INTELLIGENCE IN ACTION: AI-DRIVEN NETWORKS

M1. Lifecycle objectives and calendar for the project

Projeto em Informática 2024/2025

Hugo Ribeiro - 113402
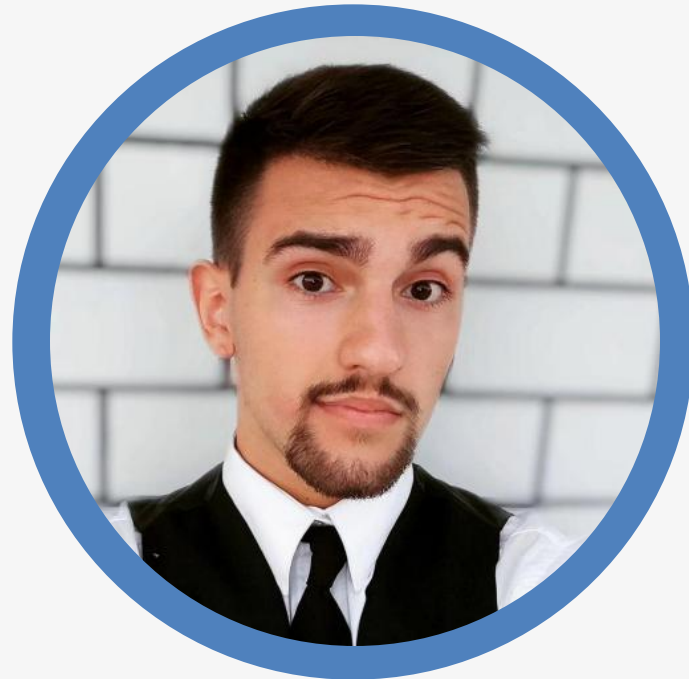Rodrigo Abreu - 113626
Eduardo Lopes - 103070
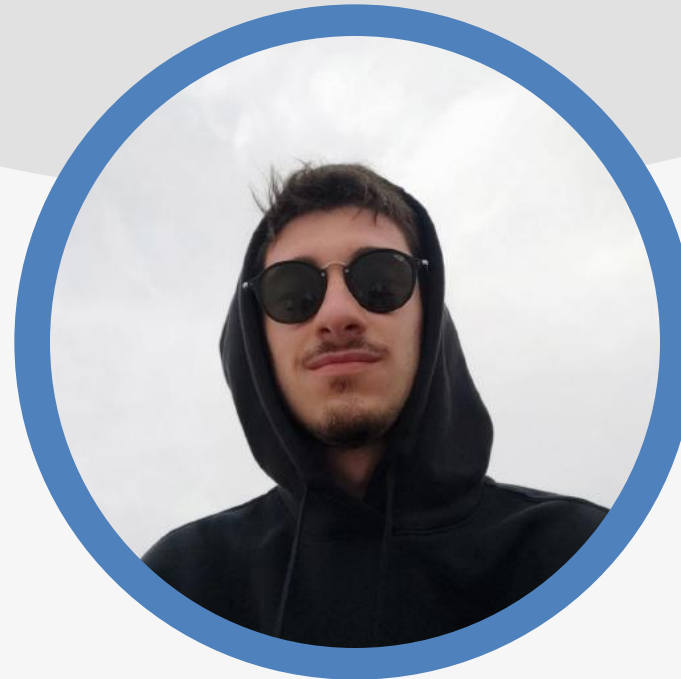Jorge Domingues - 113278
Joao Neto - 113482

