PAKDD 2014

ASUS MALFUNCTIONAL COMPONENTS PREDICTION

SYSTEMS ANALYSIS | SYSTEMS ENGINEERING

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KEY POINTS:

1. THE PAKDD CUP 2014 COMPETITION FOCUSES ON PREDICTING FAILURES IN ASUS COMPONENTS USING HISTORICAL MANUFACTURING AND USAGE DATA.
2. UNDETECTED FAILURES GENERATE HIGH MAINTENANCE COSTS, BRAND REPUTATION LOSS, AND INEFFICIENT LOGISTICS.
3. COMPONENT BEHAVIOR IS CHAOTIC AND COMPLEX, MAKING FAILURE PREDICTION DIFFICULT.

CONTENTS

PROBLEM

CURRENT CHALLENGES

- High sensitivity to external factors (temperature, humidity, usage intensity).
- Strong interdependencies between components → non-linear behavior.
- Lack of infrastructure for simulations and robust risk management.

SOLUTION

System architecture:

- Ingestion → ETL → Modeling → Visualization → Feedback

Strategies:

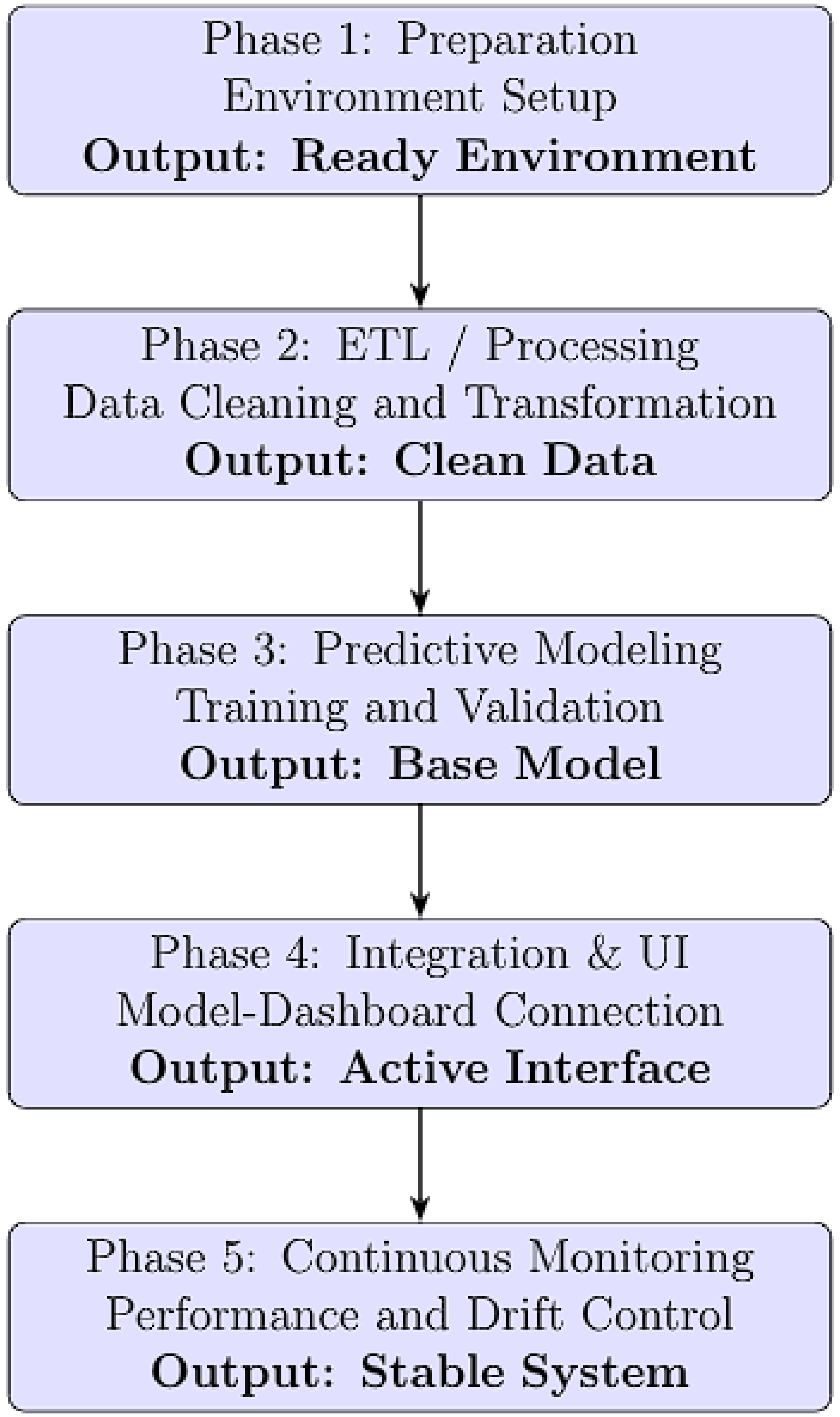
- Hybrid models (deterministic + probabilistic) to manage chaotic factors

Defined requirements:

- Accuracy ≥ 85%
- Response time < 1s
- Availability ≥ 99.9%

Technology stack:

Python, scikit-learn, Flask, Power BI, PostgreSQL, MLflow


Phase 1: Preparation
Environment Setup
Output: Ready Environment
Phase 2: ETL / Processing
Data Cleaning and Transformation
Output: Clean Data
Phase 3: Predictive Modeling
Training and Validation
Output: Base Model
Phase 4: Integration & UI
Model-Dashboard Connection
Output: Active Interface
Phase 5: Continuous Monitoring
Performance and Drift Control
Output: Stable System

ROBUST SYSTEM DESIGN & PROJECT MANAGEMENT

- Add fault tolerance and scalability (following ISO 9000, CMMI, Six Sigma standards).
- Implement a risk and quality management plan (to mitigate data loss, downtime, or security vulnerabilities).
- Define team roles, timeline, and management tools (Gantt, Kanban, Scrum).

