Part 2: Predicting Troop Betrayal in the War Against the Phrygians

[Link To Github Repo](#) (Contains README file, Dataset and working code)

Naturally, there are two sides to every story—those who stay faithful and those who turn traitorous. The faithful soldiers view betrayal as a serious threat, an internal breakdown of unity and trust. They believe that by eliminating traitors to save the clan from collapsing, they are defending their way of life and acting morally. But the traitors can also envision their own destruction because they might feel abandoned, mistreated, or taken advantage of by their own leadership. Thus, it's possible that joining the Phrygians is seen by them as a means of survival and escape from internal ruin rather than as a betrayal. One is fighting to protect the integrity of the clan, and the other is fighting to survive perceived wrongs within its ranks, in a desperate attempt to stop annihilation. Understanding motivations is essential to anticipating and averting defection.

Betrayal's Roots : What factors to consider?

- **Wealth Status:** Financial vulnerability is a key motivator for betrayal. Less wealthy soldiers may experience feelings of dissatisfaction or desperation, which increases their likelihood of defecting for monetary benefits. The ones coming from very poor backgrounds may be tempted more by offers of wealth from the enemy, whereas it is less vulnerable in financial sense to the more wealthy soldiers but not impossible to recruit them into such betrayal through other forms of power or influence.

- **Power Dynamics:** Power dynamics in the military hierarchy can have a considerable impact on a possibility of betrayal. Soldiers in higher levels may be more vulnerable to external offers of authority and influence from the enemy, making them prime targets for recruiting. Lower-ranking soldiers may feel disregarded, leading to anger and a desire for further attention. Such ambition or dissatisfaction with the current situation may make people seek defection as a means to achieving higher ranks or authority elsewhere.

- **Soldier's Track Record and Performance**: Mission success ratings reflect the soldier's effectiveness, whereas peer reviews reflect trust and teamwork within a unit. Recognition through awards and commendations may build loyalty; nevertheless, without recognition, some may seek validation through defection. Attendance data for team activities will reflect involvement or disengagement within the unit. Armed forces often maintain such information in order to gain a comprehensive understanding of each individual's health and performance status, thereby providing an assessment of everyone. This may be essential in order to predict potential betrayal and maintain rank integrity.

- **Loyalty History and Behavioural Indicators:** Past behaviour can be used to forecast future behaviour. Soldiers who have betrayed before are a good risk in the future for disloyalty. Frequent disciplinary concerns can indicate a habit of rebellious behaviour, implying a potential for future betrayal. Scores from previous loyalty exams or evaluations performed by

superiors. Sentiment can be analysed from personal communications (e.g., letters, emails) to determine emotions toward the leadership or the mission.

- **Influence of Propaganda and Proximity to the Enemy:** Propaganda powerfully influences the perception of soldiers, who can thus be easily swayed by loyalty. Messages from the enemy that align with a soldier's moral values or complaints indicate the possibility of betrayal, particularly for those who feel unfairly valued and oppressed. Proximity to the Phrygian border increases the possibility of treason, as soldiers stationed near the enemy are more vulnerable to logistical desertion and claims of wealth and power. Known attempts at bribery against a soldier serve as important warning signs of potential treachery, demonstrating the dangers of both psychological persuasion and proximity to the enemy.

Data Dive: Representing Key Factors in a Dataset

- **Military Identification Number** : Unique identifier for the soldier in the dataset. This is not used in any of the predictions but is a reference number to track individual soldiers and becomes important to keep any attempts of impersonation in check.

- **Wealth Score:** This score rates the economic history of each soldier from 1 to 10. For purposes of this analysis, a low score represents more economic susceptibility. By having an idea as to what level of wealth the soldier represents, we can determine the probability that he may traduce a person on the basis of pure economic demand.

- **Rank and Progression Time:** Represented in an array, with entries relating to time taken to progress through the ranks in military hierarchies. Each entry in the array represents the number of months or years spent on a rank before moving on to the next. The analysis of these data might indicate some patterns of advancement, and these are useful in identifying 'stagnated' or 'under-valued' soldiers in situations that make them more susceptible to defection.

- **Mission Success Ratings:** It tracks how well each soldier performs in accomplishing the assigned missions, giving a numerical score ranging from 0 to 100 that reflects their performance, number of missions, and score gained in each. Higher ratings are supposed to depict the capability as well as reliability of a soldier, which may sometimes relate to loyalty and commitment toward the unit.

- **Peer Reviews:** This captures feedback from peer soldiers on trust, teamwork, and collaboration-mostly rated on a scale of 1 to 5. Positive peer feedbacks can enhance the feelings of belonging and loyalty in a soldier; negative peer feedback may indicate problems that could likely contribute towards eventual disengagement or betrayal.

- **Attendance Records**: This follows the attendance of an individual soldier in group activities and exercises and is usually measured in percentage form of total events attended-from 0% to 100%. Regular attendance reflects attentiveness and a sense of belonging within the unit, while consistent absence may be an indication of lack of investment, therefore, potentially

high-risk for betrayal.

- **Disciplinary Actions:** This field records the number and type of disciplinary actions against a soldier, with a higher count indicating a greater risk of future disloyalty.