Feb 2025

OUR TEAM

Hugo Ribeiro

Data Engineer
UI Engineer
Messaging & API
Engineer

Rodrigo Abreu

Team Manager
Backend Engineer

Eduardo Lopes

DevOps Master
Architect

Jorge Domingues
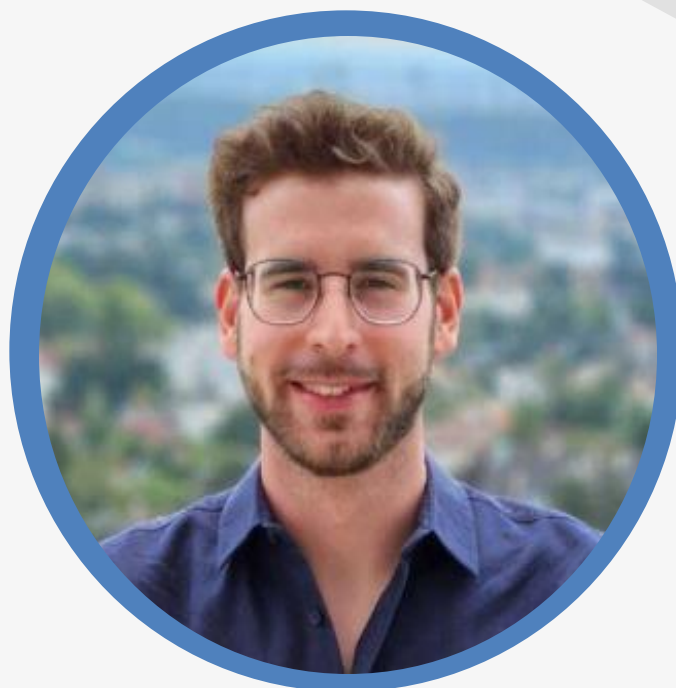
Integration
Engineer
UI Engineer

João Neto

Data Engineer
Messaging & API
Engineer

OUR TUTORS

Rafael Teixeira

AI Tutor

Rui Aguiar

Project
Supervisor

Rafael Direito

Networks Tutor

