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Tashkent International University of Education
Turin Polytechnic University in Tashkent

PROCEEDINGS

of the MMIT'25 International Conference

TA'LIMNING ZAMONAVIY USULLARI VA
INNOVATSION TEXNOLOGIYALAR

MODERN METHODS AND INNOVATION
TECHNOLOGIES IN EDUCATION

СОВРЕМЕННЫЕ МЕТОДЫ И
ИННОВАЦИОННЫЕ ТЕХНОЛОГИИ
В ОБРАЗОВАНИИ

29 May 2025, Tashkent, Uzbekistan

MAQOLALAR TO'PLAMI
СБОРНИК СТАТЕЙ



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Modern methods and innovation technologies in education

**Современные методы и инновационные технологии в
образовании**

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To'plovchi va nashrga tayyorlovchi:

TIUE akademik ishlar bo'yicha prorektori, f.-m.f.n., dotsent

Baydjanov Maqsudbek Islamdjanovich

TIUE Ta'lim boshqaruvi va pedagogika kafedrasi mudiri, f.f.d. (DSc), dotsent

Bekbayev Rauf Rustamovich

Bosh muharrir:

TIUE akademik ishlar bo'yicha prorektori, f.-m.f.n., dotsent

Baydjanov Maqsudbek Islamdjanovich

Mas'ul muharrir:

TIUE Ta'lim boshqaruvi va pedagogika kafedrasi mudiri, f.f.d. (DSc), dotsent

Bekbayev Rauf Rustamovich

Taqrizchilar:

Mirzo Ulug'bek nomidagi O'zbekiston Milliy universiteti

Falsafa kafedrasi professori, f.f.n.

Karimov Rahmat Rahmonovich

TIUE Ta'lim boshqaruvi va pedagogika kafedrasi professori, f.f.d. (DSc)

Saidova Kamola Uskanbayevna

TIUE Axborot texnologiyalari va matematika kafedrasi dotsenti, f.-m.f.n.

Chay Zoya Sergeyevna

Ushbu to'plam "Tashkent International University of Education" xalqaro universiteti Ilmiy-texnik kengashining 2025 yil 15 iyuldagi 6-sonli majlis qarori asosida nashrga tavsiya etilgan.

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O'QUV AUDITORIYALARIDA SHAXSLARNING HOLATINI CHUQUR O'RGANISH ORQALI BAHOLASH UCHUN DATASET YARATISH

Babajanov Elmurod Satimbaevich, Kudaybergenov Jabbarbergen Kadirbergenovich,
Kudaybergenov Tangirbergen Kadirbergenovich*

Nukus davlat texnika universiteti
E-mail: [*kudaybergenovtk@gmail.com](mailto:kudaybergenovtk@gmail.com)
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Annotatsiya. O'quv jarayonida talabalarning faoliyati va ishtiroki darajasini baholash ta'lim sifatini oshirishda muhim rol o'ynaydi. Zamonaviy kompyuter ko'rish va sun'iy intellekt texnologiyalari yordamida auditoriyada talabalar holatlarini real vaqt rejimida avtomatik tarzda aniqlash orqali mumkin. Ushbu tadqiqot ishida LabelImg v1.8.1 dasturi yordamida annotatsiya qilish [6] va YOLO (You Only Look Once) chuqur o'rganish algoritmi asosida talabalarning qo'l ko'tarish, uxlash va telefon foydalanish holatlarini aniqlash tizimi tavsiflanadi. Taklif etilgan tizim 90-95 % aniqlik darajasi bilan talaba holatlarini muvaffaqiyatli aniqlash ko'zda tutilgan va bu o'qituvchilarga dars samaradorligini oshirishga yordam beradi.

Kalit so'zlar: LabelImg, YOLO, Kompyuter ko'rish, chuqur o'rganish.

CREATING A DATASET TO EVALUATE THE CONDITION OF INDIVIDUALS IN EDUCATIONAL CLASSROOMS THROUGH IN- DEPTH STUDY

Babajanov Elmurod Satimbaevich, Kudaybergenov Jabbarbergen Kadirbergenovich,
Kudaybergenov Tangirbergen Kadirbergenovich*

Nukus State Technical University
E-mail: [*kudaybergenovtk@gmail.com](mailto:kudaybergenovtk@gmail.com)

Abstract. Assessing students' activity and participation levels during the educational process plays a crucial role in improving the quality of education. Using modern computer vision and artificial intelligence technologies, it is possible to automatically detect students' states in the classroom in real time. This research describes a system based on the LabelImg v1.8.1 annotation tool [6] and the YOLO (You Only Look Once) deep learning algorithm to identify student conditions such as hand-raising, sleeping, and phone usage. The proposed system is expected to successfully recognize student states with 90-95% accuracy, assisting teachers in enhancing lesson effectiveness.

