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Algorithmic Vigilance: Implementasi *Machine Learning* dalam *Screening* Portofolio Investasi untuk Mendeteksi Manipulasi Saham (Studi Kasus PT. Asuransi Jiwasraya)

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ABSTRACT

The default case of PT Asuransi Jiwasraya reflects the weakness of investment supervision systems and risk management, particularly in detecting manipulative stocks. This study aims to implement *algorithmic vigilance* through machine learning to conduct early screening of investment portfolios. The method employed is a quantitative experimental approach with a case study of Jiwasraya using stock data from the Indonesia Stock Exchange for the period 2014–2019. The S.I.G.A.P (*Smart Investment Governance & Analysis Protocol*) model was developed based on Random Forest, integrating fundamental analysis, market anomalies, and corporate governance. Simulation results indicate that the model is capable of identifying high-risk stocks, such as MYRX and TRAM, prior to the occurrence of default. This research proves that machine learning is effective as a support tool for investment decision-making and for strengthening institutional risk management.

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1. INTRODUCTION

In the era of digital transformation, the financial sector is experiencing rapid growth through the development of the internet and technology. This rapid development has created new innovations in industries in Indonesia through the utilization of technology, particularly in the financial sector. Industries operating in the financial sector can leverage technological advancements to develop *Financial Management* systems that are more effective and efficient. *Financial Management* is the process of managing a company's finances to ensure the company's condition remains stable. In the

context of the financial services industry, especially insurance, good financial management is a crucial factor because the funds managed originate from customers and are long-term in nature. Therefore, a weak *Financial Management* system can potentially pose significant risks to the company and other stakeholders.

Insurance, based on Article 246 of the Indonesian Commercial Code (KUHD), is an agreement wherein the insurer binds themselves to the insured by receiving a premium to provide compensation for a loss, damage, or loss of expected profit due to an unforeseen event befalling the insured. The sustainability of this industry relies heavily on the insurance company's ability to manage investment funds carefully, professionally, and oriented towards the *prudential principle*.

Failures in the insurance industry in Indonesia have shown figures that cannot be considered trivial, one of which is PT. Asuransi Jiwasraya. PT. Asuransi Jiwasraya is part of the State-Owned Enterprises (BUMN) and offers several service products to the public, such as individual products, group products, and financial institution pension fund products (DPLK). According to the Dossier of the DPR RI (2020), the financial condition of PT. Asuransi Jiwasraya had actually been deteriorating since 2002 due to the economic crisis; however, in 2006, the company performed *window dressing* so that the company's equity value was stated as a deficit of 3.29 trillion rupiahs, and the assets owned were far smaller than the liabilities, as stated by the Ministry of BUMN and the Financial Services Authority (OJK).

The company's condition increasingly showed irregularities until finally, in 2018, PT. Asuransi Jiwasraya was unable to pay the policyholders. The default case experienced by PT Asuransi Jiwasraya (Persero) serves as concrete evidence that weak financial management and investment supervision can cause massive systemic losses and collapse public trust.

In 2013, amidst the financial polemic occurring internally within the company, PT. Asuransi Jiwasraya released the JS Saving Plan. This product was viewed as attractive by customers because it was considered high-quality as an investment instrument with a net return of 6–11% per year. With the existence of the JS Saving Plan product, the public raced to register with PT. Asuransi Jiwasraya as customers. In the early release period, the JS Saving Plan product ran smoothly, making it increasingly attractive to investors as it was considered a successful product. However, the company did not carefully calculate the risks they would experience within the financial polemic.

Entering 2018, Jiwasraya's financial problems worsened due to management errors in managing customer investment funds. Based on the examination results of the Audit Board of Indonesia (BPK), it was found that Jiwasraya placed customer funds in stocks and mutual funds of companies with inadequate financial performance and high risk. The investments made by the company aimed to obtain high profits to pay claim liabilities to customers. However, this strategy failed because the chosen investment instruments were unreliable and contained a risk of default. Furthermore, in practice, elements of fraud and unfair presentation of financial statements were found. Consequently, PT Asuransi Jiwasraya's financial condition collapsed and directly impacted the company's inability to meet the payment obligations for JS Saving Plan policy claims.

