Predictive Modeling for Water Pump Functionality

OBJECTIVE: PREDICT WATER PUMP FUNCTIONALITY TO IMPROVE SERVICE DELIVERY IN RURAL TANZANIA.

KEY OUTCOMES:

- ACHIEVED 81% MODEL ACCURACY
- IDENTIFIED HIGH-RISK PUMPS AND REGIONS
- ENABLED DATA-DRIVEN MAINTENANCE PLANNING

Model Performance

- Model Used: Random Forest Classifier
- Accuracy: 81%
- Key Metrics:
- • Functional – F1: 0.85 | Precision: 0.81 | Recall: 0.89
- • Needs Repair – F1: 0.41 | Precision: 0.55 | Recall: 0.33
- • Non-Functional – F1: 0.81 | Precision: 0.84 | Recall: 0.78
- Observation: 'Needs Repair' class is hardest to predict.

Business Insights

- Many non-functional pumps could have been preemptively fixed.
- Key predictors of failure: construction year, region, management type, installer.
- Model allows forecasting of high-risk pumps before failure.

Recommendations

- 1. Proactive Maintenance: Prioritize high-risk pumps.
- 2. Targeted Investment: Allocate budgets to high-failure areas.
- 3. Improve Data Collection: Train field workers and standardize reports.
- 4. Digital Monitoring: Use sensors or mobile apps for real-time updates.
- 5. Stakeholder Dashboard: Visualize pump status and model predictions.

Impact Potential

- **Short-Term:**
- Reduce pump downtime and water scarcity
- Optimize maintenance scheduling

- **Long-Term:**
- Lower repair costs
- Improve infrastructure planning and community trust
- Scalable model for broader utility systems

Thank You

- Q& A

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