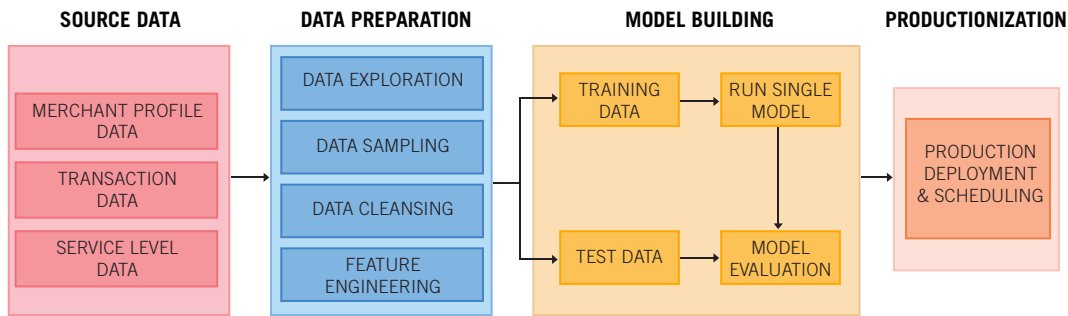## Need for New Machine Learning Approach

Machine learning (ML) is just the next step in the technology evolution to keep your business relevant in digital competition by extracting meaningful insights from raw data to quickly solve complex, data-rich business problems. ML algorithms learn from data iteratively and allow computers to find different types of hidden insights in the data without any human intervention. Out of the different types of machine learning implementation, Supervised Classification algorithms are the most widely used for binary predictions to optimize business decisions.

Traditionally, multiple models (like Decision Tree, Random Forest, Support Vector Machine, Logistic Regression) are trained and then compared to choose the best performing model. However, the best model selected on the basis of performance metrics (like accuracy, confusion matrix, Cohen's Kappa, A/B Test, ROC Curve) after training and validation at development may not remain the best choice with the changing data pattern at production.

In order to get the best predictions at each batch of production runs with minimum production support, Bitwise proposes a 'Bag of Model' approach to ML deployment on cloud.
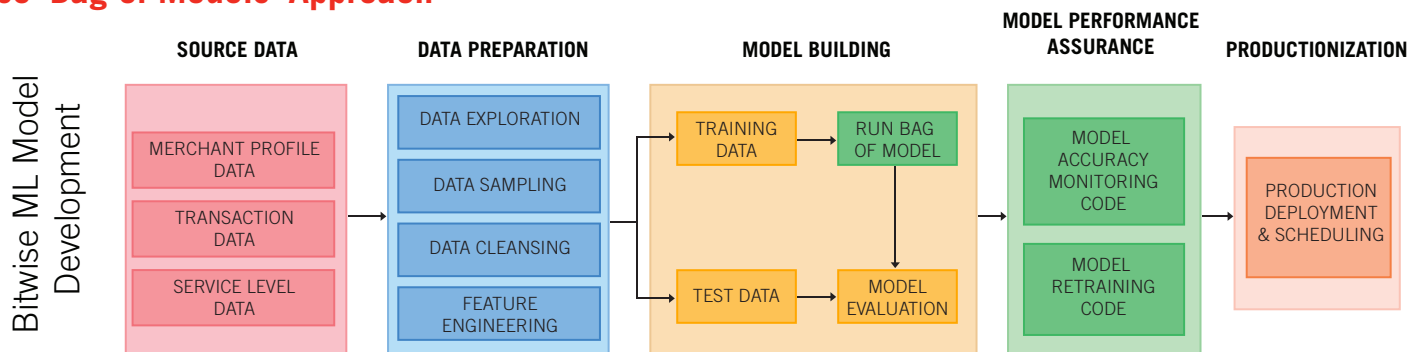
Machine Learning Implementation

Traditional Approach

- **Source Data** - Gather data from different sources
- **Data Preparation** - Clean data for homogeneity
- **Model Building** - Select the right Machine Learning algorithm
- **Run Single Model** – Build single model using training data set
- **Model Evaluation** - Test model against unseen data to test model performance
- **Performance Improvisation** - Hyper parameter tuning
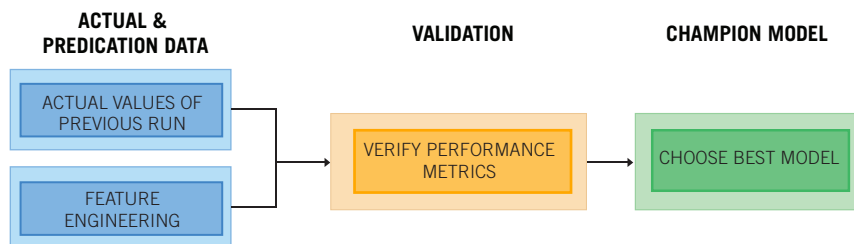- **Prediction** - Predict result for future data

