role of students' independent work on educational material, increasing the responsibility of teachers for the development of independent work skills, for stimulating the professional growth of students, fostering creative activity and initiative.

Society imposes a fairly wide list of requirements on a modern specialist, among which it is important that graduates have certain abilities and ability to independently obtain knowledge from various sources, systematize the information received, and assess a specific financial situation. The formation of such a skill occurs during the entire period of study through the participation of students in laboratory classes, the performance of control tasks and tests, the writing of term papers and graduation qualification papers. At the same time, the independent work of students plays a decisive role in the entire educational process.

The forms of independent work of students are diverse. In this discipline "Artificial Intelligence and Machine Learning" the following are provided:

Use of the material of the educational and methodological complex of the discipline

At the first stage, it is necessary to familiarize yourself with the mandatory minimum content of the basic educational program for the discipline being studied. Next, it is necessary to study the work program of the discipline, which considers the content of the topics of the lecture course, the relationship between the topics of lectures from laboratory classes, topics and types of independent work.

Work with literature

For the successful development of the discipline, it is necessary to independently study the presented topics in detail according to the recommended sources of information that are presented in the curriculum.

Independent work introduces students to scientific creativity, the search for and solution of urgent modern problems.

GOALS AND MAIN TASKS OF THE SS

The purpose of independent work

Formation of students' sustainable knowledge and skills aimed at the application of artificial intelligence methods and technologies in professional activities. Development of the ability to independently search, select and adapt AI solutions, taking into account the specifics of the subject area.

Tasks of independent work

- Expansion and deepening of theoretical knowledge gained at lectures.
- Formation of skills for working with information and software resources on the subject of the discipline.
- Mastering the methods of analyzing professional tasks from the standpoint of the applicability of artificial intelligence.
- Development of skills to design and substantiate AI solutions.
- Formation of competencies in the field of selection and use of tools (libraries, models, APIs).

Forms of organization of independent work

- Performance of individual tasks on the key topics of the discipline.
- Analysis of professional cases and project situations.
- Work with documentation for libraries (transformers, networkx, openai, opencv, etc.).
- Mastering local and cloud platforms for working with AI models (Ollama, YandexGPT, GigaChat).
- Preparation of policy briefs, presentations and mini-reports.
- Performance of test tasks, including those with elements of self-control.

The leading goal of the organization and implementation of SRS should coincide with the goal of teaching a student - the preparation of a bachelor with higher education. In the organization of SRS, an important and necessary condition is the formation of the ability to work independently to acquire knowledge, skills and the ability to organize educational and scientific activities.

The purpose of students' independent work is to master fundamental knowledge, professional skills and abilities in the profile, experience in creative and research activities. Independent work of students contributes to the development of independence, responsibility and organization, a creative approach to solving problems of the educational and professional level.

The objectives of the SRS are:

- systematization and consolidation of the theoretical knowledge and practical skills of students;
- deepening and expanding theoretical knowledge;
- formation of skills to use regulatory, legal, reference documentation and special literature;
- development of cognitive abilities and activity of students: creative initiative, independence, responsibility and organization;
- formation of independent thinking, abilities for self-development, self-improvement and self-realization;
- development of research skills;
- the use of material collected and obtained in the course of independent studies at seminars, laboratory classes, when writing term papers and final qualification papers, for effective preparation for final tests and exams.

TYPES OF INDEPENDENT WORK

In the educational process of a higher professional educational institution, two types of independent work are distinguished: classroom, under the guidance of a teacher, and extracurricular. The close relationship between these types of work provides for differentiation and effectiveness of the results of its implementation and depends on the organization, content, logic of the educational process (interdisciplinary connections, promising knowledge, etc.). :

Classroom independent work on the discipline is carried out in classes under the direct guidance of the teacher and on his assignment.

Extracurricular independent work is performed by the student on the instructions of the teacher, but without his direct participation.

The main types of independent work of students without the participation of a teacher in this discipline are:

- formation and assimilation of the content of lecture notes on the basis of educational literature recommended by the lecturer, including information educational resources (electronic textbooks, electronic libraries, etc.);

- preparation for laboratory work, their design.

The main types of independent work of students with the participation of teachers are:

- ongoing consultations;
- acceptance and defense of laboratory work (during the L/R).

