


# Chapter 10

## Automated Machine Learning Model Management: Integrating Monitoring, ML Observability, and Continuous Feedback for Enhanced Performance

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## ABSTRACT

*We present an automated machine learning model management system, which provides feedback loops, at-rest and in-flight observability, and continuous monitoring for sustaining and improving model performance in the long term. The system is built to support automated retraining and redeployment to mitigate challenges associated with data drift or the evolution of operational norms. Our models achieved 99.14% accuracy, 99.19% precision, 99.17% recall, and 99.18% F1 scores in Random Forest and Gradient Boosting. Our system demonstrated superior on-line observability and adaptability to AutoWeka and more conventional Gradient Boosting. Continuous feedback with on-going observations allows users to leverage our system in scalable, decision making applications, in non-stationary conditions while ensuring ongoing performance.*

## 1 INTRODUCTION

Machine learning has become a highly disruptive technology for many sectors today, as systems can effectively make data predictions and decisions with minimal human involvement (Castelli et al., 2025). Different sectors, such as health, finance, manufacturing, and agriculture, have seen the influence of machine learning on the practice of their professions today (Katragadda et al., 2021). However, as models become more sophisticated in many learning applications, it makes it quite difficult to manage these things in the production environment (Sivaraman, 2024). The models that are effective in a controlled environment are less effective in the real world (Kurunathan et al., 2022). Model tracking and optimisation from the start of model training, through model deployment, scaling and new version roll-out are under flagship 'Automated ML model management' (Nogare et al., 2024). The system guarantees high model metrics over new data instantiates by enforcing monitoring, ML observability and continuous feedback loops, so the system evolves to new data without performance degradation. So, the very bone of the paper is trying to provide a good answer for the kind of demand that is gradually growing for having a robust and automated management system that is currently valid for the engineering complexity and scale of the machine learning production setup, specifically stressing improvement of performance by insights for model feedback.

The primary focus of this study is the unified operation of ML models by (Vartika & William, 2023), which heeds the evolving demands of modern data. To start off, (Mahida, 2024) observed that standard machine learning workflows aim to build a model and deploy it in an environment, with minimal to no modifications, until the model's performance deteriorates to the point that manual updates or retraining be-

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