



## 01 Excel Basics & Interface

- Workbook vs Worksheet
- Cells, rows, columns, and ranges
- Data types and basic formatting
- AutoFill, Flash Fill, and series
- Sorting and filtering basics

## 02 Data Entry, Cleaning & Formatting

- Text functions: TRIM, LEFT, RIGHT, MID, LEN, CONCAT
- Date & Time functions: TODAY, NOW, DAY, MONTH, YEAR
- Find & Replace, Remove Duplicates
- Data Validation and dropdown lists
- Conditional formatting

## 03 Essential Formulas & Functions

- Arithmetic formulas (+, -, \*, /)
- Logical functions: IF, AND, OR, NOT, IFERROR
- Lookup functions: VLOOKUP, HLOOKUP, XLOOKUP, INDEX, MATCH
- Nested functions
- Named ranges

## 04 Data Aggregation & PivotTables

- COUNT, COUNTA, COUNTIF, SUM, SUMIF, AVERAGE, AVERAGEIF
- Introduction to PivotTables
- Grouping data, Slicers, and Timelines
- Refresh and update PivotTables

# DATA SCIENCE

## 05 Data Visualization with Charts & Graphs

- Column, Line, Pie, Bar, and Area charts
- Combo charts and Dual Axis
- Sparklines
- Chart formatting and customization
- Best practices for data storytelling

## 06 Advanced Excel Functions

- Array formulas and dynamic arrays
- TEXT, VALUE, INDIRECT, OFFSET
- UNIQUE, FILTER, SORT, SEQUENCE
- Using LET and LAMBDA (Excel 365)

## 07 Excel Data Tools for Analysis

- What-If Analysis: Goal Seek, Scenario Manager, Data Tables
- Solver Add-in
- Grouping, Subtotals, and Outlining
- Working with external data (CSV, Web)

## 08 Dashboarding Techniques

- KPI tracking setup
- Interactive dropdowns and form control
- Linked charts and dynamic ranges
- Layout and design principles

## 09 Power Query & Power Pivot (Advanced Users)

- Introduction to Power Query Editor
- Data transformation and merging
- Loading data into Power Pivot
- Creating relationships between tables
- DAX basics: CALCULATE, SUMX, RELATED

## 10 > Excel & Data Integration

- Importing data from web, SQL Server, Access
- Connecting Excel to Power BI
- Using Excel with Python/R (basic preview)
- Exporting Excel data to other formats

## 11 > Introduction to Databases & MySQL Basics

- What is a Database? What is MySQL?
- Relational vs Non-relational databases
- Installing MySQL & MySQL Workbench
- SQL vs MySQL vs NoSQL
- Creating and using databases
- Basic SQL syntax & structure
- SELECT, WHERE, LIMIT, ORDER BY, DISTINCT
- Filtering and logical operators (AND, OR, NOT)

## 12 > Table Management & Data Types

- CREATE TABLE, DROP TABLE, ALTER TABLE
- Data Types: INT, VARCHAR, DATE, DECIMAL, BOOLEAN
- Constraints: PRIMARY KEY, FOREIGN KEY, UNIQUE, NOT NULL, DEFAULT
- Inserting data (INSERT INTO)
- Updating records (UPDATE)
- Deleting data (DELETE)

## 13 > Data Querying & Aggregation

- COUNT(), SUM(), AVG(), MIN(), MAX()
- GROUP BY & HAVING
- BETWEEN, IN, LIKE patterns
- Aliases with AS
- Subqueries and nested queries

## 14 > Joins & Relationships

- Types of JOINS: INNER JOIN, LEFT JOIN, RIGHT JOIN, FULL JOIN
- CROSS JOIN, SELF JOIN
- Joining 3+ tables
- NULL handling in joins
- Real-world relationship modeling

## 15 > Views, Indexes & Stored Routines

- CREATE VIEW, DROP VIEW
- Indexing: When and why to use indexes
- Stored Procedures and Functions
- CASE WHEN statements
- IF, IFNULL, COALESCE

## 16 > Data Cleaning & Preparation

- Handling NULLs
- TRIM, REPLACE, CAST, CONVERT
- Using CTEs (WITH clause)
- De-duplicating data
- Conditional updates

