Integrating AI-Driven Test Orchestration in RegTech Platforms for Compliance Automation in Banking Systems

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Abstract

The issue of regulatory compliance in the banking sector has become quite complicated as the types of regulatory changes, emerging typologies of financial crime, and growing demands in terms of transparency and auditability continue to grow. RegTech solutions are now a key technological reaction, utilizing automation, analytics, and artificial intelligence (AI) to focus on the automation of compliance procedures. Nevertheless, even with the current developments in digital compliance, the process of testing these workflows, especially the ones that use AI-based models and rule-based engines, is still mostly manual, siloed, and hard to scale. The current paper suggests an AI-based test orchestration framework embedded into RegTechs. The framework will automate the test generation process, streamline the test execution process with risk-based prioritisation, and constantly monitor system behaviour to identify anomalies. The study identifies the enhancement of compliance accuracy, operational agility, and release agility through a conceptual assessment using banking scenarios. The proposed architecture will help to convert the conventional reactive compliance methods into permanent, proactive, and automated assurance frameworks to fit the current digital banking environments.

Keywords: RegTech, Banking Compliance, AI-Driven Test Orchestration, Compliance Automation, Regulatory Technology, Risk-Based Testing, Financial Crime Prevention, Rule-Based Engines, Machine Learning, Auditability, Digital Banking Systems, Automated Assurance.

1. Introduction

The banking sector across the globe is governed in a highly intricate network of regulations, such as the anti-money laundering (AML), know-your-customer (KYC), sanctions screening, payment compliance (PSD2), liquidity and capital adequacy (Basel III/IV) and data protection laws. These structures require high levels of monitoring, reporting and internal control. Lack of compliance may lead to huge fines and loss of reputation and therefore compliance is a leading strategic priority of financial institutions. The emergence of Regulatory Technology (RegTech) platforms has increased at a swift pace as bank institutions are finding effective and scalable methods of fulfilling their requirements. These systems are automated to interpret the rules, process data, score the risks, generate an alert, investigate, and report regulatory information. RegTech systems are able to identify complex behaviours with the advent of AI and machine learning (ML), limit false positives and adjust to emerging trends of financial crime. There has been no parallel development with testing these systems, though. Conventional automation is about UI- or API -level scripting and test datasets prepared manually. Such methods are slow, fragile, not applicable to settings with regular change of regulations, rules and ML models. This lack of built-in and smart test orchestration augments the operational risk and delays the regulatory change management process. The given paper presents an AI-based test orchestration layer as an inherent part of RegTech platforms. The proposed approach will provide better compliance assurance in both development-time and run-time through the combination of rule-based logic, AI-generated test assets, automated impact analysis, and continuous evidence generation.

2. Literature Review

2.1. Evolution of RegTech and Compliance Automation

Research on RegTech emphasises the transformative role of technology in simplifying complex regulatory landscapes. Research examines the effectiveness of digital interpretation of the rules, automated case management and data analytics to enhance efficiency in compliance. Some of the advantages identified by scholars include the lower cost of operation, accuracy, and the ability to control regulatory oversight. Another topic of RegTech literature is the SupTech, which are technologies applied by regulators to conduct data-driven supervision. RegTech, and SupTech both strive to make regulatory ecosystems more transparent, governed, and responsive.

2.2. AI and Automation in Compliance Processes

AI AI has now been incorporated into compliance processes particularly in AML and fraud detection. Machine learning models are used in checking anomalies, customer risk rating, pattern recognition of transactions, and text interpretation of regulations. NLP tools are used to identify obligations in regulatory documents, which can be digitised automatically into rules. Although AI can greatly enhance the accuracy of compliance, it is known to bring new challenges, such as model drift, explainability concerns, and governance challenges. It is these difficulties that render constant testing imperative.

2.3. Test Automation and AI-Driven Testing

According to modern testing literature, there has been a transformation of script-based regression to intelligent and autonomous testing. Trends include:

- AI-assisted test generation
- Self-healing test scripts
- Risk-based test orchestration
- Cloud-native scalable test execution
- Automated anomaly detection in test outcomes

Although AI-driven testing is well-studied in general software engineering, its integration into RegTech platforms is underexplored, representing a critical research gap.

3. Methodology

The proposed framework introduces a multi-layer architecture that embeds AI-driven test orchestration within a RegTech platform.

