MASHINA O‘QITISH ALGORITMLARINI OPTIMALLASHTIRISH: SAMARADORLIK VA ANIQLIKNI OSHIRISH USULLARI.

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Annotatsiya: Mazkur maqolada mashina o‘qitish algoritmlarini optimallashtirish jarayoni ko‘rib chiqiladi. Samaradorlik va aniqlikni oshirishga qaratilgan usullar, jumladan, ma'lumotlarni oldindan tayyorlash, hiperparametrlarni sozlash, regularizatsiya texnikalari, model tanlash, hamda parallelizatsiya va GPU yordami bilan algoritmlarni tezlashtirish masalalari yoritiladi. Shu bilan birga, ensemble yondashuvlari va transfer learning usullari orqali algoritmlarni yanada samarali qilish yöllari o‘rganiladi.
Kalit so‘zlar: Mashina o‘qitish, optimallashtirish, samaradorlik, aniqlik, regularizatsiya, ensemble learning, transfer learning.

Kirish

Mashina o‘qitish (MO) algoritmlari zamonaviy texnologiyalarda muhim ahamiyatga ega bölib, ular yordamida turli sohalarda murakkab muammolarni hal qilish imkoniyati yaratiladi. Biroq, ushbu algoritmlarning ishlash samaradorligi va natijalarining aniqligi ko‘p hollarda mos ma‘lumotlar, to‘g‘ri sozlangan model va hisoblash resurslaridan unumli foydalanishga bog‘liqdir. Algoritmlarni optimallashtirish nafaqat modelni tezlashtirish, balki uning aniqligini oshirish va haddan tashqari moslashuv (overfitting) yoki noto‘g‘ri baholash (underfitting) kabi muammolarni kamaytirishga ham yordam beradi.

Ushbu maqolada mashina o‘qitish algoritmlarini optimallashtirish uchun samarali usullar tahlil qilinadi. Shuningdek, asosiy optimallashtirish texnikalari, jumladan, hiperparametrlarni sozlash, ma‘lumotlarni oldindan tayyorlash, regularizatsiya usullari, va modelni birlashtirish kabi yondashuvlar keng yoritiladi.

Asosiy qism

Ma'lumotlarni qayta ishlash va tayyorlash

Ma‘lumotlar mashina o‘qitishning eng muhim qismi hisoblanadi. Model samaradorligi ko‘pincha ma‘lumotlarning sifatiga bog‘liq bo‘ladi:

Chiqindilarni aniqlash va olib tashlash: Chiqindilar (outliers) model natijalariga salbiy ta‘sir ko‘rsatishi mumkin. Statistika usullari yoki visualizatsiya yordamida bunday qiymatlarni aniqlab, ularni olib tashlash zarur.

Bo‘sh qiymatlarni to‘ldirish: Bo‘sh (missing) qiymatlar uchun statistik usullar (masalan, o‘rtacha qiymat bilan to‘ldirish) yoki ilg‘or usullardan foydalanish mumkin.

Standartizatsiya va normalizatsiya: O‘zgaruvchilar o‘lchovlarini bir xilda bo‘lishini ta‘minlash uchun ushbu usullardan foydalaniladi. Masalan, gradient tushish algoritmlari bunday moslashtirishni talab qiladi.

Hiperparametrlarni sozlash

Mashina o‘qitish algoritmlari samaradorligi va aniqligi hiperparametrlarni to‘g‘ri tanlashga bog‘liq. Buning uchun quyidagi usullar qo‘llaniladi:

Grid Search: Har bir hiperparametr uchun mumkin bo‘lgan qiymatlarni ko‘rib chiqish orqali optimal qiymatlarni topish.

Random Search: Parametrlar uchun tasodifiy qiymatlarni tanlash orqali samaradorlikni oshirish.

Bayesian Optimization: Algoritm natijalarini iterativ baholash va parametrlarni optimallashtirish.

Regularizatsiya usullari

Regularizatsiya modelning haddan tashqari moslashuviga (overfitting) qarshi kurashda muhim ahamiyatga ega:

L1 va L2 regularizatsiya: Model parametrlariga jarima (penalti) qo‘shib, ularni soddalashtirish.

Dropout: Neyron tarmoqlarni murakkablikdan himoya qilish uchun ba‘zi tugunlarni vaqtincha o‘chirib qo‘yish.

