FEDERAL STATE AUTONOMOUS
EDUCATIONAL INSTITUTION HIGHER EDUCATION
"NATIONAL RESEARCH UNIVERSITY
"HIGHEST SCHOOL ECONOMICS"

Faculty computer science, mathematics
and computer sciences

Approved by the Academic Council of
the OP "IIiKZ"
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Internship program for students of the educational program "Artificial Intelligence and Computer Vision"

Master's degree training areas
01.04.02 Applied Mathematics and Computer Science
2024, 2025 recruitment year

Nizhny Novgorod
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Educational program "Artificial Intelligence and Computer Vision" of the master's degree program 01.04.02 Applied Mathematics and Computer Science.

Annotation

Practical training in the "Artificial Intelligence and Computer Vision" master's program is implemented through a project and a final thesis. The primary goals of practical training are to broaden students' general knowledge, deepen their theoretical understanding, and develop professional skills. Participation in these practical training elements contributes to the development of universal, general, and professional competencies relevant to the program's specialization.

The internship program includes a description of the curriculum elements of the educational program, organized in the form of practical training and grouped in the “Practice” module of the curriculum.

Section 1. General Information

Well	***Type of practice***	***Sign 1[1]***	***Sign 2[2]***	***Volume in z.e.***	***Volume in ac.h.***	***Implementation period***
1	Project Internship Machine Learning in Computer Vision (offered in a foreign language)	F	C	6	228	During the academic year
2	Project Internship Deep Learning in Computer Vision (offered in a foreign language)	F	C	9	342	During the academic year
	Research Internship Research thesis preparation (offered in a foreign language)	C	C	12	456	13.01.current academic year - 23.05.current academic year

Section 2. Description of the content of the internship

2.1. Project

[1] Compulsory (C) – The EPP is mandatory for all students of the OP.
Elective Subject (E/E) – a student has the opportunity to complete one or more lines from the proposed list of elements in the “Practice” module of the curriculum.
[2] Fixed (F) – the EPP must be completed strictly in the current academic year.
Free (C) – The EPP can be completed throughout the entire period of study until the beginning of the last module of the final year.

2. 1.1. Goal, objectives, prerequisites

The goal of the Project-type EPP is to develop students' teamwork skills to create a unique result (software product, analytical report, etc.) with specific parameters under conditions of limited resources.

The tasks are:

- consolidation of knowledge acquired during the learning process;
- study of methodological, instructional and regulatory materials, specialized literature, practicing the skills acquired during training;
- stimulating group work skills ;
- collection and analysis of information, development of methods and tools for conducting practical research or creating a software product.

The prerequisites of the Project type EPP are specified separately for each project (depending on its nature and objectives).

2.1.2. Dates of control points

Type of practice	**Control point for signature tasks student**	**Control point for provision intermediate options text/report**	**Control point for provision final text/report**
Project	October	Specified in the individual assignment	June

2.1.3. Contents, features of development

Students of the EP can choose any type of project, but in terms of goals and results, research and applied projects on topics related to the profile of the educational program are preferable.

Once enrolled in a project and subsequently approved by the project supervisor, a student cannot leave the project voluntarily without the supervisor's consent. In the event of voluntarily leaving, the supervisor has the right to evaluate the student's work as unsatisfactory, which constitutes academic failure.

LIST OF PLANNED LEARNING OUTCOMES DURING INTERNSHIP, CORRESPONDING WITH THE PLANNED OUTCOMES OF MASTERING THE EDUCATIONAL CURRICULUM PROGRAMS (COMPETENCIES)

Process passages practices directed on formation following competencies:

Code competencies	**Formulation competencies**	**Professional tasks, For solutions which required given competence**
UC-1	Capable of carrying out critical analysis of problematic situations based on a systems approach and developing a strategy for action.	• organizational and managerial
PC-9	Capable of receiving, cleaning, analyzing and visualizing large volumes of data	• organizational and managerial

GPC-1.AMI	Able to solve current problems in fundamental and applied mathematics	• research
GPC-3.AMI	Able to develop mathematical models and analyze them when solving problems in the field of professional activity	• design

2.1.4. Evaluation and reporting

The project manager evaluates the student's work in accordance with the principles outlined in the project evaluation form. Upon completion of the project, the project manager completes the evaluation form, assigning a grade for the student's work and the number of credits awarded for the project's scope of work. The evaluation form must be submitted to the academic office no later than five days after the project's completion.