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NETWORK CONTEXT

Networks have evolved significantly from traditional static infrastructures to more dynamic, intelligent, and adaptive systems.

5G and Beyond-5G networks must:
- handle vast amounts of data.
- support a diverse range of applications.
- ensure high reliability and low latency.

To achieve this performance, efficiency and adaptability requirements must be met.
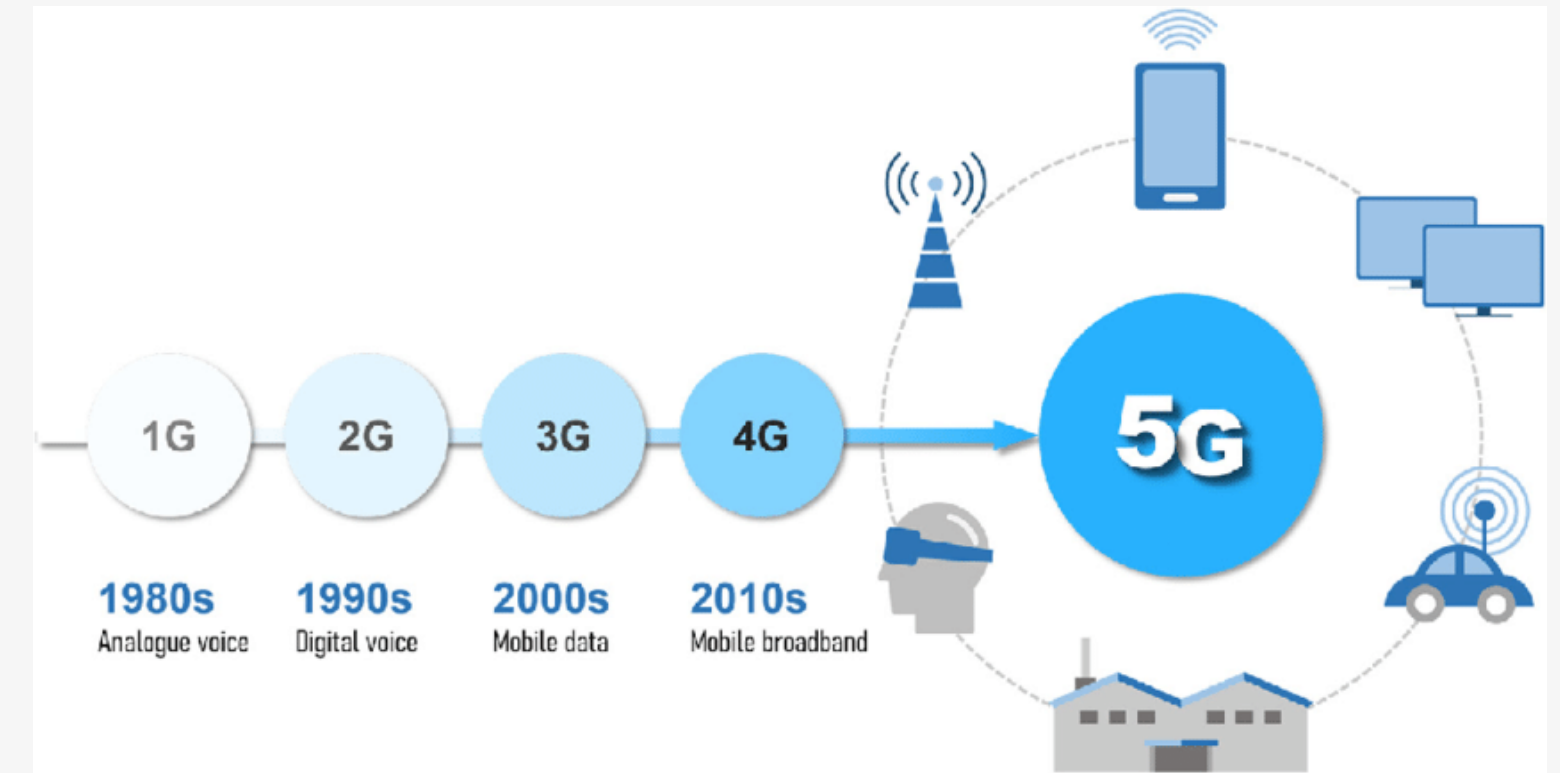
ML CONTEXT