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# DATA SCIENCE

## 18 > Security, Permissions & Optimization

- User creation, roles, and permissions
- GRANT, REVOKE
- Query optimization basics: EXPLAIN, indexing
- ACID principles
- Backup and Restore

## 19 > Integration with Data Science Tools

- Connecting MySQL to Python (pymysql, sqlalchemy)
- Exporting/importing CSVs
- MySQL to Power BI / Tableau
- MySQL with Jupyter Notebooks

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- Connecting MySQL to Python (pymysql, sqlalchemy)
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## 21 > Introduction to Power BI

- What is Power BI? Components and Architecture
- Power BI Desktop vs Power BI Service
- Installing Power BI Desktop
- Interface Overview and Navigation
- Connecting to Data Sources (Excel, CSV, Web)

## 22 > Data Loading and Transformation with Power Query

- Introduction to Power Query Editor
- Basic transformations: Rename, Remove, Fill, Pivot/Unpivot
- Merging and Appending Queries
- Creating custom columns
- Data types and error handling

# DATA SCIENCE

## 23 > Data Modeling and Relationships

- Star schema vs Snowflake schema
- Creating relationships between tables
- Cardinality and cross-filter direction
- Data normalization and denormalization
- Managing date tables

## 24 > DAX Fundamentals

- Calculated Columns vs Measures
- Common DAX functions: SUM, AVERAGE, COUNTROWS, DISTINCTCOUNT
- Logical and conditional functions: IF, SWITCH
- Time Intelligence: TOTALYTD, DATESMTD, SAMEPERIODLASTYEAR

## 25 > Data Visualization & Report Design

- Visualization types: bar, line, matrix, map, KPI, gauge, slicer
- Formatting and customizing visuals
- Tooltips, drillthrough, and bookmarks
- Best practices for data storytelling

## 26 > Interactive Dashboards and UX

- Page navigation, buttons, bookmarks
- Sync slicers and cross-highlighting
- Creating dynamic headers and tooltips
- Responsive design principles

## 27 > Power BI Service and Sharing Reports

- Publishing reports to Power BI Service
- Creating dashboards in Power BI Service
- Sharing, workspaces, and access permissions
- Data refresh and scheduled updates

# DATA SCIENCE

## 28 > Advanced DAX & Analytics

- Variables in DAX
- Ranking and Top N analysis
- Cumulative totals and running averages
- Forecasting and Decomposition Tree

## 29 > Row-Level Security and Data Governance

- Role creation and management
- Static vs dynamic row-level security
- Using USERNAME() and USERPRINCIPALNAME()
- Auditing and usage metrics

## 30 > Power BI Ecosystem & Integration

- Power BI with Excel and PowerPoint
- Introduction to Power BI API and Power Automate
- Overview of Power BI Mobile App

## 31 > Introduction to Python

- Installing Python and Jupyter Notebooks
- Python IDEs (Jupyter, VS Code, PyCharm)
- Writing and running Python scripts
- Variables, Data Types, and Type Casting
- Input/Output operations

## 32 > Introduction to Python

- Conditional statements: if, else, elif
- Loops: for, while, break, continue
- Functions: def, return, arguments, default values
- Lambda functions and map, filter, reduce
- Recursion basics

# DATA SCIENCE

## 33 > Python Data Structures

- Lists, Tuples, Sets, Dictionaries
- List comprehension
- Nesting and iteration
- Common built-in methods and functions

## 34 > Working with Files and Modules

- Reading and writing files (.txt, .csv, .json)
- File modes and context manager (with)
- Creating and importing modules
- Exploring standard libraries (math, os, sys)

## 35 > Data Analysis with NumPy and Pandas

- NumPy arrays and operations
- Array indexing, slicing, reshaping
- Pandas Series and DataFrames
- Data cleaning: handling NaNs, duplicates
- Filtering, sorting, grouping, merging

## 36 > Data Visualization

- Introduction to Matplotlib
- Line plots, bar plots, histograms, scatter plots
- Introduction to Seaborn
- Customizing plots: titles, labels, colors
- Plot styling and exporting images

## 37 > Exploratory Data Analysis (EDA)

- Descriptive statistics with Pandas
- Handling outliers and skewed data
- Correlation and covariance
- Plotting distributions and relationships
- Creating data summaries for stakeholders

