Project: GDPR & AI Act Compliance Checker Dashboard for Healthcare Projects

Supervisor: Dr. Anuradha Kar

Description:

This project aims to develop an AI-powered compliance assistant that helps organizations working with healthcare data ensure adherence to the GDPR (General Data Protection Regulation) and the EU AI Act. The system will be based on an AI based information retrieval system that is built as an interactive dashboard, powered by advanced generative AI, capable of analyzing policies, contracts, and project documentation. It will detect compliance gaps, highlight potential regulatory risks, and classify AI systems according to risk categories following existing regulatory acts and documents.

Healthcare Use Case Example:

Imagine a hospital developing an AI model to predict patient readmission risks using Electronic Health Records (EHRs). Before deployment, the compliance assistant can:

- Verify whether patient data is properly anonymized and is compliant withGDPR standards.
- Assess whether the AI system falls under the EU AI Act's high-risk category (e.g., medical decision support).
- Generate a clear compliance report for hospital administrators, auditors, and regulators with identified risks (e.g. data retention issues or algorithmic bias) and mitigation steps.

By producing human-readable reports, the tool will support healthcare organizations in fostering transparency, accountability, and trust in their AI systems.

Objectives:

- Develop a Gen AI based information retrieval system that can detect and flag regulatory risks in healthcare AI projects, covering data processing, model design, and deployment pipelines.
- Generate a compliance reporting dashboard that will provide context-specific recommendations aligned with evolving regulations in the healthcare domain.

Deliverable: 1) A literature survey on state of the art information retrieval frameworks like RAG and its variants that can be used to investigate compliance and regulatory literature in healthcare 2) A visual, interactive dashboard backed by generative AI that displays compliance status of healthcare AI projects, identified risks and severity levels, recommended mitigation strategies tailored to healthcare use cases.

Required Skills / Prerequisites: Strong background in machine learning and deep learning.Introductory knowledge of compliance frameworks such as GDPR and the EU AI Act.

Project title : State of the art climate prediction at a local scale

Supervisor : Emile Egreteau-Druet & Dr. Doreid Ammar

Groups: 2 (one will work on temperature and the other on precipitations)

Brief description :

One of today's major challenges is predicting the future climate in order to help organisations plan for it. The aim of this project is to use cutting-edge models to predict how the climate will evolve in France. In the context of global warming, we use global climate models (GCMs), which are physical models based on hypotheses about future sustainability policies. These results are then used by regional climate models (RCMs) to make predictions on a European scale. To obtain localised predictions for France, we employ bias correction and statistical downscaling methods. These methods correct errors in predictions from known periods and apply these corrections to future predictions. Bias corrections to historical data are mandatory for every climate model since they are the only way to ensure the validity of future predictions.

Starting from the results of the RCM, you will use the bias correction and statistical downscaling methods to compute predictions in an 8 km grid. This project will rely on a recent dataset that reflects the uncertainty in our knowledge about historical climate. First, you will use machine learning models such as k-nearest neighbours, random forest or support vector machines; then, you will use a model from a scientific publication.

Expected outcomes : Temperature and precipitation with the best resolution possible in France or one of its regions.

Required skills or prerequisites : Machine learning, Deep learning, need access to Aivancity's server or computation times will be unbearable

Project Title: Federated Learning in Multi-Agent Systems: Challenges and Opportunities

Supervisor : Dr**.** Etienne Mauffret

Brief description :

Federated learning (FL) is a distributed machine learning paradigm that enables collaborative model training across decentralized clients without sharing raw data. This design preserves privacy and ensures compliance with data protection regulations such as GDPR and HIPAA. However, FL introduces challenges such as communication inefficiency, statistical heterogeneity of data (non-IID distributions), system heterogeneity (varying computing resources, unreliable networks), and vulnerability to adversarial attacks.

Multi-agent systems (MAS), composed of autonomous agents interacting in shared environments, increasingly rely on data-driven learning for decision-making. Centralized training in MAS is impractical due to communication bottlenecks, privacy risks, and distributed data ownership. Integrating FL into MAS offers a promising solution, allowing agents to contribute to a shared global model while preserving autonomy and privacy. Yet, this integration raises new challenges, including: Handling highly non-IID and temporally correlated data., Ensuring convergence under asynchronous or partially connected networks, Maintaining robustness against adversarial or selfish agents, balancing local autonomy with global coordination. This project will investigate federated learning within the context of multi-agent systems, focusing on optimization, communication efficiency, security, and robustness in distributed environments.