- Incorporating AI, ML and automation, is an innovative way of meeting these challenges.

- An MLOps pipeline is an automated workflow that handles everything from data collection and inference model training to deployment/monitoring.

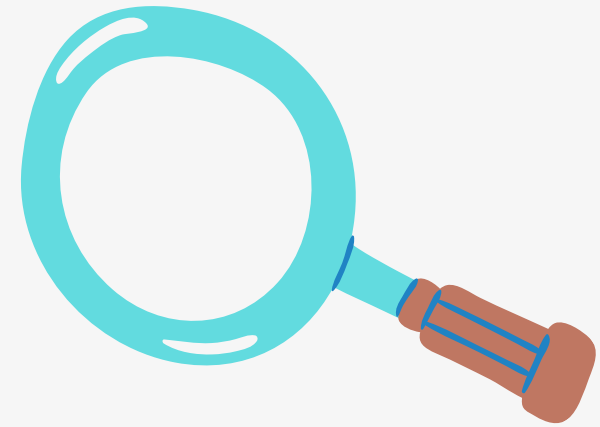- ML ingest data from the network to learn patterns and make predictions.
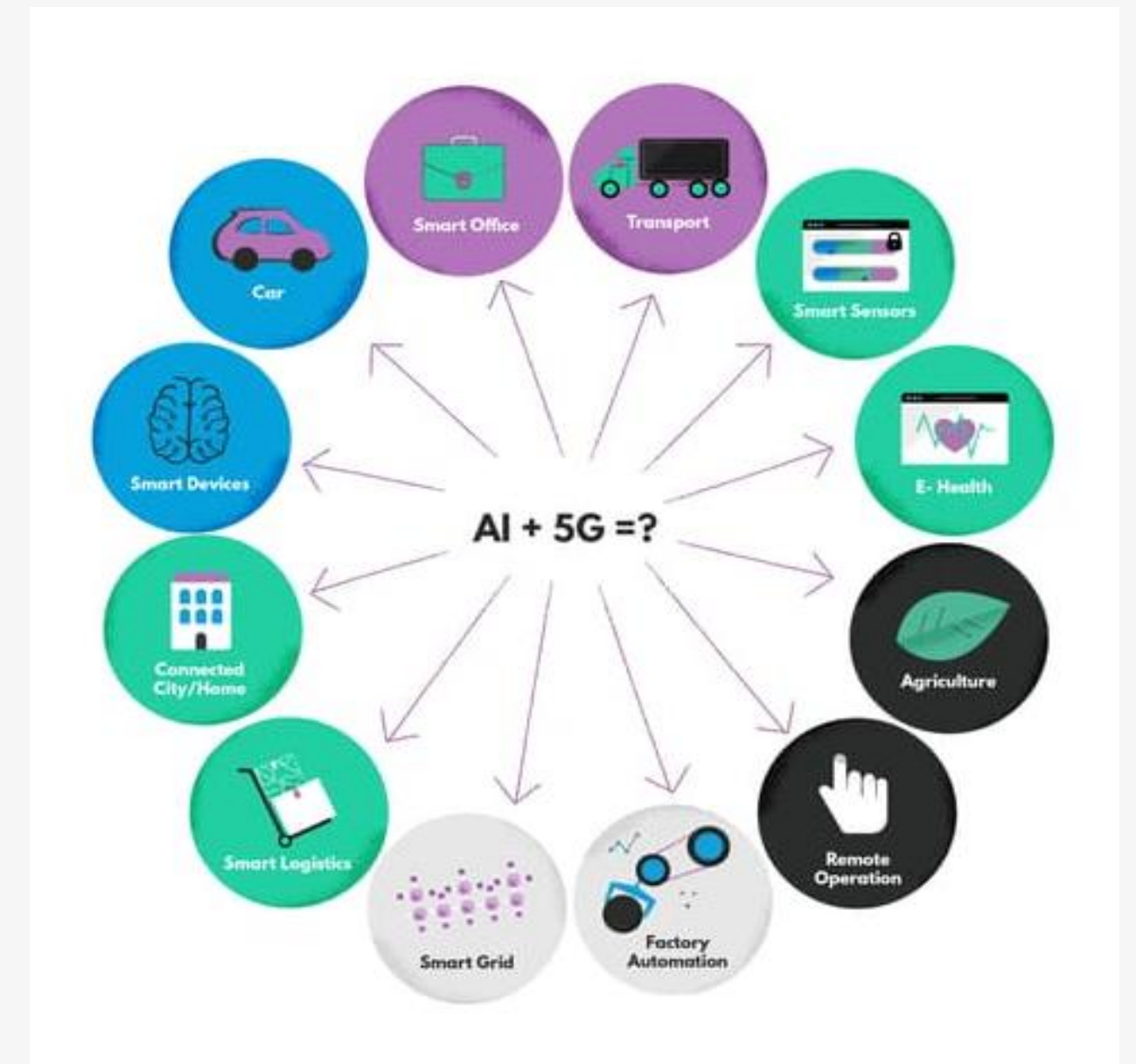
PROBLEM

- Increase in data consuming slows the network.

- Utilization spikes, can compromise network QoS.

- Technical problems (latency, packet loss) cause data transmission delays.

- Simply setting up more network and maintaining it is expensive.

RELATED WORK

Combining Network Data Analytics Function and Machine Learning for Abnormal Traffic Detection in Beyond 5G

Abdelkader Mekrache   Karim Boutiba   Adlen Ksentini

In this research, NWDAF was developed to enable subscription and analytical services. Machine learning was employed to detect abnormal traffic patterns and potential DDoS attacks. However, limitations include reliance synthetic testing, the risk of false positives, sensitivity traffic pattern shifts, necessitating frequent model retraining.