In addition, upon completion of the Project-type EPP, the student submits a project report reflecting the completion of the project assignment, acquired skills and abilities.

The internship report is the primary document by which the student reports on their work. The report is compiled as the project progresses, as the student studies and completes the work.

The report must include a title page, a table of contents, an index of diagrams, tables, and documents presented in appendices, and a conclusion. Tables, diagrams, planning, accounting, reporting, and other documentation may be presented either as the material is presented or at the end of the report (as appendices).

When preparing a report, please remember to maintain confidentiality of any information about the company that may become known to the student during the course of the project.

The report must be written in competent professional language and be structured in accordance with the following requirements for the content of the main sections of the project report:

- Section "General description of the project": this section provides the main characteristics of the project: goal, objectives, project assignment, description of the state of the company on the basis of which the project is being carried out, etc.

- Section “Progress of the project assignment”: this section describes the main stages of the project implementation.

- Section “Main results of the project”: this section provides a description of the results achieved during the implementation of the project (description of the software product, analytical report on the activities of the enterprise, etc.).

- Section "Technologies Involved in the Project": this section describes what information technologies and software the student became familiar with and worked with during the project.

- Section "Individual Contribution to the Project": this section describes for each project participant the specific tasks they worked on during the project implementation, the results they achieved, the difficulties they encountered and how they resolved them, etc.

- Section "Appendices": this section can contain tables, diagrams, planning, accounting, reporting and other documentation.

In the case of a group project, instead of individual reports from each of the project participants, it is permissible to submit one report from the entire team of project participants.

The completed project report is submitted by the student within 5 days of the project's completion. Upon completion of the project, the student submits a written report to the university project supervisor within the timeframe established by the academic schedule.

Midterm assessment takes the form of an exam. The exam evaluates the submitted project reports. The exam may also be organized as a public defense.

The exam is preceded by ongoing monitoring, which can be implemented in the form of periodic surveys of students by the internship supervisor regarding the progress of the internship and the results obtained (completion of an individual internship assignment by the student, face-to-face consultations with the internship supervisor, etc.) and/or in another form.

When evaluating internship documents, the project manager/commission (the commission may only be formed from the project manager from the faculty) is guided by the following approximate scale:

Rating on a ten-point scale

Rating out of ten scale	**Approximate content assessments**
10 - Brilliantly 9 - Great 8- Almost Great	The set of documents is complete, all documents are duly signed and certified. The internship objective was fully or exceeded, the report was submitted to the internship supervisor within the established deadlines, and is formatted in accordance with the requirements; the report presents the material in full on all aspects. Sections. There were no comments from company or organization representatives. The student answered all questions posed by the internship supervisor.
7- Very Fine 6- Fine	The set of documents is complete, but some documents are not signed or not properly certified. The internship objective was almost fully achieved, the report was submitted to the internship supervisor within the established deadlines and was formatted in accordance with the requirements; the report presents the material in full on all aspects. sections. Minor comments from representatives enterprises or organization. The student answered most of the questions posed by the internship supervisor.
5- Very satisfactory 4- Satisfactorily	The set of documents is complete, but some documents are not signed or not properly certified. The internship objective was partially achieved, the report was submitted to the internship supervisor within the established deadlines, and was prepared in accordance with the requirements; the report presents the material in full for all sections. Comments from representatives enterprises or The student answered some questions posed by the internship supervisor.

3- Badly 2- Very Badly 1- Very unsatisfactory	The set of documents is incomplete. The internship objective was not achieved. Serious comments from representatives enterprises or organization. The student did not answer the questions posed by the internship supervisor. The student did not answer the questions posed by the internship supervisor.
0- Unsatisfactory	Set of documents absent. Target practices not achieved. Serious comments from representatives enterprises or organizations. Or the student did not complete the internship at all within the required timeframe.

The final grade for the practice is calculated using the formula:

Orez = 0.5 Oreport + 0.5 Ool, where

 Report – grade for the report submitted by the student on the results of the project,

 Ool – a grade for completed work and for project documentation, assigned by the Project Manager of the relevant organization based on the results of the student's work in the student's evaluation sheet for the project.

The resulting score is rounded arithmetically (if the fractional part is 0.5 or higher, the score is rounded towards the next whole number).

Plagiarism and falsification of documents are assessed with 0 points.

FOS (if a defense is being conducted, then other questions may be asked during the defense):

Justify the choice of technology stack for experiments.

Describe the subject area for which the research is being conducted.

What software tools are used to conduct the research (development environments, version control systems, libraries, etc.)?

