МОСКОВСКИЙ ГОСУДАРСТВЕННЫЙ УНИВЕРСИТЕТ
ИМЕНИ М.В. ЛОМОНОСОВА

ФАКУЛЬТЕТ ГОСУДАРСТВЕННОГО УПРАВЛЕНИЯ

**РАБОЧАЯ программа дисциплины**

**(межфакультетский курс)**

**Human-centered Artificial
Intelligence in Medicine
(*на английском языке)***

*Человеко-ориентированный искусственный интеллект в медицине*

Автор программы:

кандидат социологических наук

Ирина Викторовна Яковлева

**2024**

**Название межфакультетского курса:**

«Human-centeredArtificialIntelligenceinMedicine» («Человеко-ориентированный искусственный интеллект в медицине»);

1. **Цели и задачи межфакультетского курса:**
	1. **Цель реализации программы межфакультетского курса**

Целью дисциплины является освоение знаний в области искусственного интеллекта (ИИ) в применении к социальным наукам и наукам о здоровье.

* 1. **Задачи реализации программы межфакультетского курса**

–формирование понимания научного подхода к области ИИ;

–освоение особенностей интеграции возможностей ИИ в социальные науки и науки о здоровье, выявление потенциальных типов взаимодействия с ИИ, перспективных методов и ожидаемых результатов;

–выявление природы взаимодействия с ИИ и его условий;

–освоение особенностей применения и применимости технологий ИИ для решения задач в медицине и науках о здоровье;

–формирование умения на базовом уровне анализировать применение и применимость технологий ИИ науках о здоровье;

–овладение навыком подхода к формированию оценки преимущества применения технологии и анализпотенциальных негативных эффектов в условиях цифрового неравенства;

– формирование знаний о категорияхответственности, доверия и факторами, на него влияющимив науках о здоровье и медицине;

1. Место дисциплины в структуре ООП:
	1. МС, ИБ, ИМ, ММ, ФБ

В соответствии с Приказом МГУ № 925 от 8 сентября 2021 года «О дополнении приказа от 13 февраля 2013 года №43 «Об организации межфакультетских учебных курсов в Московском университете» освоение не менее одного межфакультетского курса по тематике искусственного интеллекта является обязательным для всех студентов Московского университета, обучающихся по очной форме».

* 1. Обязательная, по выбору (межфакультетский курс), лекции;
	2. Межфакультетский курс не предполагает предварительных знаний в предметной области;
	3. 24 часа (лекции);
	4. Промежуточная форма аттестации: зачет.
1. Формы проведения:

 – лекции (24 часа)

 – формы текущего контроля: коллоквиум, письменные работы

1. Распределение трудоемкости:

Учебно-тематический план

программы межфакультетского курса

«Human-centered Artificial Intelligence in Medicine »

(«Человеко-ориентированный искусственный интеллект в медицине»)

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| --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | Формы контроля |
|  |  |  | Трудоемкость (в ак. часах) по формам занятий и видам работ |
| № п/п | Наименование разделов и тем | Всего,час. | Аудиторная работа |  |
| лекции | Самостоятельная работа |
| 1 | 2 | 3 | 4 |  |  |
| **1** | **Foundations of Artificial intelligence** |  |
| 1.1 | Introduction to the Course. Artificial Intelligence: meanings and concepts | 6 | 4 | 1 | КО |
| 1.2 | Artificial Intelligence: application inmedicine and health sciences | 3 | 2 | 1 | КО, С |
| 1.3 | Artificial Intelligence: benefits and unintended consequences  | 6 | 4 | 2 | КО, С, К |
| **2** | **Artificial Intelligence and Decisions** |  |
| 2.1 | Machines and humans: capabilities. interactions, trends  | 3 | 2 | 1 | КО, С |
| 2.2 | Making sense of using Artificial Intelligence | 6 | 4 | 2 | КО, С, К |
| 2.3 | Social dilemmas in health care and medicine  | 3 | 2 | 1 | КО, С |
| **3** | **Artificial Intelligence and Trust as the Basic Feature** |  |
| 3.1 | Building Trust in Artificial Intelligence Applications | 3 | 2 | 1 | КО, С, К |
| 3.2 | Explainable Artificial Intelligence  | 3 | 2 | 1 | КО, С |
| 3.3 | Final Colloquium | 3 | 2 | 2 | З |
|  |  | 36 | 24 | 12 |  |

*К – контрольная работа, З – зачет, С – собеседование,*

*КО – контрольный опрос*

1. **Содержание межфакультетского курса:**

***Раздел 1Foundations of Artificial intelligence***

Тема 1: Introduction to the Course. Artificial Intelligence: meanings and concepts.