SIMULATION & VALIDATION

- Simulate system behavior using real Kaggle data.
- Create two scenarios:
    a. Data-driven simulation: Train and evaluate a classic ML model (Random Forest or Neural Network).
    b. Event-based simulation: Model chaotic behavior using cellular automata or stochastic events.
- Analyze results to refine the architecture before the final deployment.

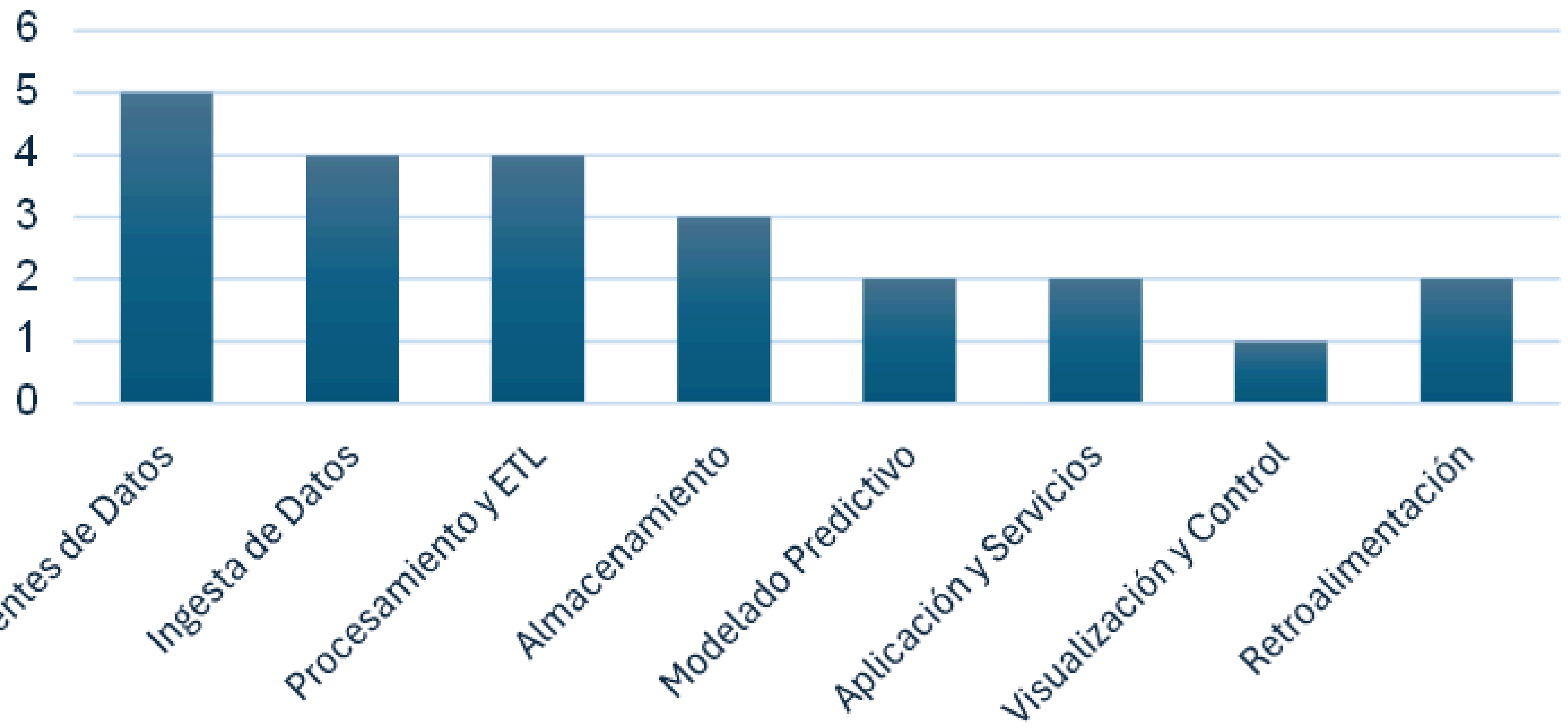
RESULTS

Present the current achievements and what is expected to be accomplished in the next phases.

CURRENT ACHIEVEMENTS

- Conceptual design of the predictive system with adaptive feedback.
- Identification of critical variables: component age, temperature, usage intensity, and manufacturing batch.
- Definition of quantitative metrics (accuracy, latency, availability, user satisfaction).
- Modular architecture ready for academic implementation.

HIGH-LEVEL ARCHITECTURE OF THE FAILURE PREDICTION SYSTEM



EXPECTED RESULTS

From Workshop 3:

- Reinforced and fault-tolerant architecture.
- Integrated risk mitigation strategies.
- Management plan with defined milestones, roles, and tasks.

From Workshop 4:

- Design validation through simulations (machine learning and cellular automata).
- Detection of emergent patterns and possible instabilities.
- Refinement of the predictive model based on simulation results.

CONCLUSIONS

According to the progress made in Workshops 1 and 2

CURRENT STATUS

-A solid systems engineering foundation has been established to address the ASUS problem.
 -The theoretical and architectural model is complete but requires practical validation.
 -Chaotic factors have been identified, and adaptive control strategies are being planned.

NEXT STEPS

-Refine the architecture with robust design, quality control, and risk management.
-Implement simulations to verify stability and performance under different conditions.
-Analyze results and adjust models based on chaotic or emergent behaviors.
Prepare the final delivery, integrating all components into a functional and validated system.

THANK YOU

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