What methods/models were developed/used in program design/research planning?

2.1.5. Resources

During the EPP process, students can use information technologies, including automated design and software development tools used in the relevant organization, Internet technologies, etc.

HSE Library https://library.hse.ru/

2.1.6. Peculiarities of performing tasks on the EPP under restrictive or other measures

Under current restrictions, preference is given to projects that can be completed remotely. Other details regarding the completion of internship assignments under current restrictions depend on the nature of the restrictions and are specified by the governing bodies of the University, Faculty, or educational program. Preparation and defense of final qualifying work can be carried out remotely using distance technologies.

2.7. All templates, sample documents, and guidelines for writing reports are available on the website.

2.2 Preparation of the final qualifying work (FQW)

2.2.1. Goal, objectives, prerequisites

The final qualifying work (FQA) is an integral part of the educational program and is conducted in accordance with the approved curriculum and academic schedule. The final qualifying work may be completed in a research-based format with elements of practical implementation .

- Research final qualifying work with elements of practical implementation – involves research carried out with the aim of obtaining new knowledge about the structure, properties and patterns of the object (phenomenon) being studied, as well as research into an applied problem, as a result of which a product (artifact) is created.

The objectives of preparing a final qualifying work (FQP) are to: acquire professional work skills by students, deepen the knowledge and competencies acquired during theoretical training, consolidate practical skills in solving specific production problems, as well as collect the necessary material for writing the FQP, write the FQP text , and prepare for the defense of the final qualifying work.

The objectives of preparing the final qualifying work are:

- consolidation of knowledge acquired during the learning process;
- study of methodological, instructional and regulatory materials, specialized literature, practicing the skills acquired during training;
- to stimulate the skills of independent analytical work ;
- collection and analysis of information obtained from practical tasks of real practice with the aim of using it when writing a final qualifying work;
- development of methods and tools for conducting practical research and analyzing the results;
- present skills in public discussion and defense of scientific and/ or practical ideas, proposals and recommendations; analysis and systematization of information on the research topic .

Prerequisites: by the time of preparing the final qualifying work, the majority of disciplines and other components provided for in the curriculum of the educational program must have been studied.

2.2.2. Dates of control points

Type of practice	**Control point for signature tasks student**	**Control point for provision intermediate options text/report**	**Control point for provision final text/report**
Preparation of final qualifying work	No later than December 15 of the current academic year	It is being determined leader in the individual task	No later than 21 calendar days before the defense of the final qualifying work

Signing an individual assignment for completing the EPP is the first and mandatory checkpoint for each student in completing any element of practical training.

The second mandatory checkpoint in completing the final qualifying work is the student's presentation to the project supervisor. At this stage, the student must formulate a working hypothesis/thesis concept, define the object and subject of the study, identify the methods, identify the problem the final qualifying work will address, and propose the basic structure of the final qualifying work.

The final qualifying work project can be prepared by the student during individual consultations with the supervisor (potential supervisor).

A student has the opportunity to revise a final qualifying work project that has not been approved by the supervisor and resubmit it. Specific dates for resubmission and evaluation are agreed upon with the supervisor, but no later than December 25 of the current academic year. If the project is not approved by the specified deadline, the supervisor is obligated to notify the academic office of the student's program via corporate email or through a special module in the HSE University's Electronic Information and Educational System.

The third mandatory checkpoint is the submission of the first version of the final qualifying work. The text of the first version of the final qualifying work is submitted to the supervisor for comments; if necessary, further corrections are made. Submission of the first version of the final qualifying work occurs in accordance with the final qualifying work

preparation schedule, as reflected in the individual assignment.

The fourth mandatory checkpoint is the submission of the final text of the final qualifying work to the Supervisor by uploading the work in electronic, unscanned form to a special module of the HSE University's Electronic Information and Study System (EISS) with a mandatory indication of the presence/absence of content generated by automatic content generation algorithms in the final text of the final qualifying work.

The fifth mandatory checkpoint is the review of the final qualifying work**.** The reviewer is appointed from among HSE faculty or researchers. Reviewers may also be representatives of other higher education institutions or employees of other organizations in the professional field relevant to the final qualifying work's topic.

The reviewer of the final qualifying work may be either a person external to HSE University or a person external to the department/department/school/institute/other division in which the supervisor of the final qualifying work works.

2.2.3. Contents, features of development

IN in the course practices The necessary information and materials for writing the final qualifying work are collected, which are then used during the preparation of the final qualifying work to write the text of the master's thesis, practical skills and competencies are improved, and Also experience independent research And practical work.