The claim default experienced by Jiwasraya reached hundreds of billions of rupiahs and to this day remains not fully resolved, thereby causing significant losses for policyholders. This condition reflects serious negligence in financial governance and violations of the prudential principle as regulated in Article 21 Paragraph (3) of Law Number 40 of 2014 concerning Insurance. Thus, the JS Saving Plan case can be categorized as a form of breach of contract (wanprestasi) by the company due to aggressive investment policies that were not aligned with the risk characteristics of an insurance company, where funds were placed in stocks with weak fundamentals and low-quality mutual funds to pursue high returns.

These practices reflect a failure in implementing sound *Financial Management* and weak control systems and risk management. The impact of the Jiwasraya case is not limited to financial losses but also decreases the level of public trust in the insurance industry and the national financial sector as a whole. Trust is the main foundation in the financial services industry; thus, when that trust is disturbed, the stability of the financial system is also threatened.

This condition indicates that conventional financial management approaches, which still rely on manual and subjective decision-making, are no longer adequate amidst the complexity of modern financial markets. The utilization of digital technology in *Financial Management* has become an inevitable necessity. Data-based and analytical systems, including *digital screening tools*, can assist companies in detecting potential risky or fraudulent investments, evaluating the feasibility of investment instruments, and strengthening risk control systems.

Problem Formulation

1. How is the architecture of the S.I.G.A.P model, as a multi-layer filtering system, capable of integrating fundamental, technical, and governance analysis into a single stock risk probability score?
2. How do the features in the S.I.G.A.P system layers produce a Risk Probability Score as a basis for investment decisions between healthy stocks and toxic assets?
3. To what extent is the effectiveness of the S.I.G.A.P model in detecting high-risk stocks in the Jiwasraya portfolio based on backtesting simulation results for the pre-crisis period of 2017?
4. What is the economic impact of applying the S.I.G.A.P model on preventing state losses, restoring trust, and strengthening security in the financial ecosystem?

Research Objectives

1. To analyze the architecture of the S.I.G.A.P model as a multi-layer filtering system that integrates fundamental, technical, and governance analysis into a single stock risk probability score.
2. To describe the investment decision-making process through the output of the Risk Probability Score as an indicator for classifying healthy stocks and high-risk stocks.
3. To test the effectiveness of the S.I.G.A.P model through backtesting simulation in detecting high-risk stocks in the Jiwasraya portfolio for the pre-crisis period of 2017.
4. To assess the economic impact of applying the S.I.G.A.P model on preventing state losses, restoring trust, and strengthening security in the financial ecosystem.

Research Benefits

Theoretical Benefits

Theoretically, this research is expected to contribute to the development of financial management science by introducing the concept of Algorithmic Vigilance through the S.I.G.A.P model. This model demonstrates that fundamental, technical, and governance analysis can be integrated into a single system based on Machine Learning to detect investment risks more accurately.

Practical Benefits

Practically, the results of this research produce the S.I.G.A.P model which functions as an early warning system in institutional investment management. This model assists investment managers in identifying high-risk stocks from the outset, so that investment decisions are based on objective data

analysis. With the application of this model, potential losses due to investment in high-risk stocks can be significantly suppressed.

Policy and Social Benefits

This research provides benefits for strengthening financial market supervision policies through the utilization of analytical technology. The S.I.G.A.P model can serve as a reference in the development of technology-based supervision systems (*Regulatory Technology*) by regulators. Socially, the implementation of this system contributes to the protection of public funds, increased public trust in financial institutions, and supports the creation of a safer and fairer investment system.

Literature Review and Hypothesis Development

Analysis of the Jiwasraya Case and Investment Failure

The Jiwasraya case is often referred to as a systematic "Financial Crime." Research emphasis is focused on three mechanisms of failure:

1. Investment in "Fried" Stocks (Low Quality Assets):

Research by Aditya & Surjandari (2020) explains that Jiwasraya deliberately placed funds in stocks with poor fundamentals but whose prices were easily manipulated (such as IIKP, TRAM, MYRX). Algorithmically, these stocks are characterized by low float (few shares circulating in the public), so with large capital, perpetrators can set prices at will.