Major concepts, basic definitions, approaches to understanding the technology, Classic AI, modern AI, thought process vs behaviour definitions

Тема 2: Artificial Intelligence: application in medicine and health sciences

Field of medicine, methods of application, prospective spheres, advanced of medicine, medical decision taking, health outcomes, prospective health behavior.

Тема 3: Artificial Intelligence: benefits and unintended consequences

Human expectations in vital spheres, levels of healthcare and developments of AI, drawbacks of the technologies, techno chauvinism, overrated reliance and skill atrophy as a problem

***Раздел 2: Artificial Intelligence and Decisions***

Тема 1: Machines and humans: capabilities. interactions, trends

What machines do better; what humans do better: how to evaluate and employ. Artificial collective intelligence as a concept. AI opportunities: jobs, tasks, experiences.

Тема 2: Making sense of using Artificial Intelligence.

Analysis of the environments, expectations and possible solutions. Evaluation framework.

Тема 3: Social dilemmas in health care and medicine

‘Good choices’ and ‘bad choices’, social impact, social consequences, expectations and contradictions

***Раздел 3: Artificial Intelligence and Trust as the Basic Feature***

Тема 1: Building Trust in Artificial Intelligence Applications

Components of user trust in AI systems: competence, reliability, predictability, benevolence. Trust calibration. Basic approaches to trust building, factors of competence, trust and behavior strategies

Тема 2: Explainable Artificial Intelligence

The ways to explain AI Approaches, origins and limitations. Possibilities of explainable AI. The focus on why needs explanation and why in AI applications.

 ***FinalColloquium***

1. **Перечень компетенций, формируемых в результате освоения межфакультетского курса:**

Общенаучные компетенции, системные компетенции, профессиональные компетенции.

1. **Используемые образовательные, научно-исследовательские и научно-производственные технологии:**

**А. Образовательные технологии**

**Б. Научно-исследовательские технологии**

**X. Учебно-методическое обеспечение самостоятельной работы студентов, оценочные средства контроля успеваемости и промежуточной аттестации:**

**А. Учебно-методические рекомендации для обеспечения самостоятельной работы студентов;**

Б. Примерный список заданий для проведения текущей и промежуточной аттестации;

**Essays:**

Write up to 2,000 words on the following issue:

The tentative list of the essays:

Sum up your viewpoint in relation to the usage of AI in your daily lives and to your professional area:

You can also pay attention to the below mentioned questions to use in your description:

-How would you describe your attitude toward AI? (ranged from ‘very positive’, ‘positive’, ‘neutral, ‘negative’, ‘very negative’)

-What kind of tasks might be delegated to AI (hard, risky and etc.) in particular in your professional area?

-Do you think AI might compete with humans in your professional field? What cooperation do you expect from AI?

How would AI applications transform your professional area?

Do people still outperform machines?

What kind of professional occupation in your area are at risk of extinction and what are the new opportunities?

What emotions do you feel towards the expansions of the AI solutions in your professional field?

How do we come to see ourselves and our role in the world?

What tasks have humans started entrusting to AI?

What human qualities outperform AI? What human qualities will this age celebrate?

What are the dilemmas in the health care field that modern people face?

When should we not implement AI in medicine?

What are the major approaches to the evaluation of the efficiency of an AI solution in medicine?

2)

**Opinions exchange and understanding of the concepts**

**Written assignment and discussion preparation**

**Tentative list**

Read the questions and provide a reply:

* 1. pages (0.5 page is minimum for one question)
1. Do you feel that you need to know how the decision is taken by the artificial intelligence based technology? (You may illustrate with any example or from your professional area)
2. Does your understanding modify your attitude towards the technology? In which way?
3. Would you delegate social dilemmas to machines? Which ones?
4. Who should control the artificial intelligence based solutions? (governments, new bodies, health care ministries or even no control needed)

5) Have you used AI generative models to write this task? (explain if used (type, pros and cons and etc.), and explain if you didn’t). With a detailed explanation, both would not negatively affect your grade

3)

Write the commentaries to the following situations, 100 – 200 words each.

You can use this file as a template.

Provide your own reasons. You can also use your own examples and illustrations.