Preparation of the final qualifying work also involves collecting and analyzing theoretical materials on the topic of the final qualifying work, processing information, systematizing the material, and coordinating the structure of the work and conclusions with the supervisor.

The volume of the final qualifying work must be at least 40 pages of typewritten text, not counting the pages of the Appendix (if any).

By agreement with the supervisor, the volume of work may be smaller, provided that the research topic is covered.

Technical requirements. The final qualifying work is printed on a standard A4 sheet of paper. Margins are left on all four sides of the printed sheet: left margin – 30 mm, right margin – no less than 10 mm, top and bottom margin – no less than 20 mm. The approximate number of characters per page is 2000. Times font. New Roman font size 14, line spacing 1.5. Justified alignment.

Page numbers are continuous. The title page is considered the first page of the work, but it is not numbered. The table of contents is marked page 2. Page numbers are placed at the bottom of the page, centered.

The title page and table of contents are formatted according to the established template. The table of contents includes all sections of the work, with page numbers indicated.

Rules for the formatting of the list of references (sources used or bibliographic list - any of the specified names is allowed).

The bibliography (or reference list) includes literary, statistical, and other sources used in writing the work. It includes such sources as monographs and educational literature, periodicals (magazine and newspaper articles), legislative and instructional materials, statistical collections and other reporting and accounting materials, and websites.

Methods of arranging material in the bibliography: in the order in which they appear in the text, therefore different alphabets are mixed in one list; foreign sources are placed among Russian-language publications – in the order in which they appear in the text.

When compiling a bibliography, all book details are included: the author's last name and initials, the book's title, the place of publication, the publisher's name, and the total number of pages. For articles published in periodicals, the title, issue, year, and page count should be indicated.

The following documents are submitted for the defense of the final qualifying work:

■the text of the final version of the final qualifying work in paper bound form;

■review of the final qualifying work supervisor;

■review of final qualifying work;

■standard registration form printed from the Antiplagiat LMS system page ;

■other demonstration and handout materials for the State Examination (including a working application (executable code) for the final qualifying work completed in the format of a course project; a program (source code and executable file) for the final qualifying work completed in the format of a research paper, etc.) .

The final version of the final thesis, along with the supervisor's review, essay, and presentation, must be submitted in Russian or English, depending on the language in which the thesis was completed. The student defends the thesis in the language (Russian or English) in which it was completed.

LIST OF PLANNED LEARNING OUTCOMES DURING INTERNSHIP, CORRESPONDING WITH THE PLANNED OUTCOMES OF MASTERING THE EDUCATIONAL CURRICULUM PROGRAMS (COMPETENCES)

Process passages practices directed on formation following competencies:

Code competencies	**Formulation competencies**	**Professional tasks, For solutions which required given competence**
UC-1	Able to carry out a critical analysis of problematic situations based on a systems approach and develop an action strategy	• organizational and managerial
UC-2	Capable of managing a project at all stages of its life cycle	• design
UC-3	Able to organize and manage team work, develop a team strategy to achieve the set goal	• design
UC-4	Able to apply modern communication technologies, including in foreign language(s), for academic and professional interaction	• organizational and managerial
UC-6	Able to identify and implement priorities for one's own activities and ways to improve them based on self-assessment and lifelong learning	• organizational and managerial

GPC-3.AMI	Able to develop mathematical models and analyze them when solving problems in the field of professional activity	• organizational and managerial
PC-6	Able to formalize and publicly present the results of professional activities using information technology	• scientific research
PC-8	Able to create, describe and responsibly monitor the implementation of technological requirements and regulatory documents in professional activities	• organizational and managerial
PC-10	Capable of implementing models and algorithms of applied mathematics in the form of computer programs	• organizational and managerial

2.2.4. Evaluation and reporting

The final qualifying work (FQP) is completed by submitting the completed FQP to the academic supervisor for final review and feedback. There is no midterm assessment or separate grade for the FQP. Failure to submit the FQP on time will result in the student being disqualified from the State Final Attestation (GIA).

Criteria And evaluation scale For intermediate certification By practice

During the defense of the internship, the internship supervisor from the faculty evaluates the results of the internship according to the following approximate scale:

Rating out of ten scale	**Approximate content assessments**
10 - Brilliantly 9 - Great 8- Almost Great	The set of documents is complete, all documents are duly signed and certified. The internship objective was fully or exceeded, the report was submitted to the internship supervisor within the established deadlines, and is formatted in accordance with the requirements; the report presents the material in full on all aspects. Sections. There were no comments from company or organization representatives. The student answered all questions posed by the internship supervisor.