RELATED WORK
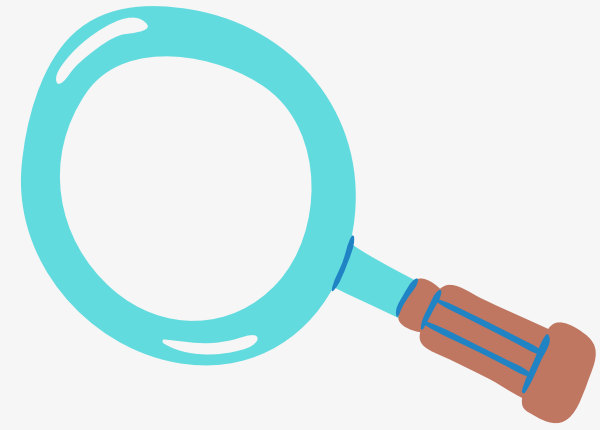
A Smart Data Analytics System Generating for 5G N/W System Via ML Based Algorithms for the Better Communications
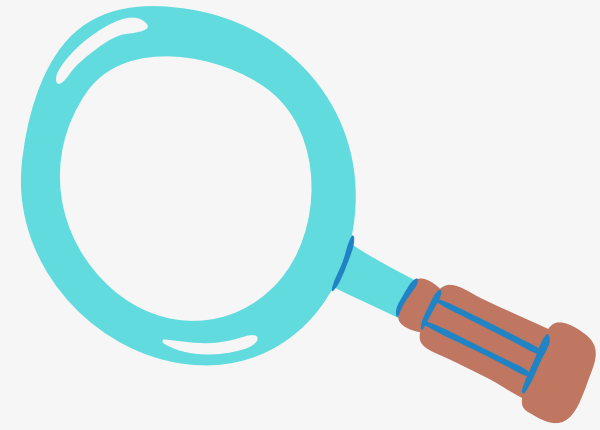
Nisha   Dr.Lakshman K   Dr. Raj Kumar

This study uses three ML models, <u>Linear Regression</u>, <u>Recurrent Neural Networks</u> and <u>Long Short-Term Memory</u> to address network load effectiveness. The authors conclude that neural networks perform better in network load prediction than linear regression.

RELATED WORK

Demo: Enhancing Network Performance based on 5G Network Function and Slice Load Analysis

Rui Ferreira
Duarte

Joao Fonseca
Marco Araujo

Joao Silva
Raul Barbosa

Mayuri Tendulkar
Bruno Mendes

Paulo
Adriano Goes

This paper addresses the importance of monitoring and gathering network metrics in real-time to predict network function load. The authors emphasize for the constant retraining of the model, as it became biased in short term, retraining would allow the model to better adapt to dynamic traffic patterns.