## 38 > Introduction to Statistics

- What is Statistics?
- Types of Statistics: Descriptive – Summarizing data, Inferential – Drawing conclusions from data
- Types of Data: Categorical (nominal, ordinal), Numerical (discrete, continuous)
- Scales of Measurement: Nominal, Ordinal, Interval, Ratio
- Applications: Market trends, user behavior analysis, business KPIs

## 39 > Descriptive Statistics

- Central Tendency: Mean (average), Median (middle), Mode (most frequent)
- Dispersion (Spread): Range, Interquartile Range (IQR), Variance & Standard Deviation
- Distribution Shape: Symmetry, Skewness, Kurtosis
- Visual Tools: Histograms, Boxplots, Bar Charts, Pie Charts
- Use Case: Analyze customer ratings, sales fluctuations, exam scores

## 40 > Probability Fundamentals

- Basic Probability Rules
- Events: Mutually Exclusive, Independent
- Conditional Probability
- Real-World Application: Click-through rates, customer churn, campaign effectiveness, Foundation for machine learning models

## 41 > Data Distributions

- Normal Distribution & the Bell Curve
- Empirical Rule (68-95-99.7%)
- Other Distributions: Binomial, Uniform, Exponential
- Z-Scores and Standardization
- Application: Detect outliers, prepare data for ML algorithms

## 42 > Correlation & Regression

- Correlation: Pearson correlation coefficient <sup>®</sup>, Interpreting direction & strength
- Simple Linear Regression (Intro): Line of best fit, Slope & Intercept, Residuals and interpretation
- Use Case: Predicting sales from ad spend, ROI analysis

## 43 > Inferential Statistics Basics

- Sampling Techniques: Random, Stratified, Cluster
- Central Limit Theorem (concept)
- Hypothesis Testing: Null vs Alternative Hypothesis, p-values, Confidence Intervals, Type I & II Errors
- A/B Testing Basics
- Application: Test effectiveness of new features, campaigns, pricing changes

## 44 > Introduction to Machine Learning

- What is Machine Learning?
- How ML differs from traditional analytics (rules-based vs pattern-based)
- Types of Machine Learning:
  - Supervised Learning** – Labeled data (e.g., predicting sales)
  - Unsupervised Learning** – Unlabeled data (e.g., customer segmentation)
  - Reinforcement Learning** – Learning from actions and rewards

## 45 > Core Concepts in Machine Learning

- 
- Training set vs Testing set
- Generalization: What makes a model reliable
- Overfitting vs Underfitting
- Key Evaluation Metrics:  
**Classification:** Accuracy, Precision, Recall, F1-score  
**Regression:** MAE, RMSE,  $R^2$
- Cross-Validation and the importance of splitting data correctly

## 46 > Core Concepts in Machine Learning

- Linear Regression – Predicting continuous values
- Logistic Regression – Predicting binary categories
- Decision Trees – Simple, rule-based decision models
- K-Nearest Neighbors (KNN) – Classifying based on proximity
- Clustering (K-Means) – Finding natural groupings
- Random Forest (Intro) – Boosting accuracy through ensembles

## 47 > The ML Workflow in Analytics

- Data Collection – Importing raw data from Excel, SQL, etc.
- Preprocessing – Cleaning, handling missing values, encoding
- Feature Engineering – Creating new variables for better predictions
- Model Training – Fitting an algorithm to your data
- Model Evaluation – Measuring accuracy/performance
- Deployment or Presentation – Using or sharing results

## 48 > Foundations of Statistics For Machine Learning

- What is Statistics? Why is it critical for ML?
- Types of Statistics: Descriptive vs Inferential
- Types of Data: Qualitative vs Quantitative

# DATA SCIENCE

- Scales of Measurement: Nominal, Ordinal, Interval, Ratio
- Populations vs Samples
- Sampling Techniques: Random, Stratified, Cluster
- Bias and Variance (conceptual introduction)

## 49 Descriptive Statistics

- Measures of Central Tendency: Mean, Median, Mode
- Measures of Dispersion: Range, Variance, Standard Deviation, IQR
- Coefficient of Variation
- Percentiles and Quartiles
- Z-scores and Standardization
- Data Visualization: Histograms, Boxplots, Density Plots
- Skewness and Kurtosis