Early Stopping: Model o‘rganish jarayonini test natijalari yomonlashishni boshlagan joyda to‘xtatish.

Modelni birlashtirish (Ensemble learning)

Bir nechta modelni birlashtirish aniqlikni oshirishda samarali usul hisoblanadi:

Bagging: Model natijalarini barqarorlashtirish uchun ma‘lumotlarning turli qismlarini o‘rgatish va natijalarni o‘rtacha olish (masalan, Random Forest).

Boosting: Kamchiliklarni bosqichma-bosqich tuzatish orqali aniqlikni oshirish (masalan, XGBoost, LightGBM).

Stacking: Turli modellar natijalarini birlashtirib yakuniy bashoratni yaxshilash.

Parallelizatsiya va samaradorlikni oshirish

GPU va bulutli hisoblash xizmatlari: Neyron tarmoqlar kabi og‘ir modellarda hisoblash tezligini oshirish uchun GPUlardan foydalanish.

Batch o‘rganish: Butun ma‘lumot o‘rniga kichik partiyalar (mini-batches) bilan ishlash orqali hisoblash jarayonini tezlashtirish.

Modelni yengillashtirish: Katta modellarni siqish (model pruning) va kvantlash (quantization) orqali ularni yengillashtirish.

Transfer learning va oldindan tayyorlangan modellar

Transfer learning murakkab modellarni qayta o‘qitish o‘rniga oldindan tayyorlangan modellarni moslashtirish imkonini beradi:

Pre-trained modellar: ResNet, BERT kabi modellarni ma‘lum bir vazifa uchun qayta ishlatish.

Embeddings: Oldindan o‘rganilgan xususiyatlarni (masalan, Word2Vec, GloVe) ishlatish orqali vaqt va resurslarni tejash.

Modelning ishlashini baholash va kuzatish

Modelni optimallashtirishda uning natijalarini to‘g‘ri baholash muhim:

Baholash mezonlari: Aniqlik, noaniqlik, F1 balli, ROC-AUC kabi mezonlardan foydalanish.

Kuzatish va yangilash: Model real ma‘lumotlar asosida muntazam kuzatilib, zarurat tug‘ilganda qayta o‘qitiladi.

Xulosa

Mashina o‘qitish algoritmlarini optimallashtirish natijadorlikni oshirish va aniqlikni ta‘minlash uchun muhim ahamiyatga ega. Ushbu maqolada ko‘rib chiqilgan yondashuvlar – ma‘lumotlarni tayyorlash, hiperparametrlarni sozlash, regularizatsiya usullari, ensemble learning va transfer learning texnikalari – algoritmlarni yanada samarali qilishga yordam beradi. Optimallashtirish jarayonida muammoning xususiyatlarini inobatga olish va to‘g‘ri texnologiyalarni tanlash muhimdir. Texnik yondashuvlarni birlashtirib, real dunyo vazifalarida yuqori samaradorlikka erishish mumkin.

FOYDALANILGAN ADABIYOTLAR:

1. Jalolov, T. S. (2023). STUDY THE PSYCHOLOGY OF PROGRAMMERS. American Journal of Public Diplomacy and International Studies (2993-2157), 1(10), 563-568.
2. Sadriddinovich, J. T. (2023). Capabilities of SPSS software in high volume data processing testing. American Journal of Public Diplomacy and International Studies (2993-2157), 1(9), 82-86.
3. Жуков, Д. С. (2020). Создание программы для имитации шифрования машины Enigma на языке Python. Постулат, (1 январь).
4. Jalolov, T. S., & Usmonov, A. U. (2021). “AQLLI ISSIQXONA” BOSHQARISH TIZIMINI MODELLASHTIRISH VA TADQIQ QILISH. Экономика и социум, (9 (88)), 74-77.
5. Jalolov, T. S. (2024). ANALYSIS OF PSYCHOLOGICAL DATA USING SPSS PROGRAM. Multidisciplinary Journal of Science and Technology, 4(4), 477-482.
6. Жалолов, Т. (2023). Использование математических методов в психологических данных (с использованием программного обеспечения SPSS). in Library, 4(4), 359-363.
7. Jalolov, T. S. (2024). ANALYSIS OF PSYCHOLOGICAL DATA USING SPSS PROGRAM. Multidisciplinary Journal of Science and Technology, 4(4), 477-482.
8. Sadriddinovich, J. T. (2024). BASICS OF PSYCHOLOGICAL SERVICE. PSIXOLOGIYA VA SOTSIOLOGIYA ILMIY JURNALI, 2(4), 61-67.
9. Jalolov, T. S. (2024). РАЗВИТИЕ ТВОРЧЕСКОГО МЫШЛЕНИЯ УЧАЩИХСЯ МЛАДШИХ КЛАССОВ С ПОМОЩЬЮ МУЛЬТИМЕДИЙНЫХ ТЕХНОЛОГИЙ. MASTERS, 2(5), 40-47.
10. Jalolov, T. S. (2024). SPSS DASTURI FOYDALANISHDA PSIXOLOGIK MA'LUMOTLARNI TAHLILI. Multidisciplinary Journal of Science and Technology, 4(4), 463-469.
11. Jalolov, T. S. (2024). PYTHONNING MATEMATIK KUTUBXONALARINI O'RGANISH: KENG QAMROVLI QO'LLANMA. BIOLOGIYA VA KIMYO FANLARI ILMIY JURNALI, 2(5), 71-77.
12. Jalolov, T. S. (2023). PARALLEL PROGRAMMING IN PYTHON. TECHNICAL SCIENCE RESEARCH IN UZBEKISTAN, 1(5), 178-183.
13. Jalolov, T. S. (2024). ПОРЯДОК СОЗДАНИЯ ПСИХОЛОГИЧЕСКИХ ТЕСТОВЫХ ПРОГРАММ. PEDAGOG, 7(6), 145-152.

14. Jalolov, T. S. (2024). BOSHLANG'ICH SINF O'QUVCHILARIDA MULTIMEDIA TEXNOLOGIYALARI ORQALI IJODIY FIKRLASHNI KUCHAYTIRISH. BIOLOGIYA VA KIMYO FANLARI ILMIY JURNALI, 2(5), 64-70.
15. Jalolov, T. S. (2023). PYTHON DASTUR TILIDADA WEB-ILOVALAR ISHLAB CHIQISH. TECHNICAL SCIENCE RESEARCH IN UZBEKISTAN, 1(5), 160-166.
16. Jalolov, T. S. (2024). ENHANCING CREATIVE THINKING IN ELEMENTARY SCHOOL STUDENTS THROUGH MULTIMEDIA TECHNOLOGIES. WORLD OF SCIENCE, 7(5), 114-120.
17. Jalolov, T. S. (2024). ВАЖНОСТЬ АНГЛИЙСКОГО ЯЗЫКА В ПРОГРАММИРОВАНИИ. MASTERS, 2(5), 55-61.
18. Jalolov, T. S. (2023). MATH MODULES IN C++ PROGRAMMING LANGUAGE. Journal of Universal Science Research, 1(12), 834-838.
19. Jalolov, T. S. (2024). EXPLORING THE MATHEMATICAL LIBRARIES OF PYTHON: A COMPREHENSIVE GUIDE. WORLD OF SCIENCE, 7(5), 121-127.
20. Jalolov, T. S. (2024). THE IMPORTANCE OF ENGLISH IN PROGRAMMING. WORLD OF SCIENCE, 7(5), 128-134.
21. Jalolov, T. S. (2024). ИЗУЧЕНИЕ МАТЕМАТИЧЕСКИХ БИБЛИОТЕК PYTHON: ПОДРОБНОЕ РУКОВОДСТВО. MASTERS, 2(5), 48-54.
22. Jalolov, T. S. (2023). PYTHON INSTRUMENTLARI BILAN KATTA MA'LUMOTLARNI QAYTA ISHLASH. Educational Research in Universal Sciences, 2(11 SPECIAL), 320-322.
23. Jalolov, T. S. (2024). DASTURLASHDA INGLIZ TILINING AHAMIYATI. BIOLOGIYA VA KIMYO FANLARI ILMIY JURNALI, 2(5), 78-84.
24. Jalolov, T. S. (2023). Artificial intelligence python (PYTORCH). Oriental Journal of Academic and Multidisciplinary Research, 1(3), 123-126.
25. Jalolov, T. S. (2023). WORKING WITH MATHEMATICAL FUNCTIONS IN PYTHON. TECHNICAL SCIENCE RESEARCH IN UZBEKISTAN, 1(5), 172-177.
26. Jalolov, T. S. (2023). SPSS YOKI IJTIMOIY FANLAR UCHUN STATISTIK PAKET BILAN PSIXOLOGIK MA'LUMOTLARNI QAYTA ISHLASH. Journal of Universal Science Research, 1(12), 207-215.
27. Jalolov, T. S. (2023). Solving Complex Problems in Python. American Journal of Language, Literacy and Learning in STEM Education (2993-2769), 1(9), 481-484.
28. Sadriddinovich, J. T. (2023). IDENTIFYING THE POSITIVE EFFECTS OF PSYCHOLOGICAL AND SOCIAL WORK FACTORS BETWEEN INDIVIDUALS AND DEPARTMENTS THROUGH SPSS SOFTWARE. In INTERNATIONAL SCIENTIFIC RESEARCH CONFERENCE (Vol. 2, No. 18, pp. 150-153).
29. Jalolov, T. (2023). UNDERSTANDING THE ROLE OF ATTENTION AND CONSCIOUSNESS IN COGNITIVE PSYCHOLOGY. Journal of Universal Science Research, 1(12), 839-843.
30. Jalolov, T. S. (2023). SUN'IY INTELLEKTDA PYTHONNING (PYTORCH) KUTUBXONASIDAN FOYDALANISH. TECHNICAL SCIENCE RESEARCH IN UZBEKISTAN, 1(5), 167-171.
31. Jalolov, T. S. (2023). PYTHON TILINING AFZALLIKLARI VA KAMCHILIKLARI. TECHNICAL SCIENCE RESEARCH IN UZBEKISTAN, 1(5), 153-159.