ORGANIZATION OF THE SPC

The methodology for organizing students' independent work depends on the structure, nature and features of the discipline "Artificial Intelligence and Machine Learning", the number of hours for its study, the type of tasks for students' independent work, the individual qualities of students and the conditions of educational activity.

The process of organizing students' independent work includes the following stages:

- preparatory (definition of goals, drawing up a program, preparation of methodological support, preparation of equipment);

- the main one (implementation of the program, the use of methods of information search, assimilation, processing, application, transfer of knowledge, recording of results, self-organization of the work process);

- final (assessment of the significance and analysis of the results, their systematization, assessment of the effectiveness of the program and methods of work, conclusions about the directions of labor optimization).

Recommended topics and tasks for self-study:

1. History and Main Approaches of AI

- To study the key stages of the development of artificial intelligence, to compare symbolic AI and machine learning.
- **Task:** to compile a brief chronology of AI development with an indication of breakthrough events and methods, to prepare a comparative table of symbolic and statistical approaches.

2. Search in the state space

- To master the methods of searching: in width, in depth, with iterative deepening.
- **Task:** Use networkx to implement a state graph and apply BFS, DFS, and iterative search to it. Output vertex traversal order.

3. Informed search and heuristics

- Study the algorithms of A*, greedy search, the concept of admissible heuristics.
- **Task:** Implement A* on a graph with weights. Compare the path and time of work with a greedy search.

4. Competitive search and minimax

- Master the Minimax algorithm and alpha-beta clipping.
- **Task:** Implement Minimax with clipping for the game of tic-tac-toe. Visualize the search tree to a depth of 3.

5. Intelligent Agents and Logic of Statements

- Explore agent architectures, inference basics, and semantics.
- **Task:** to simulate the simplest agent that makes decisions based on the "if-then" rules. To implement the algorithm of resolutions.

6. Natural Language Processing Basics

- Study the stages of text processing: tokenization, cleaning, vectorization.
- **Task:** take an arbitrary text (news, review), clear it, apply `CountVectorizer` and `TfidfVectorizer`, compare views.

7. Text classification

- To master the methods of text classification using a naïve Bayesian classifier.
- **Task:** to train `MultinomialNB` on the `sklearn fetch_20newsgroups` dataset and assess the accuracy of classification by category.

8. Information Extraction and QA

- Learn the NER (Named Entity Recognition) and Question Answering methods.
- **Task:** Use `transformers.pipeline` for NER and QA tasks. Test the `distilbert-base-cased` model on custom text.

9. Large Language Models

- Familiarize yourself with the principles of transformers and the GPT architecture.
- **Task:** generate text using Ollama, YandexGPT or GigaChat. Compare the styles and meaningfulness of responses to the same request.

10. Image Processing and Object Recognition

- Master basic computer vision techniques.
- **Task:** load the image using `opencv`, apply Gaussian and Sobel operators. Display the result.

11. Detection and classification of objects

- Learn methods of object recognition and feature extraction.
- **Task:** Using a pre-trained `resnet` model from `torchvision`, perform image classification.

12. 3D Restoration and Structural Vision

- Get acquainted with the methods of building deep maps and reconstructing scenes.

- **Task:** to study examples of 3D reconstruction from stereo pairs (you can use the colab platform). Visualize the depth map.

13. Reinforcement learning: the basics

- Study the principles of interaction between the agent and the environment, the concepts of policy and rewards.
- **Task:** Implement a simple GridWorld simulation with a fixed reward. Build an agent trajectory.

14. Q-Learning

- Master tabular Q-Learning.
- **Task:** to implement an algorithm on the task of teaching an agent to go through a labyrinth. Build a Q table and visualize the policy.

15. Genetic Algorithms

- To study the main operations: crossover, mutation, selection.
- **Task:** Implement GA to optimize the function $f(x) = x * \sin(x)$ on the segment $[0,10]$. Plot the optimization progress.

16. Application of AI in the Professional Field

- Investigate the application of AI in a specific industry (e.g., healthcare, finance, education).
- **Task:** to prepare a brief overview (1-2 pages) of cases of using AI in the selected field: models used, goals, effect.