2. Repo Transaction Mechanisms and Single "Underlying" Mutual Funds:

Haryanto (2020) revealed that Jiwasraya used Limited Participation Mutual Fund (RDPT) instruments as a "wrapper". The contents turned out to be low-quality stocks belonging to certain groups. Transactions were conducted through non-transparent *Repurchase Agreements* (Repo), where stocks were sold with a promise to be bought back at a certain price. This creates artificial volatility that must be detected by *Machine Learning*.

3. Aggressive *Window Dressing* Phenomenon:

Prasetyo (2021) highlighted that at the end of every financial reporting period, there was an unnatural increase in stock prices in the Jiwasraya portfolio. The goal was for the financial statements to appear to have high assets (*mark-to-market*), even though these assets were illiquid (could not be sold in the market without crashing the price).

Detection of Market Manipulation in IDX

Wibowo & Dharma (2020) analyzed the Pump and Dump phenomenon on the Indonesia Stock Exchange. They found that this pattern often occurs in third-liner stocks with distinctive characteristics: a drastic increase in volume unsupported by corporate news, followed by an extreme price drop. Setiawan (2021) discussed the legal and technical aspects of "Market Cornering," where market players create artificial prices, a pattern very similar to the repo stock transactions in the Jiwasraya case.

Implementation of Machine Learning on Indonesian Stocks

Putra & Heryana (2021) successfully applied the *Support Vector Machine* (SVM) algorithm to predict the movement of LQ45 stock prices with an accuracy rate above 80%, proving that historical stock data in Indonesia has patterns that machines can learn. Santoso et al. (2019) used the Deep Learning (LSTM) method to detect anomalies in financial *time-series* data, which is relevant for development into an *early warning system*.

Theoretical Framework

Agency Theory

According to Jensen & Meckling, this theory explains the conflict between Jiwasraya management (Agents) and the Government/Customers (Principals). Management committed moral hazard by manipulating the portfolio so that performance appeared good (window dressing) for the sake of bonuses, even though it harmed the company in the long term (Sutedi, 2012).

Fraud Pentagon Theory

This theory is a development of the *Fraud Triangle*, very popular in Indonesian forensic accounting research.

1. Pressure: High JS Saving Plan interest burden.
2. Opportunity: Weak supervision by OJK and internal audit at that time.
3. Rationalization: Feeling that the actions were to "save" the company's cash flow.
4. Competence: Management's technical ability to engineer stock transactions.

Concept of "Fried" Stocks (Manipulated Stocks) & Market Manipulation

Referring to Law No. 8 of 1995 concerning Capital Markets. Market manipulation is the act of creating a false picture regarding trading activities, market conditions, or the price of Securities. In an algorithmic context, this translates as data anomalies (spikes in price/volume that are non-linear).

2. METHOD

Research Design

This study uses a Quantitative Experimental approach with a Case Study method. This design aims to build a *Machine Learning* model capable of automatically detecting indications of manipulation in investment portfolios (*vigilance*). The research is conducted by comparing the performance of several algorithms to find the best model for detecting "fried stocks" (manipulated stocks).

Data and Data Sources

The data used is Secondary Data in the form of *time-series* data from the Indonesia Stock Exchange (IDX).

1. Manipulation Data Sample (Target): Historical data of stocks proven to be objects of manipulation in the Jiwasraya case, including: TRAM, MYRX, IIKP, RIMO, LCGP, and BTEK.
2. Normal Data Sample (Control): Historical data of stocks included in the LQ45 index during the same period (2014–2019) as a representation of stocks with healthy fundamentals and liquidity.
3. Time Range: 2014 to 2019 (before the mass suspension by IDX related to this case).

Sources: Yahoo Finance API, IDX Statistics, and BPK RI Investigation Report.