Project Objectives

- Analyze optimization algorithms suited for decentralized and asynchronous federated learning in MAS. Design communication-efficient and secure aggregation mechanisms for multi-agent environments.
- Study the impact of agent heterogeneity (data, computation, network) on global learning dynamics. Explore trade-offs between autonomy, efficiency, and fairness in federated MAS.Apply findings to domains such as distributed robotics, smart grids, and autonomous vehicular networks.

Expected Outcomes

- A comprehensive survey of the state of the art in federated learning and its application in multi-agent systems.
- A deep theoretical understanding of both paradigms and their interactions.
- A research paper focusing on a specific challenge or solution, developed from the survey and analysis.

Required Skills: Solid foundation in machine learning theory. Interest in distributed systems, federated learning, and multi-agent systems**.**

Project : A literature review and interactive dashboard on AI for healthcare compliance and regulations across countries

Supervisor: Dr. Anuradha Kar

Description:

Artificial Intelligence is increasingly used in healthcare for diagnostics, clinical decision support, and patient management. However, the adoption of AI is heavily influenced by compliance requirements, ethical frameworks, and regulatory landscapes that vary widely across countries. This project will conduct a systematic literature review of AI in healthcare regulations and compliance standards (e.g., FDA in the US, CE marking in the EU, HIPAA/GDPR for data privacy, local ministry guidelines).

The insights will be translated into an interactive dashboard that allows users to compare country-wise AI regulations in healthcare, track themes such as data governance, clinical validation, approval processes, and ethical considerations, and visualize global trends. The dashboard will serve as an accessible tool for researchers, policymakers, and industry professionals to understand and navigate regulatory diversity.

Objectives

1. **Literature Review** – Conduct a structured review of research papers, policy documents, and regulatory guidelines on AI in healthcare compliance.
2. **Thematic Synthesis** – Identify key themes such as data privacy, algorithmic transparency, validation standards, and approval mechanisms.
3. **Comparative Analysis** – Map regulatory similarities and differences across world regions (e.g., US, EU, Asia, Africa).
4. **Data Visualization** – Develop an interactive dashboard to present cross-country compliance requirements.
5. **Ethical Considerations** – Highlight gaps and challenges in balancing innovation with patient safety, privacy, and fairness.

Deliverables

1. **Literature Review Report** – A comprehensive document summarizing regulations, compliance frameworks, and thematic findings.
2. **Country-Wise Compliance Dataset** – Structured data compiled from literature and official guidelines.
3. **Interactive Dashboard Prototype** – A web-or PowerBI dashboard allowing users to:
    - Compare regulations across countries
    - Filter by themes (privacy, approval, ethics, safety)
    - Visualize global/regional trends in AI regulation

Required Skills / Prerequisites: Strong background in machine learning and deep learning.Introductory knowledge of compliance frameworks such as GDPR and the EU AI Act.

Project: Adaptive Learning Companion Agent: A Personalized AI Tutor for Dynamic Study Support

Supervisor: Dr. Anuradha Kar

Project Description

This project aims to design and implement an AI-powered adaptive learning companion agent that personalizes the learning journey for students. Unlike traditional Q&A chatbots, the agent will dynamically adjust learning content based on the learner's pace, weaknesses, and interests. It will generate personalized study plans, provide alerts for time management, and collaborate with other student agents to enable effective group project work.

Objectives

1. **Personalized Learning Pathways** – Develop models that adaptively curate content and exercises tailored to each learner's knowledge level, pace, and preferences.
2. **Real-Time Assessment** – Integrate NLP and ML techniques to evaluate student responses, identify weaknesses, and adjust difficulty levels dynamically.
3. **Behavioral Nudging** – Implement time management nudges, reminders, and motivational feedback using reinforcement learning and behavioral modeling.
4. **Collaborative Agent Framework** – Enable agents to communicate and share learning insights across students for **peer learning and group project support**.
5. **Human-AI Interaction** – Design an intuitive conversational interface that fosters engagement and trust in the agent.
6. **Ethics and Transparency** – Ensure explainability, fairness, and privacy in recommendations and content adaptation.