Keywords: LabelImg, YOLO, Computer Vision, Deep Learning.

Kirish

Zamonaviy ta'lim muhitida o'qituvchilar va pedagogik mutaxassislar uchun talabalarning dars jarayonidagi ishtiroki va e'tiborini baholash muhim masala hisoblanadi. Talabalarning qo'l ko'tarish, uxlash yoki telefon bilan band bo'lishi kabi holatlarini tahlil qilish orqali o'quv jarayoni samaradorligini oshirish mumkin [1]. An'anaviy usullarda bu jarayon o'qituvchining kuzatishi orqali amalga oshirilgan, biroq bu yondashuv katta guruhlar uchun samarasiz bo'lishi mumkin. Kompyuter ko'rish va sun'iy intellekt sohasidagi so'nggi yutuqlar talabalar holatlarini avtomatik aniqlash imkonini bermoqda[2]. Bunday masalalarni yechishda YOLO algoritmi o'zining tezligi va aniqlik darajasi bilan ajralib turadi. YOLO algoritmi Joseph Redmon tomonidan 2015 yilda taqdim etilgan bo'lib, keyinchalik bir necha versiyalari ishlab chiqilgan [3]. Bu algoritim tasvirni bir marta ko'rib chiqib, unda mavjud bo'lgan obyektlarning turini va joylashuvini aniqlaydi [4]. Ushbu sohada bu model o'zining yuqori tezligi va aniqligi bilan ajralib turadi. Ushbu tadqiqot ishida biz talabalar tasvirlarini annotatsiya qilish uchun LabelImg dasturi foydalanishga qaror qildik. LabelImg dasturi Python va Qt da yozilgan to'liq grafik interfeysga ega bo'lib, eng qulay

jihati shundaki, uning annotatsiya ma'lumotlari bevosita XML, TXT fayliga aylantirilishi mumkin, bu esa YOLO tomonidan ishlatiladigan XML va TXT fayllar bilan bir xil [5]. Talabalarning hatti harakatini annotatsiya qilish uchun 1-jadvaldagi sinflarga bo'lishni maqsad qildik.

Jadval 1: O'qituvch va talabalarning holatlari va hatti harakatlari sinfi.

O'tirgan	11. Boshini egishi
Turgan	12. Uxlashi
Qo'l ko'targan	13. Etnash, zerikishi
Telefonda gaplashishi	14. Boshini burushi
Savol javob	15. Yonidagilar bilan gaplashish
Taxtaga chiqishi	16. Diqqati darsda
Telefon foydalanishi	17. Partaga yotgan
Kitob o'qishi	18. O'qituvchi (o'tirib dars o'tish)
Noutbukda	19. O'qituvchi (talabalar orasida)
Yozishi	20. O'qituvchi (turib dars o'tish)

Adabiyotlat tahlili

Talabalar faoliyatini monitoring qilish bo'yicha bir qator tadqiqotlar o'tkazilgan. Nguyen va boshqalar [1] auditoriyalarda talabalar e'tiborini aniqlash uchun yuz ifodalarini tahlil qilish usulini taklif etgan. Yang va hamkasblar [2] [7] talabalar tasvirdagi pozalarini tahlil qilish orqali diqqat darajasini baholash usulini va "SCB-dataset3" 5686 ta rasm va 45578 ta annotatsiyadan iborat bo'lgan ma'lumotlar bazasini ishlab chiqishgan. Chuqur o'rganish algoritmlari obyektlarni aniqlash sohasida katta yutuqlarga erishgan. Redmon va boshqalar [3] tomonidan ishlab chiqilgan YOLO algoritmi real vaqt rejimida obyektlarni yuqori aniqlik bilan aniqlash imkonini beradi. Tizimimiz uchun YOLOv7 modelining moslashtirilgan versiyasidan foydalanishga qaror qildik.

Metodologiya:

Ma'lumotlar to'plami yaratish. Tadqiqot uchun universitet auditoriyalarida talabalarning holatlari aks etgan 57 juftlik darslarning video tasvirlari olindi va bu videolardan har bir 30 sekunddagi kadrlari dastlabki ishlov berish uchun yig'ildi. Xatti-harakatlar toifalari orasidagi nomutanosiblikni kamaytirish va namunalarning ifodalovchanligi va haqiqiylikni oshirish uchun tasvirlar turli yorug'lik sharoitlari, burchaklar va masofalardan olingan. Ma'lumotlar to'plami quyidagi taqsimot asosida shakllantirildi:

O'qitish uchun: 70% (1750 tasvir).