Typical tasks for SRS:

General approach to assessment:

- Each task is evaluated on a **10-point scale**;
- The total grade for the independent work block can be calculated as an average or a sum (at the discretion of the teacher);
- It is possible to use **partial points (0.5, 1, etc.)** with partially completed points of the task;
- No points are awarded **for copying without comprehension, broken code, or missing interpretation.**

№	Task	Evaluation criteria (max. 10 points)
1	Study the definition of artificial intelligence. Briefly describe its development and name key historical stages.	3 points — correct definition; 4 points — the main milestones of development; 3 points — logical design.
2	Compile a table of major advances in AI by decade since the 1950s.	4 points — completeness of content; 3 points — accuracy of dates and events; 3 points — table design.
3	Learn the search algorithms in breadth and depth. Implement them on a graph using NetworkX.	3 points — working implementation; 4 points — correctness of results; 3 points — explanation of differences.
4	Explore an iterative deepening search method. Compare it to DFS and BFS in terms of execution time and memory.	3 points — implementation; 4 points — comparative analysis; 3 points — registration of results.

5	Calculate the path from the initial to the target state using the A* algorithm and greedy search.	3 points — implementation of algorithms; 4 points — correctness of routes; 3 points — comparison.
6	Investigate valid and invalid heuristics. Provide examples for the route-finding problem.	3 points — theoretical justification; 4 points — examples; 3 points — analysis of consequences.
7	Implement a hill climb algorithm for a function of two variables. Study the dependence of the result on the starting point.	3 points — correctness of implementation; 4 points — visualization of the trajectory; 3 points — conclusion.
8	Study the principles of the annealing simulation algorithm. Implement the optimization task and display the search progress.	3 points — correct implementation; 4 points — graphical representation; 3 points — explanation of the choice of parameters.
9	Compare local radial search and hill ascent. Identify conditions under which one of them is more effective.	3 points — correct description; 4 points — examples of problems; 3 points — comparative analysis.
10	Implement a genetic algorithm for an optimization task (e.g., minimizing a function).	4 points — implementation; 3 points — description of parameters; 3 points — interpretation of the results.
11	Study the Minimax algorithm. Implement it for the game of tic-tac-toe.	3 points — correctness of implementation; 4 points — building a game tree; 3 points — explanation of logic.
12	Implement alpha-beta clipping based on the previously created Minimax algorithm. Compare the search depth and the number of nodes.	4 points — implementation; 3 points — quantitative comparison; 3 points — conclusion.
13	Simulate the behavior of the simplest intelligent agent with logical rules.	3 points — the structure of the agent; 4 points — implementation of logic; 3 points — explanation of the principle of operation.
14	Implement logical inference by the method of resolutions for a simple set of logical statements.	3 points — correctness of formulas; 4 points — construction of resolutions; 3 points — conclusion.
15	Explore the problem of text classification using <code>transformers.pipeline</code> . Apply the model to custom text.	3 points — implementation; 4 points — relevance of results; 3 points — interpretation.
16	Extract information from text (NER) using the BERT model. Analyze the found entities.	3 points — work with the model; 4 points — analysis of the results; 3 points — design.
17	Get acquainted with Ollama or GigaChat. Generate an answer to a professional question and analyze the adequacy of the model.	3 points — work with the interface; 4 points — content of the request and response; 3 points — quality assessment.
18	Implement a simple example of reinforcement learning (GridWorld or maze).	4 points — working implementation; 3 points — visualization of the process; 3 points — description of the policy.
19	Compare active and passive reinforcement learning. Give an example of how each can be	3 points — theoretical difference; 4 points — examples; 3 points —

