MARKET MANIPULATION DETECTION by SUPERVISED LEARNING

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MOTIVATION

As our world becomes increasingly sophisticated, it simultaneously offers more avenues for individuals with fraudulent intentions to exploit. **Fraud** has become an alarmingly pervasive issue, occurring at an astonishing rate of approximately **every 15 seconds**. The focus of the current market surveillance system is on sudden fluctuations or unusual behaviors in share prices or trading volumes. However, **this current investigation process still heavily relies on manual tracking and rule-based systems**. The methods used may need to become more efficient in detecting market manipulation.

METHODOLOGIES

Step 1 Data Collection from Shanghai and Shenzhen Stock Exchange (Price, Volume, PE Ratio, Beta, Realised Volatility, Current Ratio, Quick Ratio).

Step 2 EDA Analysis.

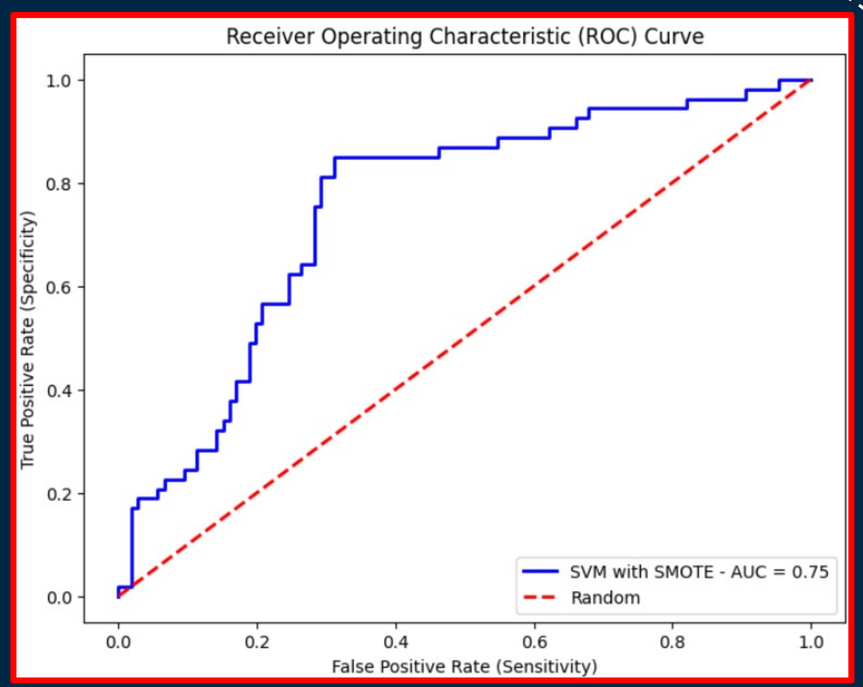
Step 3 Model Training (Support Vector Machines SVM, Decision Trees DT, Naive Bayes NB, Logistic Regression LR).

Step 4 Hyperparameters Tuning (e.g. DT - Max Depth, Loss Function, Random Forest).

Step 5 Perform oversampling method, SMOTE technique.

RESULTS

	AUC	F-Score	Accuracy
Support Vector Machine (SVM)	0.62	0.43	0.67
SVM-SMOTE	**0.75**	**0.63**	**0.72**
Decision Tree (Boosting)	0.74	0.57	0.71
Decision Tree (Random Forest)	0.69	0.38	0.63
Naïve Bayes	0.62	0.58	0.54
Logistic Regression (LR)	0.67	0.04	0.72
LR-SMOTE	0.53	0.58	0.72



- The **SVM with SMOTE** outperforms the rest of the models with the **highest accuracy and AUC**.
- **Balanced sensitivity and specificity** in determining the true positives and true negatives.
- The **high AUC** demonstrated that the model is **suitable for binary classification**, which aligns with our dataset of detecting violated cases and non-violated cases.

DISCUSSION

From the model training process and results obtained, we suggest some measures that can be done to enhance model performance:

Social Media NLP - Some types of market manipulations are largely contributed by retail investors, the Chinese stock forum, Guba (股吧) is considered a popular forum for stock market.

Separate Model Training - Refined to tailoring models to specific types of market manipulations identified in database (e.g. assume violation type P2501 is most easily detected by SVM).

Anomalies Real Time Detection - Dynamically adjusted probabilities of market manipulation detected from different models and report the trade if the probabilities are high among various models.