

Platform



jupyter



IDE

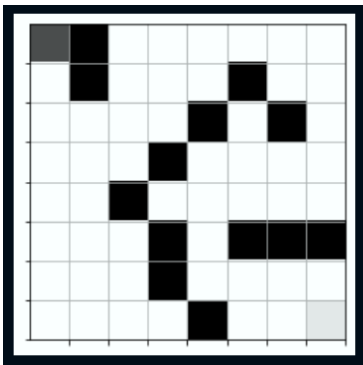
FastAPI

API Serving



docker
Containerization

Data
Presentation
(UI)



Web UI

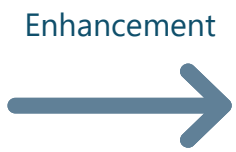


Chart.js
Interactive
Charts



Desktop

Database

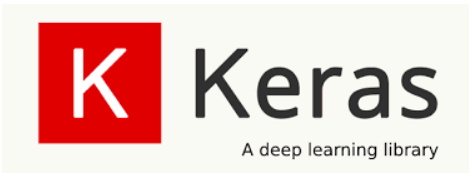


PostgreSQL
Relational
Database

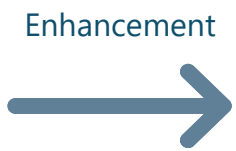


Python & Postgres Interface

Algorithms &
Modeling



A deep learning library



Linear regression,
preprocessing, metrics

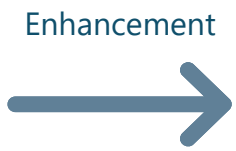


Time Series
Forecasting

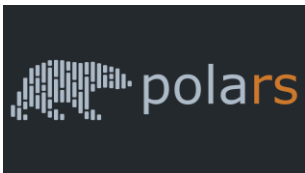


Reinforcement
Learning

Data Source &
Transformation



US Census API



Data Transformation

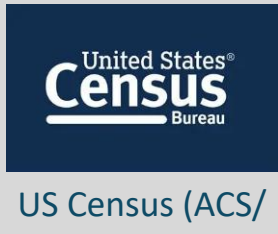


Data Transformation

System Architecture

Data & ETL

A1. External Data Sources



US Census (ACS/
BPS)



Bureau of Labor &
Statistics (JOLTS/
Unemployment)



Federal Reserve &
Economic Data (rates)

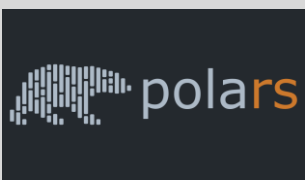
A2. ETL & Orchestration



Requests + Rate Limiting, Retries, Secrets via .env

Batch ID, idempotent upserts, logging

A3. Data Processing



Clean, Validate (nulls, ranges), normalize, feature
engineering

Storage &
Models

B1. PostgreSQL (Schemas: raw, stg, core, ml)

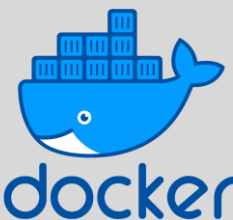


core.population_observations, core.indicator_values

ml.feature_matrix (materialized view)

Indexes incl. uq_fm_geo_year

B2. Model Training (Dockerized)



Linear
regression,
preprocessing,
metrics



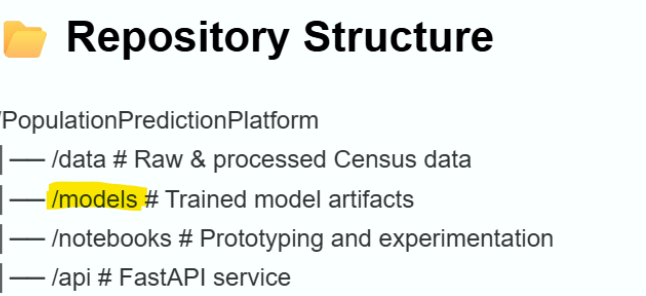
Time Series
Forecasting



Reinforcement
Learning

Evaluation &
Selection
(MAE/MAPE)

B3. Model Artifacts / Registry



models/ + metadata.json (versioned)

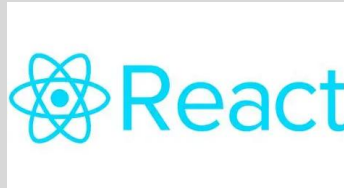
API & UI

C1. FastAPI Service (SQLAlchemy)



/predicts, /metrics, /health; Auth (JWT/basic)

C2. React (Web) / Tauri (Desktop)



Scenario inputs, Chart.js forecasts, export
PNG/CSV

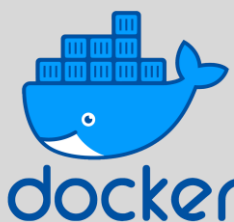
Security &
Observability

PostgreSQL



Row Based Access Control

Docker



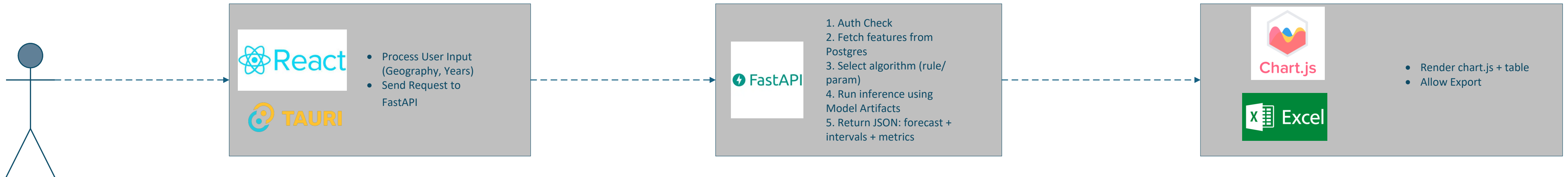
Secret management (.env)

Container Hardening

Structured Logs

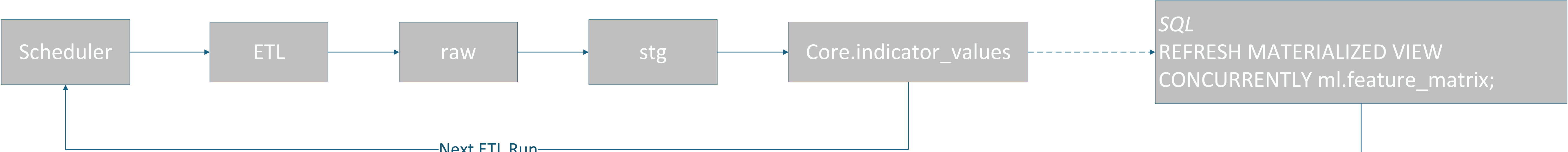
Health Checks & Metrics

Request -> Predict -> Visualize



ETL Training Loop

ETL



Training