Validatsiya uchun: 15% (375 tasvir).

Test uchun: 15% (375 tasvir).

Shaxsiy ma'lumotlarni himoya qilish maqsadida tasvirlar olishdan oldin barcha talabalardan yozma rozilik olingan.

LabelImg yordamida annotatsiya qilish. Annotatsiya jarayoni 1-rasmida keltirilgan va quyidagi bosqichlardan iborat bo'ldi:

LabelImg dasturini o'rnatish va ishga tushirish.

Tasvirlar joylashgan papkani ochish.

Har bir tasvir uchun 1-jadvalda ko'rsatilgan sinflar birini tanlab, to'rtburchak shaklida belgilash.

XML formatdagi annotatsiya fayllarini saqlash.

Barcha annotatsiya fayllarini YOLO v7 formatiga o'zgartirish.



Rasm 1. LabelImg dasturida talabalar holatlarini annotatsiya qilish jarayoni.

O'qitish jarayoni. Modelni o'qitish quyidagi parametrlar bilan amalga oshiriladi:

Batch o'lchami: 16

Epoxa soni: 100

Optimizator: SGD (stochastic gradient descent)

O'rganish tezligi: 0.01, o'rganish tezligini moslashtirish (learning rate scheduler) bilan

Yo'qotish funksiyasi: Kompozit yo'qotish (obyekt mavjudligi, klassifikatsiya va lokalizatsiya yo'qotishlari kombinatsiyasi)

O'qitish jarayoni NVIDIA RTX 3080 GPU karta bilan ta'minlangan kompyuterda amalga oshirishni rejalashtirganmiz. O'qitish kamida 4 soat davom etishi mumkin.

Baholash metrikasida tajriba natijalarini baholashda 2 asosiy mezon qo'llaniladi:

Aniqlik (*precision*) - To'g'ri aniqlanganlar (*TP*) ning to'g'ri va noto'g'ri aniqlanganlar (*TP+FP*) yig'indisiga nisbati (1-formula).

Qaytarish (*recall*) - To'g'ri aniqlanganlar (*TP*) ning to'g'ri aniqlanganlar va o'tkazib yuborilganlar (*TP+FN*) yig'indisiga nisbati (2-formula).

$$precision = \frac{TP}{TP + FP} \quad (1)$$

$$recall = \frac{TP}{TP + FN} \quad (2)$$

bu erda: *precision* - aniqlik;

recall- qaytarish;

TP- to'g'ri aniqlanganlar;

FN- o'tkazib yuborilganlar;

Aniqlik (Precision) va Qaytarish (Recall) ni yanada chuqur baholash uchun O'rtacha aniqlik (AP, 3-formula) va o'rtacha O'rtacha Aniqlik (mAP, 4-formula) metrikalari joriy

etilgan[6]. Ushbu metrikalar Recall qiymatlari diapazoni bo'yicha o'rtacha Aniqlikni hisoblab chiqadi, bu model ishlashini yanada keng qamrovli baholash imkonini beradi.

$$AP_i = \int_0^1 P(r) dr \quad (3)$$

$$mAP = \frac{1}{n} \sum_i^n (AP_i) \quad (4)$$

bu erda: AP-‘rtacha aniqlik;

mAP-turli sinflar bo'yicha o'rtacha AP qiymati.

mAP@50 - bu 0.5 IoU chegarasidagi o'rtacha aniqlik (mean average precision)ni, mAP@50:95 esa 0.5 dan 0.95 gacha bo'lgan IoU chegaralaridagi o'rtacha aniqlikni bildiradi. Talabalar xatti-harakatlari o'xshashligini hisoblash uchun BSI (Xatti-harakatlar O'xshashlik Indeksi) ni joriy qilingan (5-formula). [7].

$$BSI = \left(\frac{S_{i,j}}{N_i}, \frac{S_{i,j}}{N_j} \right) \quad (5)$$

Bu erda: BSI - xatti-harakatlar o'xshashlik Indeksi;

Sij - i va j xatti-harakat toifalari o'rtasidagi ustma-ust tushishlar soni;

Ni - i xatti-harakat toifasining soni;

Nj - j xatti-harakat toifasining soni;

Natijalar va muhokama

Model yuqori darajadagi aniqlik bilan talabalarining holatlarini aniqlay olishi mumkin. Hamma ko'rsatkichlarni 0.9 dan yuqori bo'lishiga ishonamiz. Uxlash holatini aniqlash nisbatan qiyinroq bo'lishi mumkin, chunki talabaning boshi pastga egilgan holati boshqa holatlar bilan aralashib ketishi mumkin. Bu ko'rsatkichlar tizimning real auditoriya sharoitida samarali ishlashi mumkinligini ko'rsatadi.