RELATED WORK
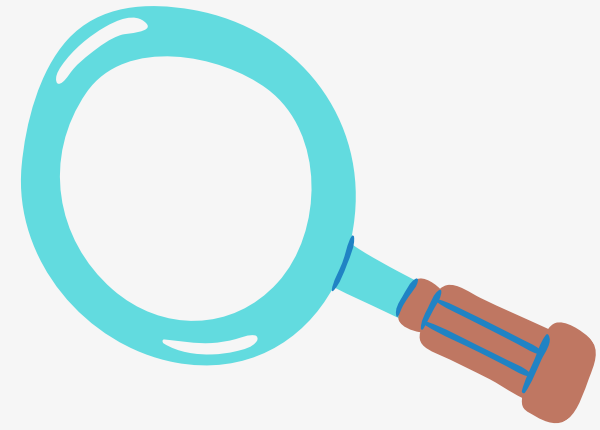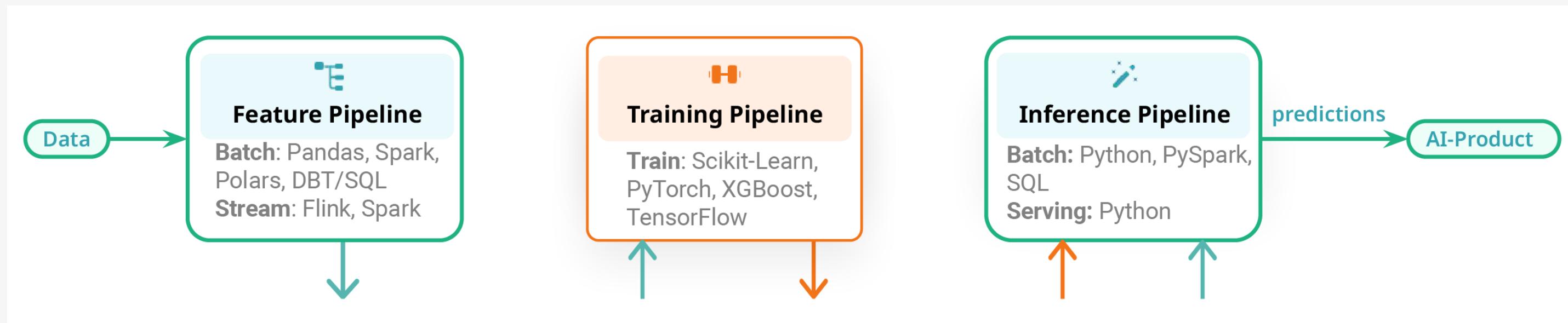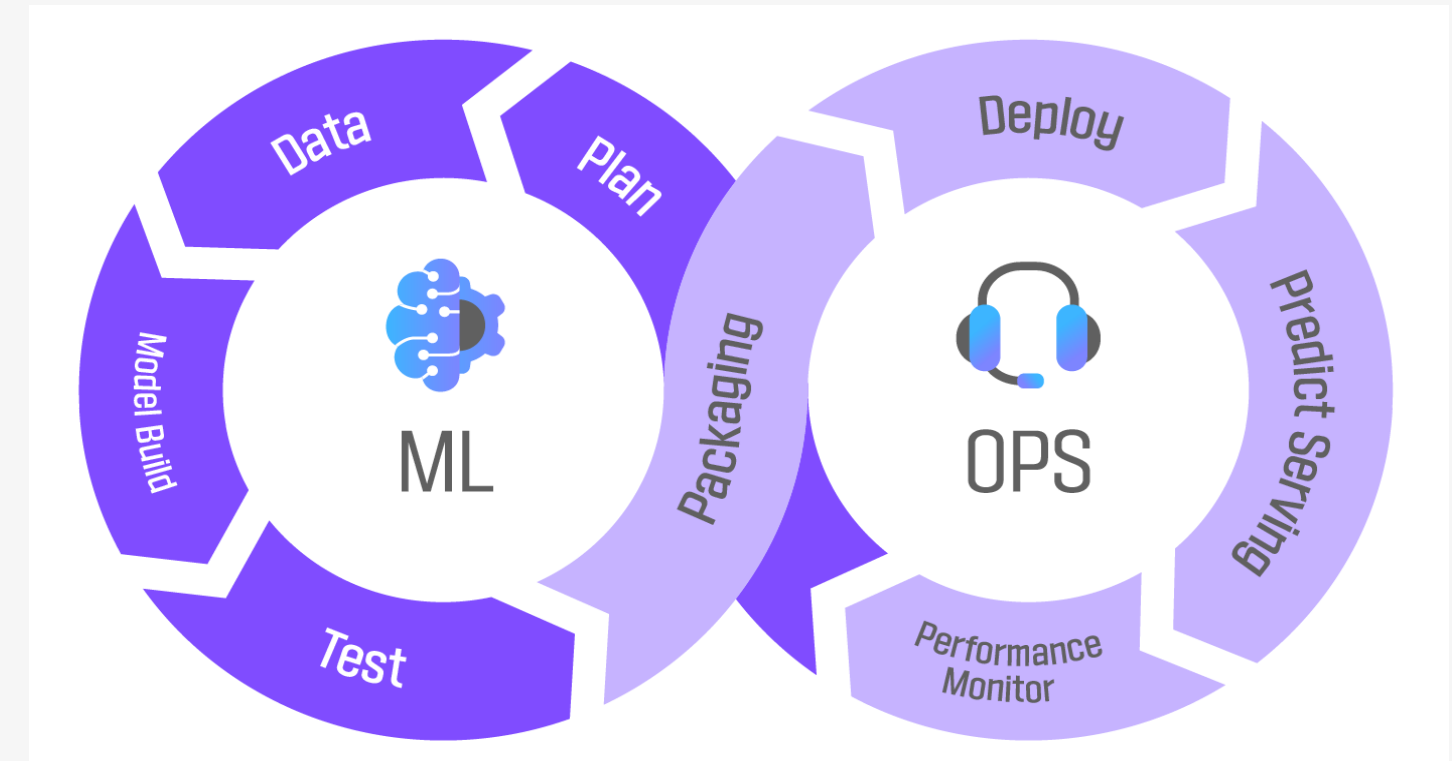
- Like previous works, our project aims to make future generation networks more adaptive and intelligent.