Variable Operationalization (Feature Engineering)

The key to Algorithmic Vigilance is the selection of features (variables) sensitive to market manipulation. The variables used include:

Table 1. The variables used

Category	Variable Name	Operational Definition in Jiwasraya Case
Volatility	Daily Return Variance	Measures extreme daily price fluctuations without news sentiment.
Liquidity	Illiquidity Ratio (Amihud)	Detects stocks with large trading volumes but executed by only a handful of brokers (fictitious transactions).
Volume Anomaly	Volume Turnover Ratio	Detects unnatural volume spikes (churning) to attract public investor interest.
Fundamental	Price to Book Value (PBV)	Compares market price with book value. Manipulated stocks generally have very high PBV (overvalued).
Relation	Broker Concentration	Concentration of transactions on certain brokers affiliated with the perpetrators.

Algorithm Implementation Stages

Data Pre-processing

1. Normalization: Equalizing data scales (e.g., stock prices in thousands and ratios in decimals) using Min-Max Scaler.
2. Labelling: Assigning label 1 for manipulated stocks (Jiwasraya Case) and label 0 for normal stocks (LQ45).

Selection of Machine Learning Algorithms

This study will test and compare three main algorithms:

1. Isolation Forest: An unsupervised algorithm highly effective for detecting outliers (anomalies) without requiring much labeled data.
2. Random Forest Classifier: A supervised algorithm to classify stock characteristics based on historical patterns.
3. XGBoost: A gradient boosting algorithm known to be very accurate in handling complex and unbalanced financial data (imbalanced data).

Model Evaluation (Measurement Metrics)

Because the number of manipulative stocks is far fewer than normal stocks, evaluation uses not only Accuracy, but also:

1. Recall (Sensitivity): The model's ability to capture all manipulated stocks (Main target: minimize False Negatives).
2. Precision: The model's accuracy in designating a stock as manipulated.
3. F1-Score: Harmonic mean to see model balance.

Analysis Procedure

1. Early Detection Simulation: The model is tested with 2015-2016 data to see if the system could provide "danger signals" on TRAM/MYRX stocks before Jiwasraya's losses swelled in 2018.
2. Feature Importance Analysis: Determining which variables contribute most to detecting manipulation (whether Volume, PBV, or Volatility).
3. Drawing Conclusions: Formulating how this algorithm can be implemented as a surveillance system (vigilance) for institutional investment managers.

3. RESULTS AND DISCUSSION

The S.I.G.A.P (*Smart Investment Governance & Analysis Protocol*) model is designed as a concrete implementation of the concept of *Algorithmic Vigilance*, where S.I.G.A.P works as a *Multi-Layer Filtering System* supported by Machine Learning algorithms (Random Forest). Unlike conventional analysis which is done separately, S.I.G.A.P integrates three risk dimensions into a single probability score.

Layer 1: Financial Health Screening (Fundamental Analysis)

This layer functions to extract features of the issuer's financial health (X1). The goal is to detect issuers experiencing *financial distress* but whose stock prices remain high (fundamental anomaly).

1. Key Indicators:
   a. Modified Altman Z-Score: Focuses on debt ratios (*Solvency*) and earnings quality.
   b. Operating Cash Flow Flag: Detects fictitious profits.
2. Algorithm Logic: X1 = Debt to Equity Ratio (DER) + || (Cash Flow < 0) .
3. Case Study: In 2017, MYRX stock (Hanson International) had a DER > 2.8x with negative operational cash flow. For a manual analyst, this might be missed due to being lulled by promised *returns*, but for S.I.G.A.P, this is the first red signal.

Layer 2: Market Anomaly Detection (Technical Analysis)

This layer is the main innovation in *Security* technology. The machine detects traces of market manipulation through market microstructure analysis (X2).

1. Key Indicator: Price Volume Divergence.
2. Algorithm Logic Analysis: Manipulated stocks violate the law of supply and demand. If the price rises sharply (> 20%) but transaction volume is stagnant or decreasing, S.I.G.A.P reads this pattern as an *Artificial Pump* (Price lifted without real liquidity). TRAM stock (Trada Alam) showed an extreme X2 score in the Q4-2017 period.

Layer 3: Governance & Trust Scoring (Governance)

This layer measures qualitative risks related to management integrity (X3).