Deliverables

1. **Literature Review Report** – Survey of adaptive learning systems, intelligent tutoring agents, and agent collaboration in education.
2. **System Architecture Design** – Documentation and diagrams describing the multi-agent framework, NLP pipeline, and recommendation algorithms.
3. **Prototype AI Tutor** – A functional system capable of:
    - Adapting content to student performance and interests
    - Providing real-time personalized feedback
    - Sending time management suggestions
    - Supporting collaborative study tasks
4. **Evaluation Framework** – Metrics to assess learning gains, engagement, and usability (e.g., student satisfaction, retention rate, knowledge improvement).

Project: Personalized Health Coach Agent for Critical Disease Patients Using Wearable Data and Medical Guidelines

Supervisor: Dr. Anuradha Kar

This project aims to develop a Personalized Health Coach Agent that supports cancer patients in managing their daily health routines and lifestyle goals. The agent will integrate wearable sensor data (heart rate, sleep patterns, physical activity) with evidence-based medical guidelines to generate tailored recommendations, reminders, and alerts.

Beyond passive monitoring, the agent will simulate empathetic and adaptive conversations with patients, adjust recommendations to individual goals (e.g., weight management, fatigue reduction, or chronic disease control), and trigger escalation protocols to healthcare professionals when anomalies or risks are detected. The solution bridges AI-driven personalization, natural language interaction, and digital health for improved patient well-being and adherence.

Objectives

1. **Data Integration** – Collect, preprocess, and analyze multimodal data from wearable sensors (e.g., heart rate, sleep, activity levels).
2. **Guideline-Based Personalization** – Encode medical guidelines into the agent to ensure clinically valid recommendations.
3. **Conversational Coaching** – Design an NLP-driven conversational interface capable of empathetic, supportive, and personalized dialogue.
4. **Risk Monitoring & Escalation** – Train anomaly detection models to identify warning signs and alert healthcare providers when necessary.
5. **Ethical & Privacy Considerations** – Analyse aspects of patient data security, explainability of recommendations, and compliance with healthcare standards (e.g., GDPR, HIPAA).

Deliverables

1. **System Architecture Design** – Technical documentation of the data pipeline, conversational agent framework, and guideline integration.
2. **Prototype Health Coach Agent** – A functional prototype capable of:
    - Analyzing wearable data and patient profiles
    - Generating daily recommendations and reminders
    - Engaging patients in supportive, adaptive conversations
    - Escalating issues to medical professionals when needed

Project: Autonomous Clinical Decision Support Agent for Summarizing and Reasoning over Electronic Health Records (EHRs)

Supervisor: Dr. Anuradha Kar

Project Description

Clinicians often struggle with information overload due to large, fragmented, and complex electronic health records (EHRs). Important clinical insights may be hidden in free-text notes, historical reports, or scattered across lab values and medication histories. This project aims to build an AI-powered Clinical Decision Support Agent that autonomously retrieves, analyzes, and summarizes relevant patient information for a given clinical query (e.g., *"What is the patient's cardiovascular risk?"*).

The agent will combine natural language processing, multimodal data integration, and multi-step reasoning to parse both structured data (labs, vitals, medications) and unstructured data (doctor's notes, discharge summaries). It will produce explainable summaries and suggest potential next steps in the clinical procedure.

Objectives

1. **Understanding SOTA in clinical decision making:** Review current state of the art methods for clinical decision making, datasets used, decision making workflow
2. **Data Parsing & Integration** – Develop pipelines to process structured (labs, meds, vitals) and unstructured (notes, summaries) EHR data.
3. **Information Retrieval & Summarization** – Use NLP and retrieval-augmented methods to autonomously extract relevant patient information.
4. **Multi-Step Clinical Reasoning** – Implement reasoning strategies (e.g.,, or agent planning) to answer complex clinician-style queries.
5. **Explainability & Evidence Traceability** – Ensure the agent highlights sources (specific labs, notes, timestamps) that support its answers.

Deliverables

1. **Literature Review Report** – Survey of clinical decision support systems, EHR summarization, and multi-step reasoning in healthcare AI.
2. **System Architecture Documentation** – Description of the data ingestion pipeline, reasoning framework, and explainability components.
3. **Prototype Clinical Agent** – A working system capable of Parsing structured & unstructured EHR data

Project title: Hybrid Cognitive Taxonomy Integration for Adaptive Quiz Generation in OneClickQuiz

Supervisor: Antoun Yaacoub

Project description: This project extends the integration of Bloom's Taxonomy and SOLO Taxonomy into OneClickQuiz (https://oneclickquiz.fr) by developing a hybrid classifier for generating adaptive multiple-choice questions (MCQs) in engineering domains, such as circuit design or programming. It addresses gaps in handling nuanced cognitive progressions under domain shifts, where single- taxonomy models (e.g., DistilBERT at 91% accuracy) may falter, by fusing taxonomies to enable real- time quiz adaptation that escalates cognitive demands based on learner responses. Inspired by recent advances in AI assessment frameworks, it hypothesizes a 12-18% alignment F1-score improvement.