- Other researchers concluded that the ML model choice is critical.

- The optimal selection depends on the specific use cases implemented and the necessity for retraining.

- We intend to go even further and develop and integrate a MLOps pipeline within the NWDAF-like architecture.
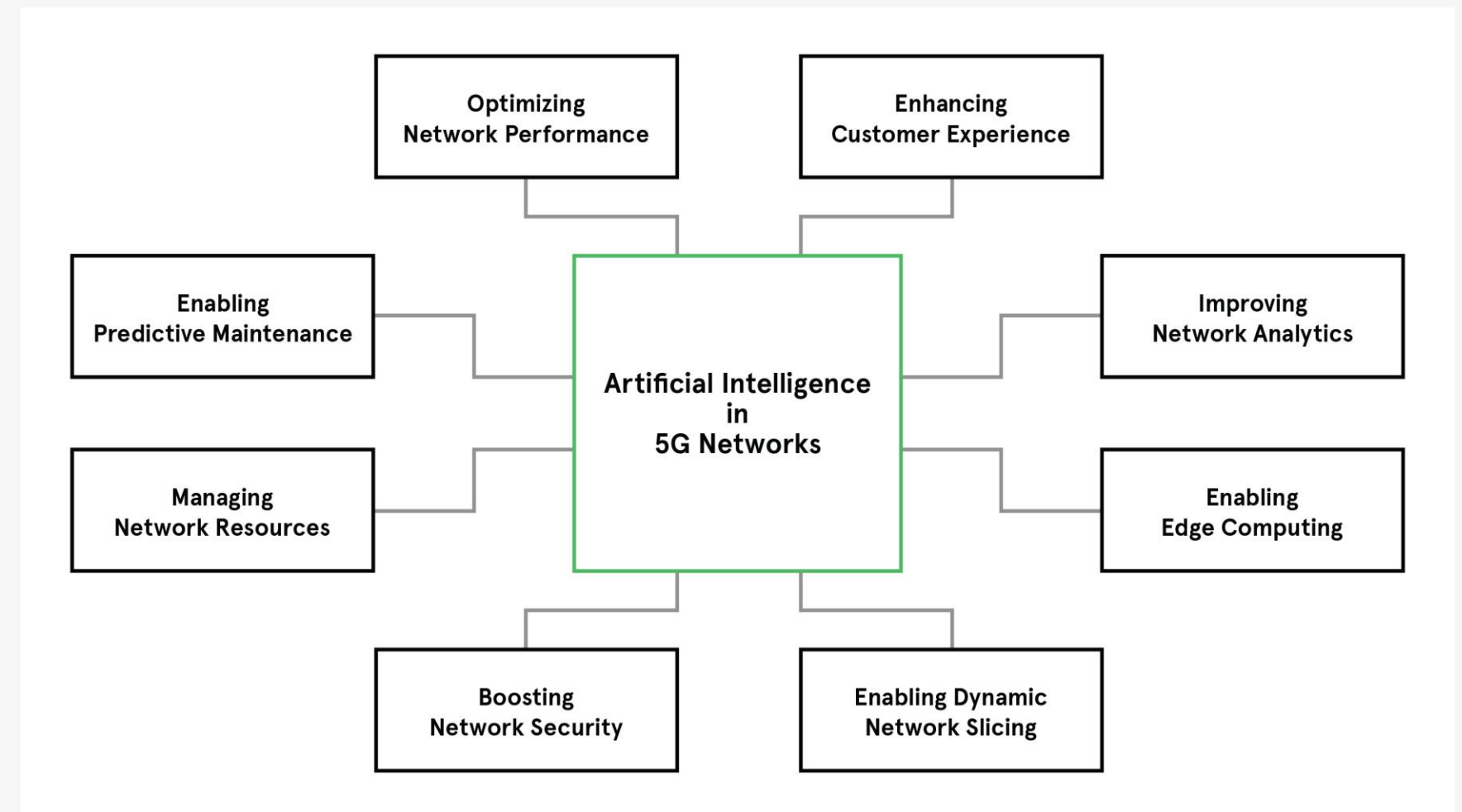
GOALS

- Implement a Data Pipeline for Network Intelligence.