	used.	connection with AI tasks.
20	Perform basic image processing (grayscale, filtering, border extraction) using OpenCV.	3 points — implementation; 4 points — correctness of operations; 3 points — explanation of effects.
21	Compare BFS and DFS in terms of spatial and temporal complexity. Draw conclusions in the table.	4 points — correct formulas; 3 points — examples of application; 3 points — table design.
22	Implement the search graph in <code>networkx</code> and visualize it. Mark the nodes of the initial and target states.	3 points — implementation; 4 points — visualization; 3 points — explanation.
23	Give an example of a problem solved with A* and describe how the path is built in this problem.	3 points — the choice of a problem; 4 points — a description of the path construction; 3 points — the logic of heuristics.
24	To conduct a comparative analysis of permissible and unacceptable heuristics in the problem of finding a way.	4 points — determination of heuristics; 3 points — comparison; 3 points — conclusion.
25	Explore scenarios where local search methods are ineffective. Give 2 examples.	3 points — theoretical explanation; 4 points — relevance of examples; 3 points — analysis.
26	Implement local ray search for the problem of minimizing the function. Build motion trajectories.	3 points — implementation; 4 points — visualization; 3 points — conclusion.
27	Compare the results of simulated annealing and hill climbing under the same initial conditions.	3 points — implementation; 4 points — comparison of trajectories; 3 points — stability analysis.
28	Create a visualization of the Minimax tree with different depths. Describe how depth affects player behavior.	3 points — tree construction; 4 points — analysis; 3 points — interpretation.
29	To develop a simplified agent with logical inference capable of making decisions in a text-based environment.	4 points — structure; 3 points — implementation; 3 points — explanation of the conclusion.
30	Perform a step-by-step logical conclusion according to the rules of the resolution for 3-4 statements.	3 points — correctness of the conclusion; 4 points — structure of reasoning; 3 points — justification of the result.
31	Compare GPT and BERT architectures. Highlight differences in the purpose and principles of text processing.	3 points — overview of architectures; 4 points — accuracy of comparisons; 3 points — conclusion.
32	Describe how the question answer (QA) task is implemented in modern LLMs. Give an example.	4 points — description of the mechanism; 3 points — model selection; 3 points — demonstration of an example.
33	Compare the Ollama and YandexGPT models in terms of the quality of generating a response to the same request.	3 points — making a request; 4 points — comparing the results; 3 points — critical analysis.
34	Test the <code>bert-base-cased</code> model to classify custom texts. Analyze accuracy.	4 points — model adjustment; 3 points — implementation; 3 points — interpretation.
35	Implement agent training in a GridWorld environment with tabular Q-Learning. Build a	4 points — implementation; 3 points — visualization of the strategy; 3 points —

	final strategy.	interpretation.
36	Compare the performance of Q-Learning and SARSA algorithms on a simple task.	3 points — implementation; 4 points — strategy/reward comparison; 3 points — conclusion.
37	To study the mechanism of exploration/exploitation in reinforcement learning. To model the impact of ϵ on the outcome.	3 points — explanation of the mechanism; 4 points — implementation with different ϵ ; 3 points — analysis.
38	Develop a 3D scene based on a set of images. Use ready-made datasets and visualization tools.	3 points — data collection; 4 points — visualization; 3 points — explanation.
39	Learn the <code>cv2</code> operators. <code>Sobel()</code> and <code>cv2.Canny()</code> . Apply them to the image and explain the differences.	3 points — implementation; 4 points — comparison of results; 3 points — conclusion.
40	Describe the structure of visual object recognition and apply it to a real-world example (e.g., a photo of a room).	4 points — description of the stages; 3 points — application; 3 points — interpretation.
41	Explore how features can be extracted from 2D images. Give an example.	3 points — description of approaches; 4 points — example of a problem; 3 points — justification.
42	Use <code>cv2.CascadeClassifier</code> to recognize objects (for example, faces). Describe how it works.	3 points — implementation; 4 points — correctness of recognition; 3 points — explanation.
43	Compare the accuracy of object recognition between <code>resnet18</code> and <code>mobilenet_v2</code> models.	4 points — correctness of model launch; 3 points — accuracy analysis; 3 points — comparison.
44	Describe the principles of generating training data for training visual recognition models.	4 points — description structure; 3 points — examples of data; 3 points — explanation of significance.
45	Segment an image (for example, a sheet of paper in the background) using threshold filters.	3 points — implementation; 4 points — segmentation result; 3 points — explanation of the choice of method.
46	To compare the neural network and heuristic approaches to solving the same AI problem.	4 points — description of two approaches; 3 points — choice of a problem; 3 points — comparison.
47	Make a comparison table: task — AI method — example of application in the profession. At least 5 rows.	3 points — logical correspondence; 4 points — completeness of the table; 3 points — design.
48	Explore data augmentation techniques and apply them to an image.	3 points — description of methods; 4 points — implementation; 3 points — analysis of the result.
49	To study the concept of "interpretability of the model". To give 2 examples of interpretation methods.	3 points — explanation of the term; 4 points — examples; 3 points — importance in the profession.
50	Choose a professional task and describe how search techniques, AI agents, and training can be applied to it.	3 points — choosing a problem; 4 points — correct description of methods; 3 points — substantiation of the solution.

