📁 Data Preprocessing

✂️ Data Loading & Cleaning
- Remove missing values
- Handle outliers
- Select relevant features

Comprehensive Data Preparation
- Numeric conversion
- Statistical filtering
- Feature selection

🎯 Input Layer
- Raw Input Features
- Initial Data Representation

Feature Transformation

⬜ Dense Layer 1
- ReLU Activation
- L2 Regularization
- Initial Feature Learning

Stabilize Activations

☑️ Batch Normalization
- Normalize Layer Outputs
- Accelerate Training
- Reduce Internal Covariate Shift

Further Feature Refinement

🔀 Dense Layer 2
- ReLU Activation
- L2 Regularization
- Complex Feature Extraction

Normalize Representations

☑️ Batch Normalization
- Stabilize Intermediate Representations
- Prevent Overfitting

Compress Feature Space

⏳ Bottleneck Layer
- ReLU Activation
- L2 Regularization
- Capture Essential Features

Feature Reconstruction

⬜ Dense Layer 3
- ReLU Activation
- L2 Regularization
- Initial Decoding Stage

Normalize Decoded Features

☑️ Batch Normalization
- Stabilize Reconstruction
- Ensure Consistent Scaling

Final Feature Refinement

🔀 Dense Layer 4
- ReLU Activation
- L2 Regularization
- Detailed Feature Restoration

Generate Reconstructed Input

🎯 Final Output Layer
- Linear Activation
- Reconstruct Original Input
- Minimize Reconstruction Error

Model Output

📦 Final Artifacts
- Trained Autoencoder
- Preprocessing Scaler
- Training History

🏋️ Model Training

🎓 Model Fitting
- Adam Optimizer
- Early Stopping
- Learning Rate Reduction

⚙️ Advanced Training Strategies
- Adaptive learning
- Prevent overfitting
- Optimize performance

Model Evaluation

📊 Performance Analysis
- Reconstruction Error
- MSE Calculation
- Anomaly Detection