3.1. Architectural Layers

3.1.1. Regulatory Input Layer

Records rules, policies and internal policy changes. NLP services translate unstructured regulation text into machine readable rules which are then optimized by compliance experts.

3.1.2. Compliance Rule and Workflow Engine

Applies regulatory rationale through rules, decision tables andML models. Oversights workflow tracking, notifications, investigations, and reporting.

3.1.3. AI-Driven Test Orchestration Layer (Core Contribution)

This layer automates:

- Test case generation from rules
- Test prioritisation based on risk and regulatory impact
- Self-healing of broken test scripts
- Maintenance of traceability between rules, implementations, and tests

3.1.4. Execution and Observability Layer

Containerisation or serverless runners make scaling of test execution possible. Logs, coverage, metrics, and anomalies are gathered with observability tools.

3.1.5. Compliance Evidence and Reporting Layer

Stores completed test results, connected facts of evidence to particular regulations and produced auditor-ready records.

3.2. Orchestration Workflow

- **Change Detection:** Emits when a regulatory change is done or a model is retrained or a code is changed.
- **AI-Assisted Impact Analysis:** AI identifies affected workflows, data elements, and risk zones.
- **Automated Test Generation & Selection:** Both LLMs and ML generate or prioritize tests based on risk-based prioritisation.
- **Distributed Test Execution:** Runs functional, data integrity, model validation, and end-to-end scenario tests.

- **Analytics and Anomaly Detection:** Summarizes results, finding patterns or regressions that simple pass/fail test cannot find.
- **Compliance Evidence Creation:** Produces audit-ready documentation that is directly mapped on regulatory requirements.

3.3. Evaluation Approach

A conceptual evaluation using synthetic banking scenarios compares:

- Traditional scripted test automation
- AI-driven test orchestration

Metrics include:

- Test coverage
- Defect detection rate
- Requirement traceability
- Mean Time to Detect (MTTD) issues
- Cycle time for regulatory change releases

4. Results and Discussion

4.1. Improvements in Quality and Compliance

AI-generated tests are more comprehensive in regulatory edge cases and high-risk situations, and are more accurate at detecting defects. The possibility to map all tests to a single or many regulatory obligations increases the traceability which makes the evidence more transparent to be audited and supervised.

4.2. Operational Efficiency and Agility

Artificial intelligence-based orchestration minimizes human work in the test case design and maintenance. Automated risk-based regression helps the acceleration of the release, which allows a bank to react to a new regulation swiftly. Scalable execution environments eliminate bottlenecks and enhance feedback times.

4.3. Reduced Compliance and Operational Risk

The constant verification of rules, models, and workflows reduce the chances of the violation of compliance. Anonymous early identification of anomalies such as drift in model or minor behavioural deviations helps in promoting risk management and resilience in operations.

4.4. Alignment with Regulatory Expectations

The apparent demand of almost real-time compliance oversight, transparent traceability, and effective governance of AI systems is becoming the expectations of regulators. The framework underlines these expectations - Regulatory text - system logic - test evidence.

5. Future Direction and Conclusion

5.1. Future Direction

Several areas present opportunities for further enhancement:

5.1.1. Real-World Deployment and Empirical Studies

Large-scale pilots across banks and jurisdictions are needed to validate performance, adaptability, and cost-benefit outcomes.

5.1.2. Integration with SupTech Systems

Future RegTech platforms could share test evidence and compliance insights directly with supervisors, enabling collaborative and data-driven oversight.

5.1.3. Reinforcement Learning for Adaptive Orchestration

AI models would be able to schedule tests dynamically and allocate compute resources as well as optimise test suites as risk conditions change.

5.1.4. Advanced Governance and Explainability

There is a need to have mechanisms that guarantee accountable, transparent AI-based testing, particularly where the models are used to make compliance-related decisions.

Conclusion

The RegTech platforms have become central to current financial compliance, yet it has not kept up with technological advancement in testing of the platforms. The AI-based test orchestration can be seen as a transformational concept, as it makes it possible to run compliance workflows continuously, with no human involvement, and risk-consciously. The proposed architecture will combine regulatory interpretation, test generation, orchestration and evidence creation into a single system. Conceptual evaluation results indicate that there are improvements in:

- Compliance accuracy
- Release agility
- Operational risk reduction
- Audit readiness

By embedding intelligent testing within RegTech platforms, banks can shift from reactive to proactive compliance assurance, supporting more resilient and transparent financial systems.

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