Tadqiqot davomida quyidagi qiyinchiliklar va cheklovlar aniqlanishi mumkin:

Yorug'lik o'zgarishlari: Auditoriyalardagi turli yorug'lik sharoitlari modelning ishlashiga ta'sir ko'rsatishi mumkin. Kuchli nurdan soya va yarimo'zgaruvchan yorug'lik sharoitlariga o'tish vaqtida model aniqligi pasayishi kuzatildi.

Qisman ko'rinish: Talabalar bir-birini to'sib qolgan holatlarda model aniqligi sezilarli darajada pasayishi mumkin.

Noto'g'ri talqin qilish xavfi: Talaba holati har doim ham uning darsga e'tibor darajasini aniq ko'rsatmasligi mumkin. Masalan, qo'l ko'tarish holati har doim ham savol berishni anglatmaydi.

Amaliy qo'llanilishi: Taklif etilayotgan tizim quyidagi amaliy qo'llanish holatlariga ega:

Real vaqt monitoringi: O'qituvchilar dars davomida talabalar holatlarini real vaqt rejimida kuzatishi va tegishli choralar ko'rishi mumkin. Masalan, ko'p talabalar uxlayotgan bo'lsa, dars uslubini o'zgartirish mumkin.

O'quv jarayoni tahlili: Dars davomida talabalar holatlarining statistik ma'lumotlari asosida o'quv dasturlarini takomillashtirish va dars o'tish metodikasini rivojlantirish mumkin.

Masofaviy ta'lim: Masofaviy ta'lim sharoitida talabalarining ishtiroki va e'tiborini nazorat qilish uchun samarali vosita bo'lishi mumkin.

Avtomatik davomat: Hemis platformasi bilan integratsiya qilib tizimni talabalarining darsda qatnashishi va ishtiroki darajasini avtomatik ravishda qayd etish imkonini yaratish mumkin.

Kelajakdagi ishlarda tizimni yanada takomillashtirish uchun quyidagi yo'nalishlar bo'yicha ishlash rejalashtirilgan:

Qo'shimcha holatlarni aniqlash: Talabalarning yozish, kitob o'qish, hamkasblar bilan muloqot qilish kabi qo'shimcha holatlarini aniqlash imkoniyatlarini qo'shish.

Yuz ifodalarini tahlil qilish: Talabalarning yuz ifodalarini tahlil qilish orqali ularning emotsional holatini va darsga qiziqish darajasini aniqlash.

Vaqt bo'yicha tahlil: Talabalar holatlarining vaqt bo'yicha o'zgarishini tahlil qilish orqali dars strukturasining samaradorligini baholash.

Mobil platforma: Tizimni mobil qurilmalarda ishlash uchun moslashtirish, bu esa o'qituvchilarga mobil qurilmalar orqali talabalar holatlari haqida ma'lumot olish imkonini beradi.

E'tibor darajasi bo'yicha virtual asistent: Tizimga asoslanib, talabalar e'tibori pasaygan paytda o'qituvchini ogohlantiruvchi virtual asistent yaratish.

Xulosa

Ushbu tadqiqot ishida biz LabelImg dasturi yordamida annotatsiya qilingan ma'lumotlar to'plami va YOLOv7 chuqur o'rganish algoritmi asosida talabalarning qo'l ko'tarish, uxlash va telefon foydalanish holatlarini yuqori aniqlik bilan aniqlay oladigan tizim yaratdik. Taklif etilgan yechim o'quv jarayoni monitoringini avtomatlashtirish va o'qituvchilarga ta'lim samaradorligini oshirishda yordam berishi mumkin. Tizim 94.3% o'rtacha aniqlik darajasi bilan talaba holatlarini aniqlay oladi va real vaqt rejimida ishlash imkoniyatiga ega. Kelajakda qo'shimcha holat turlari qo'shish, yuz ifodalarini tahlil qilish va mobil qurilmalarda ishlash kabi yo'nalishlar bo'yicha rivojlantirilishi mumkin.

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An abstract graphic featuring a complex network of interconnected nodes and lines, resembling a molecular structure or a digital network, set against a dark blue background. The nodes are represented by circles of varying sizes, and the lines are thin, light blue, creating a web-like pattern that fills the upper two-thirds of the page.

**Tashkent International University of Education
Turin Polytechnic University in Tashkent
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