- Develop and Integrate Machine Learning Models.

- Automate Network Optimization & Decision-Making.

Data → **Feature Pipeline**
Batch: Pandas, Spark, Polars, DBT/SQL
Stream: Flink, Spark

Training Pipeline
Train: Scikit-Learn, PyTorch, XGBoost, TensorFlow

Inference Pipeline
Batch: Python, PySpark, SQL
Serving: Python

→ predictions → AI-Product

GOALS

- Implementation of a scalable and modular MLOps pipeline that works as a NWDAF when integrated with a 5G network.

- Ensure Compliance with 3GPP Standards.

- Attempt Integration with existing 5G Core Network Components.
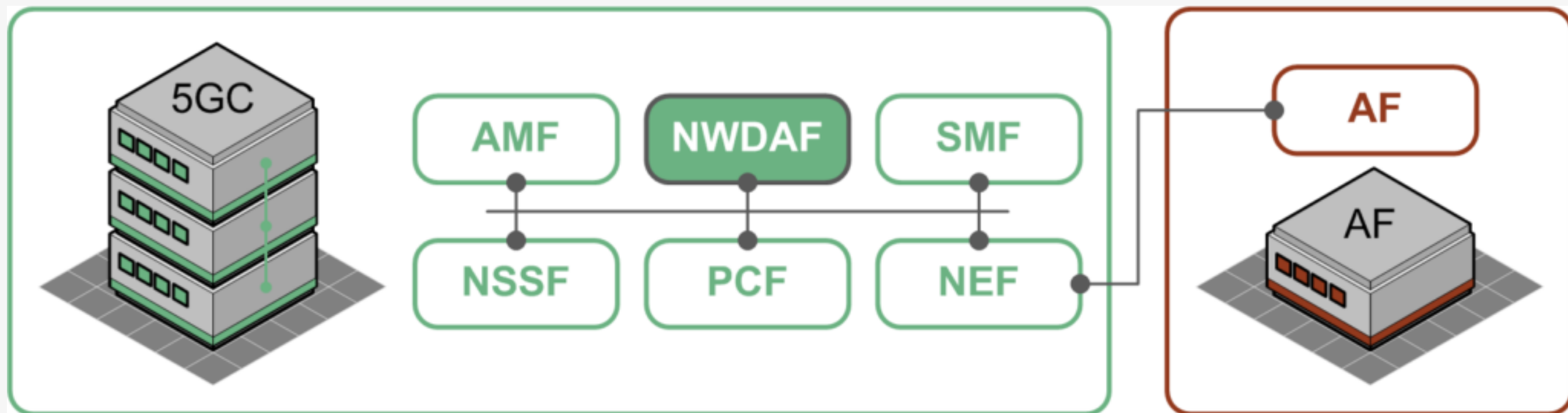
GOALS

- Ensure seamless Communication Between Services within the pipeline.

- Evaluate System Performance under several Network Conditions.

- Provide a User-Friendly Deployment and Monitoring System.

EXPECTED RESULTS

- A modular and scalable MLOps pipeline that when integrated with a 5G network works as a base for a NWDAF.

- A NWDAF-like architecture that can be deployed in any 3GPP-compliant network.

- Comprehensive validation of NWDAF-like architecture performance through real-world use cases in a 5G environment.

Vendor Agnostic · 3GPP Compliant · Fully Functional · Interoperable · Deployed Flexibly

5G IQ NWDAF®

Communication Plan

Slack - Communicate with tutors.

Discord – Team Communication

Github – Coding Repository

Github Projects – SCRUM to organize teamwork.

PROJECT CALENDAR

Click here, for a better view.

Scan the QR code to check our documentation website.

Or click here.

THANK YOU