## 50 Probability Theory

- Basic Probability Rules
- Conditional Probability and Bayes' Theorem
- Independent vs Dependent Events
- Permutations and Combinations
- Probability Trees
- Applications in Naive Bayes and probabilistic modeling

## 51 Probability Distributions

- Discrete Distributions: Bernoulli, Binomial, Poisson
- Continuous Distributions: Uniform, Normal, Exponential, t-distribution
- Central Limit Theorem
- Empirical Rule (68–95–99.7 Rule)
- Applications: Outlier Detection, Assumptions for parametric models

## 52 Inferential Statistics

- Sampling Distributions
- Point Estimation and Interval Estimation
- Confidence Intervals for means and proportions
- Hypothesis Testing: Null vs Alternative, One-tailed vs Two-tailed, Type I and Type II Errors, p-values and Statistical Significance
- t-test, z-test, Chi-Square Test, ANOVA
- Use Case: A/B testing

## 53 Correlation and Regression

- Correlation Coefficients: Pearson, Spearman, Kendall
- Covariance
- Simple Linear Regression
- Multiple Linear Regression
- Interpretation of coefficients
- Multicollinearity and VIF
- Residual analysis and diagnostic plots
- Regression Assumptions
- Polynomial Regression

## 54 Feature Engineering & Selection (Statistical View)

- Encoding Categorical Variables: One-Hot, Label Encoding
- Standardization & Normalization
- Log, Box-Cox, and Power Transforms
- Feature Selection Techniques: ANOVA F-test, Mutual Information, Chi-square Test, Recursive Feature Elimination (RFE)
- Dimensionality Reduction: PCA (with Variance Explanation)

## 55 Advanced Regression Techniques

- Ridge Regression
- Lasso Regression
- ElasticNet

# DATA SCIENCE

- Logistic Regression: Odds, Log-Odds, Sigmoid
- Evaluation Metrics: Accuracy, Precision, Recall, F1, ROC-AUC
- Model Calibration

## 56 Bayesian Statistics

- Prior, Likelihood, Posterior
- Bayesian Inference
- MAP vs MLE
- Bayesian vs Frequentist methods
- Bayesian Networks (Intro)
- Use in Naive Bayes and probabilistic programming

## 57 Time Series Statistics (Advanced)

- Time Series Decomposition: Trend, Seasonality, Residual
- Stationarity and Differencing
- Autocorrelation and Partial Autocorrelation
- Lag and Moving Averages
- ACF, PACFARIMA Models (overview)
- STL Decomposition
- Forecasting Evaluation Metrics: MAPE, RMSE

## 58 Statistical Model Evaluation & Validation

- Cross-Validation: K-Fold, Stratified, Leave-One-Out
- Bias-Variance Tradeoff
- Resampling Techniques: Bootstrapping, Jackknife
- Statistical Tests for Model Comparison: Paired t-test, McNemar's Test
- Confidence Intervals for Predictions
- Calibration and Reliability Curves

## 59 Foundation of Machine Learning

- Introduction to Machine Learning
- Types of Machine Learning: Supervised, Unsupervised, Reinforcement
- Python Programming for Data Science
- Data Cleaning and Preprocessing Techniques
- Exploratory Data Analysis (EDA)
- Introduction to Statistics: Mean, Median, Mode, Variance, Standard Deviation
- Basics of Probability and Bayes Theorem
- Linear Algebra for Machine Learning: Vectors, Matrices, Dot Product
- Introduction to Calculus: Derivatives and Gradients
- Splitting Data: Train/Test, Cross-Validation
- Introduction to Basic Algorithms: Linear Regression, Logistic Regression, k-Nearest Neighbors (k-NN)

## 60 Core Machine Learning Algorithms and Evaluation

- Decision Trees and Random Forests
- Support Vector Machines (SVM)
- Naive Bayes Classification
- Clustering Algorithms: K-Means, Hierarchical Clustering, DBSCAN
- Dimensionality Reduction Techniques: Principal Component Analysis (PCA), t-SNE
- Feature Engineering and Feature Selection
- Model Evaluation Metrics: Confusion Matrix, ROC Curve, AUC, Precision, Recall, F1 Score
- Hyperparameter Tuning Methods: Grid Search, Random Search
- Introduction to Pipelines and Data Scaling
- Concepts of Overfitting, Underfitting, and Regularization (L1, L2)

