Federal State Autonomous Educational Institution of Higher Education
PEOPLES' FRIENDSHIP UNIVERSITY OF RUSSIA
NAMED AFTER PATRICE LUMUMBA
RUDN University

ACADEMY OF ENGINEERING

(educational division (faculty/institute/academy) as higher education programme developer)

Approved at the meeting of Academic
Counsil of RUDN University
Protocol № 2022-08/24-12/1
09.12.2024
(date, month, year)

PROFESSIONAL EDUCATION PROGRAMME OF HIGHER EDUCATION

Field of Studies / Specialty:

1.2.1 Artifitial Intelligence and Machine Learning

(scientific speciality code and title)

Profile / Specialisation

Artifitial Intelligence and Machine Learning

(PhD program title)

The Educational Programme is developed in compliance with:
Educational Standard of RUDN University, approved by order of the Rector of RUDN University No. 139 dated March 9, 2022.

Length of Educational PhD Programme:

3 years

(full-time education)

Educational PhD Programme Features: programme is implemented in English

AGREED by:

Head of Educational Programme
Razoumny Yu.N.

(signature)

Head of Faculty
Razoumny Yu.N.

(signature)

Head of Educational Policy Department
Vorobyeva A. A.

(signature)

Head of PhD Study Department
Borisova A. S.

(signature)

1.EDUCATIONAL PROGRAMME GOAL

The goal of the PhD program is to prepare and defend a dissertation for the degree of Candidate of Sciences in the scientific specialty **1.2.1 Artifitial Intelligence and Machine Learning**.

The purpose of opening and implementing this program is the high-quality training of highly sought-after specialists who are capable of comprehensively solving problems in the development and application of artificial intelligence and machine learning systems. The program is aimed at training scientific and scientific-pedagogical personnel to create new, improve and apply existing methods and algorithms of machine learning and artificial intelligence in various areas of human activity, which will allow solving a wide range of natural science problems, from problems of optimal control to the development of approaches to creation of “strong” artificial intelligence. In addition, the goal is to orient the graduate student to the development of an academic career, maximum adaptation in the scientific environment; solving the problems of building a nationally oriented economy and forming the necessary quality of “human capital”, preparing and defending a dissertation for the scientific degree of Candidate of Sciences.

The opening of the program will increase the competitiveness of the university by training highly sought-after specialists in the field of artificial intelligence and machine learning.

2. BRIEF SUMMARY OF THE PROGRAM

The program is focused on training highly qualified specialists in training area 1.2.1. "Artificial Intelligence and Machine Learning." The curriculum is designed in such a way that it allows students to develop skills that are currently in demand. The goal of the program is to create conditions for acquiring the level of knowledge, abilities, skills, experience and experience necessary for carrying out professional activities and preparing for the defense of a scientific qualification work (dissertation) for the academic degree of Candidate of Sciences, as well as conducting scientific research in the interests of the development of science and humanity and humanitarian values. Research activities within the educational program cover the following areas of research:

1. Natural scientific foundations and methods of artificial intelligence.
2. Research in the field of assessing the quality and effectiveness of algorithmic and software solutions for artificial intelligence and machine learning systems. Methods for comparing and selecting algorithmic and software solutions under many criteria.
3. Methods and algorithms for modeling thought processes: reasoning, argumentation, recognition and classification, concept formation. Research in the field of neuromorphic methods of data analysis, simulation modeling of the structure and functions of the brain, including using machine learning methods. Neuroinformatics and methods for modeling biological nervous systems.
4. Development of methods, algorithms and creation of artificial intelligence and machine learning systems for processing and analyzing texts in natural language, for images, speech, biomedicine and other special types of data.
5. Methods and technologies for searching, acquiring and using knowledge and patterns, including empirical ones, in artificial intelligence systems. Research in the field of

joint application of machine learning methods and classical mathematical modeling. Methods and means of using expert knowledge.

6. Formalization and formulation of management problems and (support) decision-making based on artificial intelligence and machine learning systems. Development of control systems using artificial intelligence systems and machine learning methods, including control of robots, cars, UAVs, etc.

7. Development of specialized mathematical, algorithmic and software for artificial intelligence and machine learning systems. Methods and means of interaction of artificial intelligence systems with other systems and a human operator.

8. Multi-agent systems and distributed AI.

9. Methods and means of using parallel, quantum computing, etc. to solve problems of artificial intelligence and machine learning.

10. Research into ethical issues associated with the creation and implementation of AI systems, including modeling of expected social and economic consequences.

11. Research in the field of "strong AI", including the formation of a conceptual framework and elements of mathematical formalism necessary for constructing an algorithmic apparatus.

12. Research in the field of "trusted" AI-class systems, including problems of forming test samples of precedents, reliability, stability, retraining, etc.

13. Methods and means of generating data sets and precedents, including "big data", necessary for solving problems of artificial intelligence and machine learning. Problem-specific data collections for mission-critical application areas.

14. Methods and means of generating arrays of conditionally real data and precedents necessary for solving problems of artificial intelligence and machine learning.

15. Mathematical research in the field of statistics, logic, algebra, topology, function analysis and other areas, focused on solving problems of artificial intelligence and machine learning.

16. Research in the field of special optimization methods, problems of complexity and elimination of enumeration, dimension reduction.

17. Research in the field of multilayer algorithmic structures, including multilayer neural networks.

The educational program is intersectoral in nature, since the creation of new, improvement and application of existing methods and algorithms of machine learning and artificial intelligence is an urgent task in various areas of human activity: space industry, instrument engineering, traditional and nuclear energy, aircraft manufacturing, rocketry, mechanical engineering, nanotechnology, traditional and pipeline transport, industrial, civil and special construction, economics.