**How AI will test the principles upon which our self-understanding is grounded?**

1. What are the reasons that revolutionized the sciences?

…………your reasons and thoughts………………….

1. What is the era when reality can be predicted, simulated and approximated?

…………your reasons and thoughts………………….

1. How AI may augment human reason?

…………your reasons and thoughts………………….

**It is one thing to provide a patient with a diagnosis or prognosis, but what will the patient do with that information?**

The context:

A system needs to be in place to take care of the patient once the patient has been provided the results. Not all countries have straightforward systems to handle the medical care process. Thus, before implementing AI, there need to be clear structures and procedures regarding what the care process will look like. The patient needs to be able to act upon the provided information. Otherwise, one should consider the value of providing such info, if the patient is unable to act upon it. This is an ethical discussion.

The situations to comment on:

1. Is it valuable for a patient (and/or their loved ones) to know that they suffer from bipolar disease, as this knowledge may help them to understand their behavior?

…………your reasons and thoughts………………….

1. A patient may not want to know they suffer from cancer if there is no available treatment.

…………your reasons and thoughts………………….

1. Whereas another patient may desire the prognosis, even though it is untreatable because they want to make the most of their remaining life.

…………yourreasonsandthoughts………………….

**В. Примерный список вопросов для проведения текущей и промежуточной аттестации:**

Перечень вопросов:

1. How do we define artificial intelligence (AI)?
2. Marvin Minsky and a definition of intelligence as a ‘suitcase word’, provide the explanations.
3. Provide examples and explain the approaches within the following frames: ‘thinking humanly vs thinking rationally’.
4. What capabilities does the computer need to act ‘humanly’?
5. What is the difference between the ‘thinking humanly vs thinking rationally’ in approaches to AI?
6. What disciplines can the foundations of AI be found? Provide brief explanations.
7. What is the era when reality can be predicted, simulated and approximated?
8. What are the reasons that revolutionized the sciences?
9. How AI may augment human behavior?
10. What tasks have humans started entrusting to AI?
11. What human qualities outperform AI? What human qualities will this age celebrate?
12. How does AI challenge self-perception and interaction with machines?
13. Is sentence completion (with the usage of generative models) distinct from writing?
14. What are the major ML techniques used in the social sciences?
15. What are the major ML techniques used in the health sciences?
16. What are the concepts of interpretability, fairness, and generalizability in the social and health sciences?
17. What method would we apply to assess prevalence or distributions of variables between (social) groups, countries or geographical entities, or over time (between cohorts)?
18. How can we screen and identify individuals at risk or higher-level patterns? (provides the data and method)
19. What type of analysis is used in approaches to diseases where long-term risk prediction is relevant?
20. What are the approaches to risks identification in the health and social sciences?
21. What is the goal of a descriptive research in health sciences?
22. How the sensor data, language data and etc. can be used to detect conditions or disease?
23. What are the major distinctions between ‘digital natives’ and other generations?
24. How AI has been applied to the practice of medicine and to health care more broadly?
25. Considering the current state of progress, where is research and development most urgently needed in the field and why?
26. What are the roots of artificial intelligence in human history, before the general introduction of digital computers?
27. What are the major concepts of Classic AI and Modern AI?
28. How did computer science emerge as an academic and research discipline and how was AI identified as a component of that revolution?
29. How did a medical focus on AI applications emerge from the early general principles of the field?
30. How did the field of cognitive science influence early work on AI in Medicine (AIM) and how have those synergies evolved to the present?
31. What were the early medical applications of AI and how were they received in the clinical and medical research communities?
32. What are the Human Factors of AI in Healthcare?
33. What is a skill atrophy and how is it connected to AI methods implemented?
34. What is the safety of AI in Healthcare? What are the Technology-Induced Errors in Healthcare and AI Safety?
35. What are the limitations of ML methods in medicine?
36. What are the social challenges that we face by implementing AI in health care settings?
37. What are the approaches to the ethics of AI with considerations to privacy and safety?
38. What are the trends in quality and safety research within the healthcare field?
39. What is an adverse event and what are the ways to tackle by means of ML?
40. What is the concept of a shared decision-making?
41. What are the major domains of AI?
42. AI and reliance on data: what are the major difficulties?
43. What are the criteria that drive technology innovation?
44. Explain medicalization of life as an approach.
45. What so the terms ‘learning’ and ’intelligence’ mean in relation to AI?
46. What expectations of the past influence the present of AI?
47. What are the major ways the AI is changing healthcare and health?
48. What is an electronic health records? How do they affect the patient-provider relationship?
49. Provide a brief overview of the study of inequalities and AI.
50. What is the politics of algorithms, data and code?
51. What are the inequalities that are highly likely to be made more durable by AI?
52. AI as a social phenomenon: provide a brief overview of the wider social, cultural, economic and political conditions.
53. How could improper AI hurt health systems?
54. What are typical cybersecurity vulnerabilities due to AI implementation in healthcare?
55. What is the influence of AI on human skills?
56. What are the factors to take into account for AI application evaluation?
57. What are the ways to empower patients and caregivers by AI applications?
58. What are typical cybersecurity vulnerabilities due to AI implementation in healthcare?
59. What is the influence of AI on human skills?
60. What are the ways to empower patients and caregivers by AI applications?
61. What are major approaches to understanding health behavior? What factors does is depend on?
62. What are the approaches to analyze the trust of the Internet?
63. What are the traditional digital divide factors? Why are they included in the method?
64. What are the major characteristics and requirements of the doctor-patient communication in the XXI?
65. What are the approached to explainable AI, whom should the technology be explained?
66. What are the approached to build trust to the machines?
67. What are the typical social dilemmas in health sciences?
68. How can we define emotions by facial expressions?
69. What are the methodological issues of facial recognition?
70. What social problems can be solved by means of AI?
71. **Учебно-методическое обеспечение программы**