## 61 Advanced Machine Learning & Specialized Topics

- Ensemble Learning: Bagging, Boosting, Stacking
- Advanced Gradient Boosting Techniques: XGBoost, LightGBM, CatBoost
- Time Series Analysis and Forecasting: ARIMA, Facebook Prophet, LSTM Concepts
- Recommender Systems: Collaborative Filtering and Content-Based Filtering
- Natural Language Processing: Tokenization, TF-IDF, Word Embeddings
- Introduction to Deep Learning: Neural Networks, Activation Functions, Forward and Backward Propagation
- Model Interpretability Techniques: SHAP, LIME
- Fundamentals of Model Deployment and Serving
- Workflow Automation and Scheduling
- Versioning and Experiment Tracking

## 62 Foundations of Deep Learning

- Introduction to Deep Learning and its place in Machine Learning
- Biological vs Artificial Neural Networks
- Architecture of a Neural Network: Layers, Weights, Biases
- Activation Functions: Sigmoid, Tanh, ReLU, Leaky ReLU
- Forward Propagation and Loss Functions
- Backpropagation and Gradient Descent
- Optimization Algorithms: SGD, Momentum, RMSProp, Adam
- Underfitting, Overfitting, and Regularization Techniques
- Batch Normalization and Dropout
- Initialization Techniques

## 63 Building and Training Neural Networks

- Ensemble Learning: Bagging, Boosting, Stacking
- Advanced Gradient Boosting Techniques: XGBoost, LightGBM, CatBoost
- Time Series Analysis and Forecasting: ARIMA, Facebook Prophet, LSTM Concepts
- Recommender Systems: Collaborative Filtering and Content-Based Filtering
- Natural Language Processing: Tokenization, TF-IDF, Word Embeddings
- Introduction to Deep Learning: Neural Networks, Activation Functions, Forward and Backward Propagation
- Model Interpretability Techniques: SHAP, LIME
- Fundamentals of Model Deployment and Serving
- Workflow Automation and Scheduling
- Versioning and Experiment Tracking

## 64 Foundations of Deep Learning

- Design Principles of Neural Networks
- Input Data Preparation and Normalization
- Training, Validation, and Test Splits
- Hyperparameter Tuning in Neural Networks
- Epochs, Batch Size, Learning Rate Scheduling
- Monitoring Performance: Accuracy, Loss, Early Stopping
- Debugging Neural Networks
- Model Saving and Checkpointing
- Introduction to Transfer Learning
- Evaluating and Interpreting Model Predictions

# DATA SCIENCE

## 65 Convolutional Neural Networks (CNNs)

- Introduction to CNNs and Visual Data
- Convolutional Layers and Filters
- Padding, Stride, and Receptive Field
- Pooling Layers: Max Pooling, Average Pooling
- Flattening and Fully Connected Layers
- CNN Architectures: LeNet, AlexNet, VGG, ResNet (conceptual overview)
- Applications in Image Classification and Object Detection
- Feature Extraction and Fine-tuning with Pretrained Models
- Data Augmentation Techniques for Image Tasks
- Interpreting CNN Predictions (Activation Maps, Saliency Maps)

## 66 Recurrent Neural Networks & Sequence Models

- Introduction to Sequence Modeling
- Recurrent Neural Networks: Structure and Limitations
- Exploding and Vanishing Gradient Problem
- Long Short-Term Memory (LSTM) Networks
- Gated Recurrent Units (GRUs)
- Applications in Time Series, Text, and Language Data
- Word Embeddings and Embedding Layers
- Bidirectional RNNs
- Sequence-to-Sequence Models and Attention Mechanism (basics)
- Evaluation of Sequence Model Outputs

## 67 Recurrent Neural Networks & Sequence Models

- Overview of NLP and Deep Learning
- Tokenization, Text Cleaning, and Preprocessing
- Word Embeddings: Word2Vec, GloVe
- Text Classification with Neural Networks
- Sentiment Analysis using LSTM/GRU

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- Named Entity Recognition
- Machine Translation Basics
- Sequence Generation and Text Summarization
- Introduction to Transformer Models
- Transfer Learning in NLP (BERT, GPT – conceptual level)