32. Sadriddinovich, J. T. (2024). ANALYSIS OF PSYCHOLOGICAL DATA IN ADOLESCENTS USING SPSS PROGRAM. PEDAGOG, 7(4), 266-272.
33. Jalolov, T. S. (2023). TEACHING THE BASICS OF PYTHON PROGRAMMING. International Multidisciplinary Journal for Research & Development, 10(11).
34. Jalolov, T. S. (2023). THE MECHANISMS OF USING MATHEMATICAL STATISTICAL ANALYSIS METHODS IN PSYCHOLOGY. TECHNICAL SCIENCE RESEARCH IN UZBEKISTAN, 1(5), 138-144.
35. Jalolov, T. S. (2024). PYTHONDA MATEMATIK STATISTIK TAHLIL HAQIDA. WORLD OF SCIENCE, 7(5), 583-590.
36. Jalolov, T. S. (2024). DJANGO'S ROLE IN WEB PROGRAMMING. MASTERS, 2(5), 129-135.
37. Jalolov, T. S. (2024). PYTHON LIBRARIES IN HIGH VOLUME DATA PROCESSING. WORLD OF SCIENCE, 7(5), 561-567.
38. Jalolov, T. S. (2024). ИСПОЛЬЗОВАНИЕ API В PYTHON: ПОДРОБНОЕ РУКОВОДСТВО. WORLD OF SCIENCE, 7(5), 553-560.
39. Jalolov, T. S. (2024). МАТЕМАТИЧЕСКОМ СТАТИСТИЧЕСКОМ АНАЛИЗЕ В PYTHON. MASTERS, 2(5), 151-158.
40. Jalolov, T. S. (2024). LEVERAGING APIS IN PYTHON: A COMPREHENSIVE GUIDE. WORLD OF SCIENCE, 7(5), 544-552.
41. Jalolov, T. S. (2024). DJANGONING VEB-DASTURLASHDAGI ROLI. WORLD OF SCIENCE, 7(5), 576-582.
42. Jalolov, T. S. (2024). PYTHON-DA API-LARDAN FOYDALANISH: KENG QAMROVLI QO'LLANMA. MASTERS, 2(5), 113-120.
43. Jalolov, T. S. (2024). YUQORI HAJMLI MA'LUMOTLARNI QAYTA ISHLASHDA PYTHON KUTUBXONALARI. MASTERS, 2(5), 121-128.
44. Jalolov, T. S. (2024). DJANGO В ВЕБ-ПРОГРАММИРОВАНИИ. MASTERS, 2(5), 136-142.
45. Jalolov, T. S. (2023). ADVANTAGES OF DJANGO FEMWORKER. International Multidisciplinary Journal for Research & Development, 10(12).
46. Jalolov, T. S. (2023). Programming languages, their types and basics. Technical science research in Uzbekistan, 1(5), 145-152.
47. Jalolov, T. S. (2023). PEDAGOGICAL-PSYCHOLOGICAL FOUNDATIONS OF DATA PROCESSING USING THE SPSS PROGRAM. INNOVATIVE DEVELOPMENTS AND RESEARCH IN EDUCATION, 2(23), 220-223.
48. Jalolov, T. S. (2023). Programming languages, their types and basics. Technical science research in Uzbekistan, 1(5), 145-152.
49. Jalolov, T. S. (2024). ЗНАЧЕНИЕ ИНФОРМАЦИОННОЙ КОММУНИКАЦИИ В ВЫСШЕМ ОБРАЗОВАНИИ. MASTERS, 2(8), 1-7.
50. Jalolov, T. S. (2024). SPSS S DASTURIDAN PSIXOLOGIK MA'LUMOTLARNI TAHLILIDA FOYDALANISH. MASTERS, 2(8), 8-14.
51. Jalolov, T. S. (2024). OLIY TA'LIMDA AXBOROT MUMKINASINING AHAMIYATI. PSIXOLOGIYA VA SOTSIOLOGIYA ILMIY JURNALI, 2(7), 21-26.
52. Jalolov, T. S. (2024). USE OF SPSS SOFTWARE IN PSYCHOLOGICAL DATA ANALYSIS. PSIXOLOGIYA VA SOTSIOLOGIYA ILMIY JURNALI, 2(7), 1-6.