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| №п/п | Автор | НазваниеКниги/статьи | Отв. Редактор(для коллективных работ) | Место издания | Издательство | Года издания |
| A. |  |
| 1 |  | Artificial Intelligence in Health Care: The Hope, the Hype, the Promise, the Peril | Michael Matheny, SonooThadaneyIsrani, Mahnoor Ahmed | National Academy of Medicine, Washington | NAM.EDU | 2019 |
| 2 |  | Artificial Intelligence in Medicine | NiklasLidstroemer, HutanAshrafian | Switzerland | Springer Nature Switzerland AG | 2022 |
| 3 | Kate Crawford | Atlas of AI. Power, Politics and the Planetary Costs of Artificial Intelligence  |  |  | Yale University Press | 2021 |
| 4 | Eric Topol | Deep Medicine. How Artificial Intelligence Can Make Healthcare Human Again |  | New York | Basic Books | 2019 |
| 5 | Akshay Kore | Designing Human-Centric AI Experiences: Applied UX Design for Artificial Intelligence |  | Bengaluru | Apress | 2022 |
| Б. |  |
| 6 | Cathy O’Neil | Weapons of Math Destruction |  | New York | Crown | 2014 |
| 7 | Roger Penrose | The Emperor’s New Mind. Concerning Computers, Minds and the Laws of Physics |  |  | Oxford University Press | 2016 |
| 8 |  | Health and behavior: the interplay of biological, behavioral, and societal influences | Committee on Health and Behavior, Research, Practice, and Policy, Board on Neuroscience and Behavioral Health |  | Institute of Medicine, National Academy Press | 2001 |
| 9 |  | Hello, World: Artificial Intelligence and its Use in the Public Sector | Jamie Berryhill, KévinKokHeang, Rob Clogher, Keegan McBride |  | OECD | 2019 |
| 10 |  | The Oxford Handbook of Health Communication, Behavior Change, and Treatment Adherence | Leslie R. Martin M. Robin DiMatteo |  | Oxford University Press | 2016 |
| 11 |  | The sociology of health promotion | Robin Bunton, Sarah Nettleton, Roger Burrows |  | Routledge | 2005 |

Интернет-ресурсы:

1. Нейронные сети и их применение в научных исследованиях (МГУ): <http://msu.ai>
2. Научно-образовательные школы МГУ: <http://nosh.msu.ru>
3. Институт перспективных исследований проблем искусственного интеллекта и интеллектуальных систем МГУ имени М.В. Ломоносова: https://iai.msu.ru/
4. Фонд «Интеллект»: поддержка науки и образования по AI:

https://intellect-foundation.ru/

1. Открытый архив научных статей: <https://arxiv.org>
2. Association for the Advancement of Artificial Intelligence (AAAI): <http://aaai.org>
3. **Материально-технические условия реализации программы**
4. Аудитории для проведения лекций
5. Презентационная техника (проектор, экран, компьютер/ноутбук).
6. Для самостоятельной работы студентам необходим компьютер с выходом в Интернет. Курс может быть проведен полностью в дистанционном формате.