## 68 **Advanced Architectures & Trends in Deep Learning**

- Transformer Architecture: Self-Attention, Multi-Head Attention
- Encoder-Decoder Architecture
- Introduction to Vision Transformers (ViT)
- Generative Adversarial Networks (GANs)
- Autoencoders and Variational Autoencoders (VAE)
- Few-shot and Zero-shot Learning
- Meta-learning and Multi-task Learning
- Contrastive Learning and Self-supervised Learning
- Ethics, Fairness, and Bias in Deep Learning Systems
- The Future of Deep Learning in Research and Industry

## 69 **Introduction to Artificial Intelligence**

- Definition and scope of Artificial Intelligence
- History and evolution of AI
- Key differences: AI vs. Machine Learning vs. Deep Learning
- Types of AI: Narrow AI, General AI, Superintelligence
- Applications of AI across domains (healthcare, finance, transportation, etc.)
- The Turing Test and concept of intelligent behavior
- Challenges and limitations of AI

## 70 **Problem Solving & Search Techniques**

- Problem formulation in AI
- Uninformed search algorithms: Breadth-First Search, Depth-First Search, Uniform Cost Search
- Informed search algorithms: Greedy Search, A\* Algorithm

# DATA SCIENCE

- Heuristics and optimization strategies
- Constraint Satisfaction Problems (CSPs)
- Adversarial search and game playing
- Minimax algorithm and alpha-beta pruning

## 71 Knowledge Representation & Reasoning

- Propositional logic and First-Order Predicate Logic
- Inference rules and theorem proving
- Knowledge representation schemes: semantic networks, frames, ontologies
- Expert systems and rule-based reasoning
- Forward and backward chaining
- Uncertainty handling with probabilistic reasoning
- Bayesian networks and decision theory

## 72 Machine Learning for AI

- Supervised and unsupervised learning
- Common algorithms: Linear Regression, Decision Trees, SVM, k-NN
- Reinforcement learning basics
- Overfitting, underfitting, and regularization
- Model evaluation: accuracy, precision, recall, F1-score
- Introduction to neural networks
- Exploration vs. exploitation
- Markov Decision Processes (MDPs)

## 73 Natural Language Processing

- Basics of linguistics for NLP
- Text preprocessing: tokenization, stemming, lemmatization
- Language models and n-grams
- Named Entity Recognition (NER), Part-of-Speech Tagging
- Sentiment analysis and text classification
- Machine translation fundamentals
- Dialogue systems and conversational agents
- Introduction to transformer models

## 74 Computer Vision and Perception

- Introduction to digital image processing
- Feature extraction and edge detection
- Object detection and classification
- Image segmentation and face recognition
- Motion tracking and visual SLAM
- Optical character recognition (OCR)
- Real-world applications in healthcare, security, retail

## 75 Ethics, Governance, & Future of AI

- Fairness, transparency, and accountability in AI systems
- Bias and discrimination in data and models
- Explainability and interpretability
- Privacy and data protection concerns
- Autonomous weapons and AI in warfare
- AI and the future of work
- Regulations and global AI policies
- Future trends: General AI, AI consciousness, superintelligence

## 76 Generative AI (GenAI)

- Introduction to Generative AI and its evolution
- How Generative AI differs from Traditional AI
- Overview of foundation models and pre-trained architectures
- Large Language Models (LLMs): GPT, BERT, LLaMA, Claude, Gemini (overview)
- Prompt Engineering: Zero-shot, One-shot, Few-shot prompting
- Text generation with LLMs: Use cases and best practices
- Introduction to diffusion models for image generation
- Tools and APIs: OpenAI, HuggingFace Transformers, LangChain
- Building simple GenAI-powered apps
- Risks, Limitations, and Ethical concerns of GenAI
- Future of Generative AI in education, business, healthcare, and creativity

# DATA SCIENCE

## CARRIER OPPORTUNITIES AFTER STUDYING DATA SCIENCE

01

**Data Scientist**

02

**Data Architect**

03

**Data Engineer**

04

**Business Analyst**

05

**Data Analyst**

06

**Data Modeler**

07

**Statistician**

08

**ML - Engineer**