7- Very Fine 6- Fine	The set of documents is complete, but some documents are not signed or not properly certified. The internship objective was almost fully achieved, the report was submitted to the internship supervisor within the established deadlines and was formatted in accordance with the requirements; the report presents the material in full on all aspects. sections. Minor comments from representatives enterprises or organization. The student answered most of the questions posed by the internship supervisor.
5- Very satisfactory 4- Satisfactorily	The set of documents is complete, but some documents are not signed or not properly certified. The internship objective was partially achieved, the report was submitted to the internship supervisor within the established deadlines, and was prepared in accordance with the requirements; the report presents the material in full for all sections. Comments from representatives enterprises or The student answered some questions posed by the internship supervisor.
3- Badly 2- Very Badly 1- Very unsatisfactory	The set of documents is incomplete. The internship objective was not achieved. Serious comments from representatives enterprises or organization. The student did not answer the questions posed by the internship supervisor. The student did not answer the questions posed by the internship supervisor.
0- Unsatisfactory	Set of documents absent. Target practices Not achieved. Serious comments from the supervisor. Or the student failed to submit the final qualifying work within the allotted time.

The formulas below are recommended. The final grade formula for a final qualifying work is determined by the committee before which the work will be defended.

When assigning a final grade to a final qualifying work, it is recommended to use the following criteria and formula:

$$О_{итог} = 0.2 * О_{НР} + 0.2 * О_{Р} + 0.2 * О_{КР} + 0.2 * О_{Защита} + 0.1 * О_{Публикация} + 0.1 * О_{ПР}$$

■$О_{НР}$- assessment of the final qualifying work supervisor;

■$О_{НР}$- assessment of the reviewer of the thesis;

■$О_{КР}$- assessment of the documentation on the final qualifying work and the timeliness of its submission during the completion of the final qualifying work (compliance with the stages of presentation of the results of the final qualifying work);

■$О_{Защита}$- the commission's assessment based on the results of the public defense of the final qualifying work (is given as the arithmetic mean of the assessments of all commission members);

■$О_{Публикация}$- assessment of the presence of a publication based on the results of the final qualifying work: 10 - if there is a publication, 0 - if there is none;

■$О_{ПР}$- assessment of the presentation of the results of the final qualifying work at scientific events (conferences, seminars, etc.): 10 - if there are supporting documents for the presentation of the results of the final qualifying work, 0 - if there are none.

Resulting grade is rounded off arithmetically (≥0.5=) . Plagiarism And falsification documents are evaluated V 0 points.

The final grade for the final qualifying work is given by open voting of the members of

the State Examination Commission.

Fund for assessment of final qualifying work.

1. How many sources were used in compiling the review? What types of sources (articles, books, conference proceedings, popular publications), and for what period?

2. Justify the relevance of the topic of the work

3. Are there any works or research on the topic of your final qualifying work?

4. Justify the choice of methods used in your research.

5. Justify the choice of technology stack for experiments.

6. Describe the subject area for which the research is being conducted.

7. What software tools are used to conduct the research (development environments, version control systems, libraries, etc.)?

8. State the practical significance and/or scientific novelty of the work.

9. What methods/models were developed/used in designing the program/planning the research?

10. What is the asymptotic complexity of the algorithms used?

11. What factors are taken into account when planning a computational experiment?

12. Were the resources of the HSE computing cluster used in developing the software or conducting the experiments?

13. Justify the conclusions you came to as a result of writing your final qualifying work.

Other questions may also be asked during the defense of the internship report.

2.2.5. Resources

During the EPP process, students can use information technologies, including automated design and software development tools used in the relevant organization, Internet technologies, etc.

HSE Library https://library.hse.ru/

2.2.6. Peculiarities of performing tasks on the EPP under restrictive or other measures

Under current restrictions, preference is given to projects that can be completed remotely. Other details regarding the completion of internship assignments under current restrictions depend on the nature of the restrictions and are specified by the governing bodies of the University, Faculty, or educational program. Preparation and defense of final qualifying work can be carried out remotely using distance technologies.

2.2.7. All templates, sample documents, and guidelines for writing final qualifying work are available on the website.

Section 3. Features of organizing training for people with disabilities and people with disabilities

Practical training for students with disabilities is organized taking into account the characteristics of their psychophysical development, individual capabilities, and health status.