- **Sentiment Analysis Score:** This field assigns a numerical sentiment score based on qualitative analysis of personal communications (e.g., letters, emails), indicating a soldier's feelings toward leadership or the mission. Understanding these sentiments is crucial for predicting potential loyalty or betrayal, as emotional states can significantly influence decision-making.

- **Proximity to Enemy:**This field indicates whether a soldier is stationed near the Phrygian border (1) or at a safer distance (0). Soldiers closer to the enemy are more vulnerable to defection opportunities, making this a straightforward and quantifiable measure of risk.

- **Propaganda Influence Score:** This score measures the extent to which enemy propaganda resonates with a soldier's beliefs and grievances. It runs from 0 (no influence) up to 10 (high influence). A higher score indicates a greater susceptibility to enemy messaging, making it easier to quantify loyalty risks based on psychological factors.

- **Loyalty History:** This field indicates whether a soldier has a history of disloyalty or betrayal or taking bribes, with 0 representing no past betrayals and 1 indicating a previous act of disloyalty. This data is crucial for predicting future behaviour, as soldiers with a history of betrayal are statistically more likely to betray again. In a binary tree algorithm, this field can be used to immediately flag soldiers with a past betrayal, allowing for quicker identification and risk assessment within the unit.

Military Identification Number	Wealth Score (On Scale of 1-10)	Rank and Progression Time (Months)	Mission Success Ratings (Out of 100)	Peer Reviews (On Scale of 1 to 5)	Attendance Records	Disciplinary Actions (On Scale of 1-5)	Sentiment Analysis Score (On Scale of 0-1)	Proximity to Enemy	Propaganda Influence Score (On Scale of 1-10)	Loyalty History (Target Cloumn)
1	7	12	85	4	95%	0	0.7	0	2	0
2	3	24	60	3	80%	2	0.4	1	8	1
3	5	18	75	5	90%	1	0.6	0	3	0
4	8	30	90	5	100%	0	0.9	0	1	0
5	2	6	55	2	70%	3	0.2	1	10	1

Data Compilation and Collection Strategy

The military already collects extensive data on soldiers, such as *Military Identification Numbers, Rank and Time Progression, Peer Reviews, Mission Success Rates, Attendance, Disciplinary Actions and Proximity to the Enemy.* These key metrics are fundamental in assessing behaviour and performance, making them an ideal starting point for loyalty prediction models. By leveraging this existing, trusted data, our model builds on a reliable framework already in place.

To enhance predictions and close gaps, it's crucial to gather additional data points—specifically *Sentiment Analysis Scores, Propaganda Influence Scores, and Loyalty History.*
To gather sensitive information without raising suspicion, a strategic and discrete approach is necessary. **Sentiment analysis** could be carried out subtly through natural language processing of

private communications, such as email and social media, to monitor attitude changes. **Propaganda Influence Scores** can be calculated using carefully designed surveys that measure soldiers' exposure to and perceptions of enemy messaging. These surveys should be presented as part of routine psychological assessments, blending seamlessly with other mental health evaluations to avoid suspicion. **Loyalty History**, according to reports from the defaulter, should be kept confidential so as not to jeopardise the interest of soldiers but also the investigation. Privacy is required in terms of having accurate data collection and the preservation of trust and cohesion in the ranks. By strategically embedding these new data points into existing processes, we can gather critical insights without compromising morale or operational security.

Building, Optimising, and Scaling the Betrayal Estimator Model

To build a machine learning model capable of handling larger datasets and increasing computational demands, we need to take a comprehensive approach that includes model development and scaling. Here is our strategy:

1. Data Preprocessing and Management
Sampling: By applying any technique such as stratified sampling we can work on a representative subset of your data if the full dataset is too large.
Data Pipeline: We can use the data pipeline incorporating these libraries to ingest, transform, and store data with efficiency using either Apache Kafka or Apache Spark.
Batch Processing: Process data in batches rather than loading everything into memory at once. This reduces the memory usage of the system.

2. Model Selection and Optimization
Scalable Algorithms: Some algorithms are intrinsically more scalable than others, such as tree-based approaches, like Random Forest or Gradient Boosting. That is used when dealing with an enormous amount of data.
Simplify Models: We can simplify the models that use fewer computing powers during the early stages of model development.

3. Feature Engineering
Dimensionality Reduction: We can apply PCA or t-SNE to reduce the feature space; it will make the models less complex and faster to train.
Feature Selection: Select only the most relevant features toward improving the training time and reducing overfitting.

4. Monitoring and Maintenance
Performance Monitoring: Monitor the performance of the model in production to pinpoint scalability issues or degradation over time.
Regular Updates: Regular retraining of models with new data for maximum effectiveness and relevance.

For implementation of this strategy, please refer to the linked resources, which include a detailed README, the dataset, and working code: Link To Github Repository

Programming Language and Libraries

- **Language:** Python

- **Libraries:**

  For Data Handling and Preprocessing: Pandas, NumPy

  For Machine Learning Framework: Scikit-learn

  For Model Evaluation : Metrics from Scikit-learn: Functions like accuracy_score, confusion_matrix, and classification_report

  File Handling : CSV Files

Thank You!

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