Gnanamani

College of Technology

Gateway to Great Life !

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AUTONOMOUS

Department: BIO MEDICAL ENGINEERING

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TOPIC: SMART WATER MANAGEMENT

Team members

1.Gowri Sankar. S

2.Kaushik. E

3.Jegan. S

4.Hari Krishnan.K

5.Gowtham. V

By.

Harikrishnan K

In smart water management using IoT (Internet of Things), feature engineering, model training, and evaluation play crucial roles in optimizing the system's performance:

1. Feature Engineering:

- Data Collection: Gather data from IoT sensors, which can include information on water flow rates, temperature, pressure, weather conditions, water quality, and more.
- Data Preprocessing: Clean and preprocess the data to handle missing values, outliers, and noise.
- Feature Selection: Identify the most relevant features for analysis and model building. This can involve domain knowledge to choose the right variables.
- Feature Transformation: Convert raw data into suitable formats, like scaling, normalization, or encoding categorical variables.
- Feature Creation: Create new features from existing ones to capture complex relationships in the data, e.g., deriving water usage patterns from flow rate and time data.

2. Model Training:

- Algorithm Selection: Choose machine learning algorithms suitable for the problem. For water management, regression, classification, or time series forecasting models may be appropriate.
- Data Splitting: Divide the dataset into training, validation, and testing sets. Time-based splitting can be essential to account for temporal patterns in water data.
- Model Building: Train models on the training data, using features engineered in the previous step. This can include linear regression, decision trees, neural networks, etc.

- Hyperparameter Tuning: Optimize model hyperparameters to enhance predictive accuracy and generalization.
- Continuous Learning: Implement mechanisms to retrain models periodically with new data to adapt to changing conditions and maintain accuracy.

3. Evaluation:

- Metrics: Define appropriate evaluation metrics, depending on the specific objectives. Common metrics for smart water management might include Mean Absolute Error (MAE) for demand prediction or Precision and Recall for anomaly detection.
- Cross-Validation: Use techniques like k-fold cross-validation to ensure the model's robustness and generalize well.
- Testing: Assess the model's performance on the testing dataset to estimate its real-world applicability.
- Model Monitoring: Continuously monitor the deployed model's performance in the field, ensuring it remains accurate and effective.
- Feedback Loop: Incorporate feedback mechanisms to update the model based on the latest data, potentially using techniques like online learning.

Overall, feature engineering, model training, and evaluation are integral to creating effective and efficient smart water management systems using IoT. They help in maximizing resource utilization, minimizing water wastage, and ensuring the sustainability of water resources.