During the training process, graduate students receive theoretical and practical training and skills in research and scientific-pedagogical work, allowing them to work effectively after completing the educational program at enterprises in various fields and industries in leadership positions, as well as in research and educational organizations.

3. LABOR MARKET NEEDS FOR PERSONAL TRAINING IN EDUCATIONAL PROGRAMME PROFILE

Graduates who have completed this program are focused on working in Russian and international companies, enterprises, educational institutions, and research organizations in

various fields of industry related to the application and development of artificial intelligence and machine learning technologies.

The area of professional activity of graduates who have completed the postgraduate program includes the area of professional activity of graduates, which includes the areas of science, technology, technology and pedagogy, covering a set of tasks in the direction of “Computer Science and Informatics”.

In the professional sphere, the main consumers of the educational program are Russian and international enterprises such as:

- State Corporation “Roscosmos”;
- Joint Stock Company “NPO “Eshelon””;
- Kaspersky Lab;
- JSC "TsNIIMash";
- Ethiopian Institute of Space Science and Technology, Ethiopia
- Symbiosis International University, India
- Federal State Autonomous Educational Institution of Higher Education “Peoples' Friendship University of Russia”;
- Federal State Budgetary Institution of Science Institute of Management Problems named after. V. A. Trapeznikov of the Russian Academy of Sciences (IPU RAS);
- Computer center named after. A.A. Dorodnitsyn Russian Academy of Sciences Federal Research Center "Informatics and Control" of the Russian Academy of Sciences (CC RAS).

4.REQUIREMENTS FOR APPLICANTS APPLYING TO THE PHD PROGRAMME

For admission to the program, the Admission Rules apply, approved by the relevant local regulatory act and posted in the public domain on the official website of the RUDN University.

5.STRUCTURE AND WORKLOAD OF THE EDUCATIONAL PROGRAMME FOR PhD STUDIES

Structure and scope of the postgraduate program - duration of study 3 years full-time.

№	PhD programme structure	Workload, credit units
1. Scientific component		150
1.1.	Scientific activity	126
1.2.	Preparation of publications and (or) patent applications provided for in paragraph 5 of the Educational Standard of RUDN University	18

1.3.	Intermediate certification at the stages of scientific research	6
2. Educational component		24
2.1.	Disciplines (modules)	13
2.2.	Internship	5
2.3.	Intermediate certification in disciplines (modules) and practice	6
3. Final attestation Evaluation of the dissertation for compliance with established criteria		6
PhD programme workload in credit units:		180

6.CHARACTERISTICS OF EDUCATIONAL PROGRAMME GRADUATE'S PROFESSIONAL ACTIVITIES

6.1 Professional area*:*

The area of professional activity of graduates who have completed the postgraduate program includes the fields of science, technology, technology and pedagogy, covering a set of tasks in the direction of "Artificial Intelligence and Machine Learning", including knowledge-intensive high-tech industries in the space industry, instrument engineering, mechanical engineering, aircraft construction, research and analytical centers various profiles, in the socio-economic sphere - funds, insurance and management companies, financial organizations and business structures, as well as educational organizations of higher education.

The areas of focus of the Artificial Intelligence and Machine Learning PhD program include areas of science and technology where artificial intelligence and machine learning technologies can be implemented.

6.2 Objects of professional activity:

The objects of professional activity of graduates who have mastered the postgraduate program are the chosen field of scientific knowledge, as well as concepts, hypotheses, theorems, physical and mathematical models, algorithms and programs, experimental research methods, mathematical, information, technical, software for automated information, computing, design and control systems, computers, complexes, systems and networks used in machine learning and artificial intelligence.

The chosen area of scientific knowledge is artificial intelligence and machine learning.

The postgraduate program is aimed at mastering all types of professional activities for which the graduate is preparing.

When developing and implementing postgraduate programs, the scientific director of the educational program focuses on the specific type (types) of professional activity for which the graduate student is preparing, based on the needs of the labor market, the research and material and technical resources of the structural units participating in the implementation of the program.

6.3 Objectives of professional activity:

Within the framework of this area of training, the graduate student prepares for research activities in universities, research and production enterprises of any form of ownership, as well as for teaching activities in universities.

Types of professional activities for which graduates who have completed the postgraduate program are prepared:

– research activities in the fields of science and technology, in the direction of machine learning and artificial intelligence technologies;

– teaching activities in educational programs of higher education.

6.4. Objectives of the graduate's professional activity

A graduate who has completed a postgraduate program, in accordance with the types of professional activities that the educational program is focused on, is ready to solve the following professional tasks:

The objectives of the professional activity of a graduate of graduate school are:

– independent (including leading) research activities, requiring broad fundamental training in modern areas of machine learning and artificial intelligence, in-depth specialized training in the chosen direction, and proficiency in modern research methods;

– scientific and pedagogical work in higher and secondary specialized educational institutions.

7.LOCATION OF IMPLEMENTATION OF THE PHD PROGRAMME

The PhD program is implemented by the Federal State Autonomous Educational Institution of Higher Education Peoples' Friendship University of Russia named after Patrice Lumumba.

The information about partner organisations involved in the implementation of the PhD programme:

Internship and Scientific Research	Internship location
Pedagogical practice (stationary)	RUDN University, Moscow
Research activity aimed at preparing for a thesis defense (stationary)	RUDN University, Moscow

8.FEAUTURES OF EDUCATIONAL PROGRAMME IMPLEMENTATION

The PhD program is implemented with elements of DET (based on the TUIS platform).

The language of implementation of the PhD program is English.

The program is *not adapted* for teaching the disabled and people with disabilities