Students' Activities for the Formation and Development of Skills of Educational Independent Work

In the process of independent work, the student acquires the skills of self-organization, self-control, self-management, self-reflection and becomes an active independent subject of educational activity.

Performing independent work under the supervision of a teacher

The student must:

- master the minimum content submitted for independent work of students and proposed by the teacher in accordance with the educational standards of higher education;
- plan independent work in accordance with the schedule of independent work proposed by the teacher;
- the student must carry out independent work in the organizational forms provided for by the curriculum and the teacher's work program;
- perform independent work and report on its results in accordance with the schedule for submitting results, types and terms of reporting on students' independent work.

A student can:

in addition to the one proposed by the teacher (with justification and agreement with him) and the minimum mandatory content determined by the program for this discipline:

- independently determine the level (depth) of the study of the content of the material;
- to suggest topics and questions for independent study;
- within the framework of the general schedule for the performance of independent work, offer a reasonable individual schedule for the implementation and reporting on the results of independent work;
- offer their own options for organizational forms of independent work;
- to use for independent work methodological manuals, manuals, developments in addition to the list proposed by the teacher;
- to use not only control, but also self-control of the results of independent work in accordance with the methods of self-control proposed by the teacher or chosen independently.

Independent work of students should have an important impact on the formation of the personality of the future bachelor, it is planned by the student independently. Each student independently determines the mode of his work and the degree of work spent on mastering the educational content in each discipline. He performs extracurricular work according to a personal individual plan, depending on his preparation, time and other conditions.

Questions to check the CPS

1. What is meant by the term "artificial intelligence"?
2. When and by whom was the term "artificial intelligence" first proposed?
3. What are the key stages in the development of AI in the 20th and 21st centuries?
4. How is symbolic AI different from learning-based approaches?
5. What is the essence of the breadth search method?
6. What are the features of a deep search?
7. In what situations is iterative deepening search used?
8. What is a state graph?
9. How can I implement a search graph in Python using the NetworkX library?
10. What does the term "heuristics" mean in the context of AI?
11. How is greedy search different from the A* algorithm?
12. What is a valid heuristic? Give an example.
13. What are the components of evaluation function A*?
14. What is the local maximum in optimization problems?
15. How does the hill climb algorithm work?
16. What are the features of the annealing simulation algorithm?
17. What is crossover and mutation in genetic algorithms?

18. What is the difference between a local radial search and a single climb to a hill?
19. What type of problems are solved with the help of genetic algorithms?
20. What is adversarial search?
21. How does the Minimax algorithm work?
22. What is alpha-beta clipping used for?
23. What is the role of the estimation function in the Minimax algorithm?
24. In which games is the Minimax algorithm applicable?
25. What is an intelligent agent?
26. What is the difference between a reactive agent and a memory agent?
27. What does inference mean?
28. What is the essence of the resolution method?
29. What type of logic underlies the semantics of statements?
30. What are the main stages of text processing in NLP?
31. What is tokenization and why is it needed?
32. What tasks does text classification solve?
33. What does extracting information from text mean?
34. What features does the `transformers` library provide?
35. What are the differences between the BERT and GPT models?
36. What language models can be used via Ollama, YandexGPT or GigaChat?
37. What is Reinforcement Learning?
38. What is the difference between active reinforcement learning and passive learning?
39. What is an agent policy in RL?
40. What tasks can be solved with Q-Learning?
41. What does the dilemma "exploration vs exploitation" mean?
42. What is the value function in reinforcement learning?
43. What components are included in the classic RL system scheme?
44. What are the main stages of image processing used in computer vision?
45. What is object detection?
46. What is the difference between Sobel and Canny operations in OpenCV?
47. What does 3D scene restoration mean?
48. What role do structural features play in object recognition?
49. What Python libraries are used in computer vision tasks?
50. What are some examples of AI applications in your professional field?

