PAKDD 2014 - ASUS Malfunctional Components Prediction

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Introduction

Electronic components in ASUS laptops may fail due to multiple interacting factors such as environmental conditions, manufacturing variability, and user behavior. These failures generate financial losses, reduced customer satisfaction, and logistical challenges in maintenance and inventory management. Previous solutions rely on reactive maintenance and lack predictive capabilities. The main challenge is to design a system that can reliably anticipate failures in a highly sensitive and partially chaotic environment.

Goal

The goal of this work is to build a predictive system capable of forecasting malfunctioning components in ASUS devices.

The expected result is a scalable failure prediction model integrated with monitoring and decision-support tools.

Proposed Solution

The proposed solution uses machine learning to analyze historical failure data, environmental conditions, and usage behavior. The architecture follows a layered design:

- **Data Ingestion**: Collection from sensors, ERP and maintenance logs
- **ETL Processing**: Cleaning, feature engineering, and validation
- **Predictive Modeling**: Algorithms such as XGBoost or classification models
- **Visualization & Alerts**: Dashboards and notifications for decision makers
- **Feedback Loop**: Continuous monitoring and model retraining

This modular architecture ensures scalability, traceability, and integration with industrial environments.

Experiments

A series of experiments were proposed to validate the predictive system:

Experiment	Objective	Method
Data Quality Evaluation	Detect noise/missing	Statistical validation, outlier
Model Training	Predict failure risk	Classification algorithms with
Performance Monitoring	Ensure reliability over time	Drift detection + retraining cycle
Integration Testing	Verify communication	APIs and simulated alerts

Tests focus on accuracy performance (≥85% target), response time (≤1s) and model stability under variable conditions.

Results

The workshops conclude that the system has strong business and operational value:

Strengths	Weaknesses
High-value industrial impact	High sensitivity to external factors
Continuous improvement via feedback	Noise and missing data require control
Scalable architecture	Predictive uncertainty under chaotic behavior

Expected results include improved maintenance scheduling, reduced unexpected failures, and better inventory planning.

Conclusions

The system meets the goals of failure prediction by combining data-driven models with systems engineering principles. Despite chaotic dynamics in component behavior, performance can be stabilized through monitoring, adaptive feedback, and robust data quality processes. This work establishes the foundation for a functional industrial solution capable of improving product reliability and reducing operational costs.

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