Project objectives:

- Develop and fine-tune a multi-label DistilBERT ensemble for hybrid Bloom-SOLO classification, targeting 12-18% improvement in alignment F1-score over single-taxonomy baselines.
- Integrate the hybrid model into OneClickQuiz using prompt engineering for dynamic generation and adaptation.
- Evaluate causal impacts on engineering student learning outcomes through randomized controlled trials (RCTs) and mediation analysis on linguistic features like lexical density.

Expected outcomes:

- An enhanced OneClickQuiz plugin with hybrid taxonomy support and open-source codebase.
- A curated dataset of 2,000+ hybrid-labeled engineering MCQs.
- A technical report with empirical results, including mediation analysis, suitable for submission to IEEE Transactions on Learning Technologies or LAK 2026.

Required skills or prerequisites (if any): Machine learning (e.g., fine-tuning Transformers), Python programming, and familiarity with educational taxonomies.

Project title: Multimodal Quiz Generation: Incorporating Images and Code Snippets in OneClickQuiz for Engineering Domains

Supervisor: Antoun Yaacoub

Project description: This project enhances OneClickQuiz (https://oneclickquiz.fr) by adding multimodal generation capabilities, creating MCQs with images (e.g., circuit diagrams) or code snippets (e.g., Python algorithms) aligned to cognitive taxonomies. It fills gaps in engineering edtech where text-only quizzes limit spatial cognition, using vision-language models to hypothesize >90% taxonomy alignment F1 and 15% higher engagement versus text baselines.

Project objectives:

- Curate and label a multimodal dataset of 1,000+ engineering pairs, fine-tuning CLIP-DistilBERT for hybrid classification.
- Develop prompt-driven generation pipelines and integrate API hooks for media in OneClickQuiz.
- Conduct A/B user studies with engineering students to measure alignment accuracy, engagement (NPS), and cognitive load.

Expected outcomes:

- A multimodal prototype extension for OneClickQuiz, supporting image/code quizzes.
- A benchmark dataset of taxonomy-aligned multimodal engineering content.
- Comparative analysis report, targeting ICALT 2026 for publication.

Required skills or prerequisites (if any): Computer vision/NLP (e.g., CLIP integration), software engineering for plugins.

Project title: Ethical Prompt Optimization for Bias-Resilient Feedback in Multilingual Engineering Assessments

Supervisor: Antoun Yaacoub

Project description: Drawing from feedback linguistics and ethics in OneClickQuiz (https://oneclickquiz.fr), this project optimizes prompts for multilingual bias reduction (e.g., Eurocentric examples in global engineering), using constrained optimization to hypothesize 30% bias cuts without >5% readability trade-offs, addressing gaps in ethical multilingual AI for higher-order assessments.

Project objectives:

- Generate and annotate 1,800 multilingual feedbacks, fine-tuning mT5 with Lagrangian constraints for bias-readability.
- Develop a prompt optimizer and integrate into OneClickQuiz for cultural adaptation.
- Perform multilingual RCTs with bias surveys and performance regressions.

Expected outcomes:

- An ethical prompt optimizer toolkit for OneClickQuiz.
- A multilingual bias benchmark dataset.
- Trade-off analysis report, targeting FAccT 2026 or AIED 2026.

Required skills or prerequisites (if any): Multilingual NLP (mT5), optimization algorithms; ethical AI auditing.

Project title: Real-Time Adaptive Learning Paths in OneClickQuiz Using Reinforcement Learning

Supervisor: Antoun Yaacoub

Project description: Extending dynamic feedback mechanisms in OneClickQuiz (https://oneclickquiz.fr), this project implements reinforcement learning (RL) for personalized quiz paths that adapt in real-time to student responses, optimizing cognitive progression in engineering subjects (e.g., machine learning concepts). It addresses longitudinal gaps in RL for taxonomy alignment, hypothesizing 20% mastery gains via safe PPO agents with fairness rewards.