53. Jalolov, T. S. (2024). THE IMPORTANCE OF INFORMATION COMMUNICATION IN HIGHER EDUCATION. WORLD OF SCIENCE, 7(8), 14-19.
54. Jalolov, T. S. (2024). ИСПОЛЬЗОВАНИЕ ПРОГРАММНОГО ОБЕСПЕЧЕНИЯ SPSS В АНАЛИЗЕ ПСИХОЛОГИЧЕСКИХ ДАННЫХ. WORLD OF SCIENCE, 7(8), 20-26.
55. Jalolov, T. S. (2024). MATHEMATICAL STATISTICAL ANALYSIS IN PYTHON. MASTERS, 2(5), 143-150.
56. Jalolov, T. S. (2024). БИБЛИОТЕКИ PYTHON ДЛЯ ОБРАБОТКИ БОЛЬШИХ ОБЪЕМОВ ДАННЫХ. WORLD OF SCIENCE, 7(5), 568-575.
57. Jalolov, T., & Ramazonov, J. (2024). GRASS ERASING ROBOT. Multidisciplinary Journal of Science and Technology, 4(2), 173-177.
58. Jalolov, T. (2024). FRONTEND AND BACKEND DEVELOPER DIFFERENCE AND ADVANTAGES. Multidisciplinary Journal of Science and Technology, 4(2), 178-179.
59. Sadriddinovich, J. T., & Abdurasul o'g'li, R. J. (2024). UNIVERSAL ROBOTLASHTIRILGAN QURILMA. BIOLOGIYA VA KIMYO FANLARI ILMIY JURNALI, 2(9), 78-80.
60. Sadriddinovich, J. T., & Abdurasul o'g'li, R. J. (2024). SHIFOXONADA XIZMAT KO'RSATISH UCHUN MO'LJALLANGAN AQILLI SHIFOKOR ROBOT. THEORY AND ANALYTICAL ASPECTS OF RECENT RESEARCH, 3(26), 318-324.
61. Sadriddinovich, J. T., & Abdurasulovich, R. J. (2024). INTRODUCTION TO PYTHON'S ROLE IN ROBOTICS. PEDAGOGICAL SCIENCES AND TEACHING METHODS, 3(34), 202-204.
62. Sadriddinovich, J. T., & Muhiddinovna, M. M. (2024). BACKEND HAQIDA MA'LUMOT. FORMATION OF PSYCHOLOGY AND PEDAGOGY AS INTERDISCIPLINARY SCIENCES, 3(30), 34-37.
63. Sadriddinovich, J. T., & Muhiddinovna, M. M. (2024). WEB PROGRAMMING INFORMATION. SUSTAINABILITY OF EDUCATION, SOCIO-ECONOMIC SCIENCE THEORY, 2(19), 232-234.