GENERAL RECOMMENDATIONS FOR THE ORGANIZATION OF INDEPENDENT WORK

The main form of independent work of the student is the study of lecture notes, their supplementation, recommended literature, active participation in laboratory classes. But for successful educational activity, its intensification, it is necessary to take into account the following subjective factors:

1. Knowledge of school program material, the presence of a solid system of gaps necessary for mastering the main university courses. This is especially important for mathematical disciplines. It is necessary to distinguish gaps in knowledge that make it difficult to assimilate new material from small abilities. By spending effort to overcome these gaps, the student will ensure normal academic performance and believe in his abilities.

2. Availability of skills, skills of mental work:

- a) the ability to take notes at lectures and when working with a book;
- b) mastery of logical operations: comparison, analysis, synthesis, generalization, definition of concepts, rules of systematization and classification.

3. The specifics of cognitive mental processes: attention, memory, speech, observation, intelligence and thinking. Poor development of each of them becomes a serious obstacle in learning.

4. Good working capacity, which is ensured by normal physical condition. After all, serious learning is a large, versatile and diverse work. The result of learning is evaluated not by the amount of information communicated, but by the quality of its assimilation, the ability to use it and the development of one's ability for further independent education.

5. Correspondence of the chosen activity, profession to individual abilities. It is necessary to develop the ability to self-regulate one's emotional state and eliminate circumstances that disturb the business mood, interfere with the planned work.

6. Mastering the optimal style of work that ensures success in activities. Alternating work and pauses in work, rest periods, individually justified sleep duration, preference for evening or morning classes, stress resistance at exams and features of preparation for them,

7. The level of demands on oneself, determined by the established self-esteem.

An adequate assessment of knowledge, advantages, disadvantages is an important component of a person's self-organization, without it it is impossible to successfully manage one's behavior and activity.

One of the main features of education in higher school is that constant external control is replaced by self-control, the active role in learning belongs not so much to the teacher as to the student.

Knowing the basic methods of scientific organization of mental work, it is possible to achieve the best results with the least expenditure of time, money and labor efforts.

The effectiveness of assimilation of incoming information depends on the working capacity of a person at a particular moment of his activity.

Working capacity is the ability of a person to work with a high degree of intensity for a certain time. There are internal and external factors of working capacity.

Internal factors of working capacity include intellectual characteristics, will, and state of health.

External:

- organization of the workplace, work and rest schedule;
- the level of labor organization - the ability to obtain information and use information;
- the amount of mental load.

The outstanding Russian physiologist N. E. Vvedensky identified the following conditions for the productivity of mental activity:

- Any work should be entered gradually;
- dimensionality and rhythm of work. Different people have a more or less different pace of work;
- the usual sequence and systematicity of activity;
- correct alternation of work and rest.

Rest does not imply obligatory complete inaction on the part of a person, it can be achieved by a simple change of business. During the day, the working capacity changes. The most fruitful is the *morning time* (from 8 to 14 hours), and the maximum working capacity falls on the period from 10 to 13 hours, then *the afternoon* (from 16 to 19 hours) and *the evening* (from 20 to 24 hours). It is better to study the material that is very difficult to understand at the beginning of each period of time (preferably in the morning) after a good rest. After 1-1.5 hours, breaks of 10 - 15 minutes are needed, after 3 - 4 hours of work, the rest should be long - about an hour.

An integral part of the scientific organization of mental labor is the mastery of the technique of mental labor.

The time that the student has to complete the curriculum consists of two components: one of them is classroom work at the university according to the schedule of classes, the other is extracurricular independent work. Tasks and materials for independent work are given during

classes according to the schedule, in the same classes the teacher controls independent work, and also assists students in the correct organization of work.

Self-study will require intensive mental work, which must not only be properly organized, but also stimulated. At the same time, it is very important to be able to maintain steady attention to the material being studied. The development of attention requires significant volitional efforts. That is why, if a student notices that he is often distracted during independent studies, he needs to force himself to concentrate. Such a procedure must be done constantly, as this is attention training. Sustained attention appears when a person treats the matter with interest.

It is necessary to properly organize your classes in time: 50 minutes - work, 5-10 minutes - break; after 3 hours of work, a break - 20-25 minutes. Otherwise, increasing fatigue will lead to instability of attention. A very significant factor affecting the increase in mental performance is systematic physical education. The organization of active recreation provides for the alternation of mental and physical activity, which completely restores a person's working capacity.

EDUCATIONAL, METHODOLOGICAL AND INFORMATION SUPPORT OF THE DISCIPLINE

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