Project objectives:

- Build an RL environment (Gym) modeling taxonomy states and train a constrained PPO agent for path selection.
- Embed RL-driven adaptation into OneClickQuiz, with A/B testing for ethical constraints.
- Evaluate retention and progression through semester-long studies with mixed-effects models.

Expected outcomes:

- An RL module for adaptive paths in OneClickQuiz, with analytics dashboard.
- A longitudinal dataset of simulated and real student trajectories.
- Impact study report, suitable for EDM 2026 or Journal of Educational Data Mining.

Required skills or prerequisites (if any): Reinforcement learning (e.g., PPO algorithms), Python (Stable Baselines3); stats for longitudinal analysis.

Project title: Multi-Agentic AI with Self-Healing Capabilities for Adaptive Cognitive Alignment in OneClickQuiz

Supervisor: Antoun Yaacoub

Project description: We focus on enhancing OneClickQuiz (https://oneclickquiz.fr) with a multi-agentic AI system that integrates cognitive alignment (Bloom's and SOLO Taxonomies) with self-healing capabilities. Drawing from prior studies on feedback mechanisms and cognitive frameworks, the project introduces a network of specialized agents—e.g., a Question Generator Agent, Feedback Analyzer Agent, and Self-Healing Coordinator—collaborating to dynamically generate and refine engineering quizzes (e.g., thermodynamics or coding). These agents leverage a shared knowledge base and employ self-healing mechanisms to detect and correct alignment errors or system failures in real-time, addressing gaps in robust, adaptive educational AI as noted in 2025 reviews on resilient AI systems. The hypothesis is that multi-agent coordination with self-healing will improve alignment accuracy by 25% and system uptime by 15% over single-agent baselines.

Project objectives:

- Design and implement a multi-agent system using frameworks like A2C or OpenAI Gym Multi- Agent, with agents specialized for question generation, feedback analysis (building on RoBERTa-MTL), and self-healing (detecting misalignments via anomaly detection).
- Develop self-healing protocols using reinforcement learning (e.g., Q-learning for error recovery) and integrate them into OneClickQuiz to autonomously adjust agent behaviors or regenerate content when cognitive misalignment or system errors occur.
- Conduct a mixed-methods evaluation with 60 engineering students over a semester, assessing alignment F1-score (>93%), self-healing success rate (>85%), and user satisfaction (NPS > 7) through logs, surveys, and A/B testing against a single-agent version.

Expected outcomes:

- A multi-agentic, self-healing OneClickQuiz extension with open-source code, demonstrating collaborative AI for educational adaptability.
- A dataset of 2,500+ agent-generated and self-healed quiz-feedback pairs, annotated for cognitive alignment and error types.
- A research paper exploring multi-agent dynamics and self-healing in edtech, targeting IEEE Transactions on Learning Technologies or AIED 2026.

Required skills or prerequisites (if any): Multi-agent reinforcement learning, anomaly detection, Python (e.g., TensorFlow, PyTorch), and familiarity with cognitive taxonomies.

Project: Design of Sliding Mode Control Using Artificial Intelligence and Convolutional Neural Networks (CNNs) for Autonomous Robots

Supervisors: Dr. Vishvjit Thakar, Dr. Anuradha Kar

Project Description

Sliding Mode Control (SMC) is a robust control method widely used in nonlinear dynamic systems, including autonomous robots, due to its ability to handle uncertainties and external disturbances. However, traditional SMC design requires precise system modeling and may suffer from chattering effects.

This project explores the integration of Artificial Intelligence (AI) and Machine Learning (ML)—specifically Convolutional Neural Networks (CNNs)—to design an adaptive Sliding Mode Controller for autonomous robots. CNNs will be leveraged to extract features from sensory inputs (e.g., vision, LiDAR, IMU) and adapt the control law in real-time, enhancing robustness, adaptability, and trajectory tracking accuracy. The final system should demonstrate how AI-driven control can outperform classical SMC under uncertain and dynamic environments.

Project Objectives

1. Review & Analysis – Conduct a literature review on Sliding Mode Control and its integration with AI/ML in robotics.
2. System Modeling – Model the dynamics of an autonomous robot (e.g., differential drive robot, mobile platform).
3. AI-enhanced Control Design –
    - Develop a baseline Sliding Mode Controller.
    - Integrate CNN-based perception to adapt control parameters dynamically.
4. Simulation & Testing – Validate the proposed controller in simulation (e.g., ROS, Gazebo, MATLAB/Simulink, or PyBullet).
5. Performance Evaluation – Compare the AI-enhanced SMC with traditional SMC in terms of robustness, stability, chattering reduction, and tracking accuracy.
6. Scalability & Applicability – Explore potential extensions to other autonomous robotic platforms.