Bitwise 'Bag of Models' Approach

- **Source Data** - Gather data from different sources
- **Data Preparation** - Gather, clean, combine, structure and organize data by using statistical data analysis techniques
- **Model Building** -
  o Split dataset for Training and Validation of model
  o Train model using various algorithms for identified features
  o Tune hyper parameters of best performing model
  o Calculate accuracy metrics of each algorithm
- **Model Performance Assurance** - Select the best performing model as Champion by comparing accuracy metrics and others as Challenger models
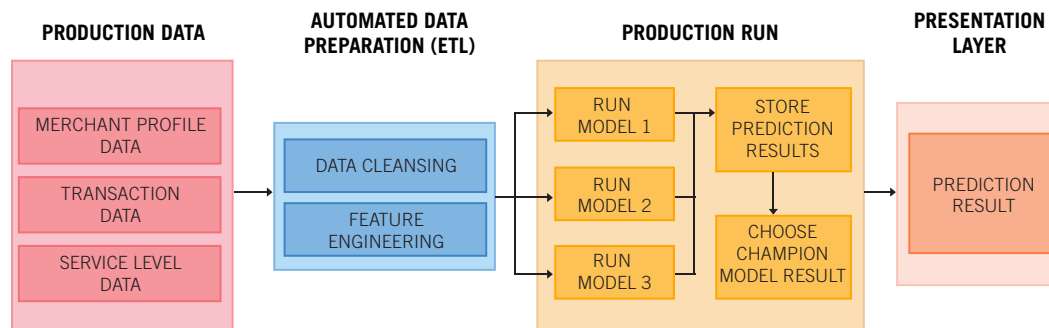- **Prediction** – Predict result for future data using Champion model

Champion Selection

- Validate predictions result of previous execution with newly obtained actual labels and calculate performance metrics
- Update the reference to point to champion model as per validation results

ACTUAL & PREDICATION DATA

VALIDATION

CHAMPION MODEL

ACTUAL VALUES OF PREVIOUS RUN

FEATURE ENGINEERING

VERIFY PERFORMANCE METRICS

CHOOSE BEST MODEL

Prediction Run in Production

- Execute Bag of Models for latest predictions and store their results for validation
- Use champion model result for presentation

PRODUCTION DATA

AUTOMATED DATA PREPARATION (ETL)

PRODUCTION RUN

PRESENTATION LAYER

MERCHANT PROFILE DATA

TRANSACTION DATA

SERVICE LEVEL DATA

DATA CLEANSING

FEATURE ENGINEERING

RUN MODEL 1

RUN MODEL 2

RUN MODEL 3

STORE PREDICTION RESULTS

CHOOSE CHAMPION MODEL RESULT

PREDICTION RESULT

Key Benefits

- High-accuracy models selected using metric comparison
- Automated performance check and selection of best model's score with every production run
- Periodic notification of model performance and intimation of retraining
- Reduced maintenance cost

Why Bitwise for Your Analytics Needs

- Extensive experience developing innovative machine learning processes.
- We offer the relevant expertise, proven methodologies, vendor partnerships and industry best practices developed over 20 years of experience to help implement Analytics related solutions.
- Bitwise offers a proven approach to aligning the appropriate requirements such as Project / Business Requirements, Use Case, Platform Identification, Tool Evaluation and Resource Requirements that are needed to implement advanced analytic capabilities.

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Bitwise delivers technology solutions that leverage data to enable business insights. By deploying our breakthrough technology innovations, we help our global clients maximize their competitive advantage. We are the industry's most experienced and dedicated team of data professionals, focusing on data warehousing, business intelligence (BI), big data, and Web/mobile application development. We optimize value for our clients through our global-delivery model and with our proprietary technology tools that reduce the time, complexity, and cost of data initiatives. Together, our people and technology provide the insights clients need to continue to lead their fields. Bitwise is headquartered in Chicago, Illinois with offices in Pune, India and London, UK.

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