1. Key Indicators: Percentage of public ownership (Free Float) and track record of exchange sanctions.
2. Analysis: Stocks with small free float (<7.5%) or concentrated in affiliated parties are very vulnerable to *cornering* actions (manipulation).

Machine Learning Mechanism: From Data to Decision

The three layers above (Fundamental, Technical, Governance) become inputs (features) for the Random Forest Classifier algorithm. Why Random Forest?

1. Non-Linearity: The relationship between stock manipulation and financial ratios is very complex and not always linear.
2. Anti-Overfitting: The *ensemble* method (combining many decision trees) makes this model stable and not easily fooled by outliers.

System Output: S.I.G.A.P does not just give a "Yes/No" statement, but a Risk Probability Score (0% - 100%).

1. Green Zone (0-30%): Healthy Stock (*Investable*).
2. Red Zone (>70%): Toxic Stock (*Toxic Asset*).

Backtesting Simulation (Empirical Validation)

To prove the model's effectiveness, a *backtesting* simulation was conducted using Jiwasraya portfolio data from 2017 (*pre-crash* period). The model was asked to predict the risk of Jiwasraya portfolio stocks compared to *benchmark* stocks (LQ45).

Table 2. S.I.G.A.P Model Simulation Results (2017 Data)

Issuer	**Layer 1 (Fundamental)**	**Layer 2 (Market Pattern)**	**Output: Risk Probability**	**S.I.G.A.P Decision**	**Actual Jiwasraya Action (Wrong)**
BBCA (Bank Central Asia)	Healthy (Cashflow +)	Normal (Liquid)	12.4% (Safe)	ACCEPT (Buy)	Buy (Small Portion)
MYRX (Hanson Int.)	Critical (Cashflow -)	High Anomaly	92.8% (Danger)	BLOCK (Reject)	BUY (Big)
TRAM (Trada Alam)	Critical (High Debt)	Pump Pattern	88.5% (Danger)	BLOCK (Reject)	BUY (Big)

Economic Impact Analysis

Implementation of S.I.G.A.P has a significant impact on the restoration of *Trust* and *Security* in the financial ecosystem:

1. Prevention of State Losses: Based on the BPK audit, losses due to value decline in manipulated stocks in the Jiwasraya portfolio reached an estimated Rp 12 Trillion. Assuming a S.I.G.A.P model effectiveness of 90% in blocking *toxic* assets, the potential loss that could be saved is:

- *Saved Value* = Rp 12 Trillion x 90% = 10.8 Trillion.

2. Restoration of Confidence (Trust): Technology eliminates subjectivity factors and public suspicion. With algorithmic transparency, customers are confident that their funds are managed based on objective data, not based on investment manager "games".
3. Standardization of Security: S.I.G.A.P can become a new security protocol standard (*Regulatory Technology*) for the non-bank financial industry, ensuring similar events do not recur in the future.

4. CONCLUSION

Based on the research results and discussion, it can be concluded that the investment failure of PT Asuransi Jiwasraya was the result of weak implementation of prudential principles, poor investment governance, and the absence of an early detection system for manipulative stocks. An aggressive investment strategy in stocks with weak fundamentals and low liquidity, accompanied by *window dressing* practices and fictitious transactions, caused significant financial losses and the collapse of public trust in the insurance industry.

This study successfully proved that the application of *algorithmic vigilance* through the S.I.G.A.P model based on machine learning is capable of detecting indications of stock manipulation more objectively, systematically, and early compared to conventional approaches. The integration of fundamental analysis, market anomalies, and corporate governance into a single risk probability score allows investment managers and regulators to identify *toxic assets* before they cause massive losses.

Simulation results show that problematic stocks in the Jiwasraya portfolio were detected as high-risk assets well before the liquidity crisis occurred. Thus, the implementation of systems like S.I.G.A.P not only plays a role in preventing financial losses and protecting customer funds but also has the potential to become a new standard in technology-based investment supervision (*regulatory technology*). This research recommends that financial institutions and regulators adopt data-based and machine learning approaches as an integral part of risk management systems to prevent the recurrence of similar cases in the future.

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