Project Deliverables

1. Summary of SMC, AI-based control methods, and CNN applications in robotics.
2. Implementation of the robot's dynamic model and a classical Sliding Mode Controller.
3. CNN-integrated Sliding Mode Controller capable of adaptive decision-making from sensory input.
4. Experimental results comparing baseline vs. AI-enhanced controller across various scenarios (disturbances, noise, uncertain environments).

Project: Crop Harvesting Prediction using Machine Learning

Supervisor: Dr. Vishvjit Thakar, Dr. Anuradha Kar

Project Description

The project focuses on developing a machine learning model that can predict the optimal time for crop harvesting by leveraging agricultural datasets. Accurate harvest prediction is crucial for maximizing crop yield, reducing losses due to premature or delayed harvesting, and improving supply chain planning. Students will work with historical and real-world agricultural data such as weather patterns, soil conditions, crop growth stages, satellite/remote sensing data, and yield records. The project integrates machine learning and data science techniques to model crop growth cycles, identify patterns, and forecast harvest readiness. Students will also explore the potential of explainable AI to make predictions interpretable for farmers and stakeholders.

Project Objectives

1. Data Acquisition & Preprocessing
    - Collect and clean agricultural datasets (weather, soil, crop type, remote sensing, yield history).
    - Handle missing values, normalize data, and perform feature engineering.
2. Model Development and optimization
    - Implement and compare machine learning models (e.g., Random Forest, Gradient Boosting, LSTMs for time-series data).
    - Incorporate domain-specific features (e.g., growing degree days, NDVI from satellite data). Evaluate model performance using metrics such as RMSE, MAE, or R^2 for regression, or F1-score/accuracy for classification (ready vs. not ready).
    - Optimize hyperparameters using tools like Optuna/W&B sweeps.
3. Interpretability & Usability
    - Apply explainability methods (e.g., SHAP, LIME) to understand which factors most influence harvest predictions.
    - Propose how the model can be deployed in a farmer-friendly decision-support system.

Project Deliverables

1. Data Report: Documentation of datasets, preprocessing steps, and exploratory data analysis (EDA).
2. Machine Learning Models Trained and validated ML models for crop harvest prediction.
3. A dashboard (e.g., Streamlit app) showing predicted harvest windows for selected crops.
4. Explainability Analysis: Report on key features influencing predictions, with visualizations (feature importance, SHAP plots).

Project: Control Design for Box Gripping Robot Using Machine Learning Algorithms

Supervisor: Dr. Vishvjit Thakar, Dr. Anuradha Kar

Project Description

This project aims to design and implement a control system for a robotic manipulator capable of gripping and handling boxes of varying sizes, weights, and materials. Traditional control strategies rely heavily on precise modeling and calibration, which can be time-consuming and inflexible. By applying machine learning (ML) algorithms, the project explores adaptive and data-driven control approaches that enable the robot to learn effective gripping strategies under uncertain and dynamic conditions. The project will involve simulating and/or experimenting with robotic control tasks where the robot must grasp, lift, and place boxes without slippage or damage. Students will work on sensor integration (force, torque, vision), ML-based control design (reinforcement learning, supervised models, or hybrid approaches), and performance evaluation to develop a robust robotic gripper controller.

Project Objectives

1. **Problem Understanding & Data Collection**
    - Study gripping dynamics: friction, weight distribution, and contact forces.
    - Collect training data from sensors in simulated or real environments.
2. **Model Development**
    - Explore ML-based approaches for control: *Supervised Learning* → predict optimal grip force based on box features.
3. **Control System Design**
    - Develop an ML-driven controller that adjusts grip force and manipulator trajectories dynamically.
    - Ensure adaptability to different box shapes, weights, and textures.
4. **Evaluation & Optimization**
    - Define performance metrics: grip success rate, energy efficiency, task completion time. Benchmark ML-based controllers against baseline (PID/model-based) controllers.

Project Deliverables

1. **Technical Report on System Modeling & Data Acquisition** Description of robotic setup, sensors, and dataset used.
2. **Machine Learning Models & Controllers** Implemented ML algorithms for gripping control (code + documentation). Comparative analysis of different algorithms.
3. **Simulation/Prototype Demonstration** Working demonstration in a simulator