



Introduction to AI and Data Science

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Introduction

Topics Covered

- What is AI, DS, ML, DL and GenAI?
- Scope of Data Science
- Data Science Workflow and Lifecycle
- Applications and use cases
- Tools and Frameworks

What is Artificial Intelligence?

- Artificial Intelligence or AI refers to ability of a computer systems to perform tasks that typically require human intelligence.
- The tasks include visual perception, speech recognition, decision-making, and language translation.
- AI systems are designed to adapt and improve their performance over time based on their experiences and interactions with the environment.

What is Data Science?

- Data science or DS is a multidisciplinary field that involves using various techniques, algorithms, and systems to extract knowledge and insights from data in various forms.
- Data scientists analyze, interpret, and visualize data to uncover patterns, trends, and insights that can be used to make informed decisions.

What is Machine Learning?

- Machine Learning or ML is the subset of AI that enable systems to **learn from data** and **improve their performance over time** without being explicitly programmed to do so.
- **Machine learning algorithms** are designed to **identify patterns and relationships in data**, allowing them to **make predictions or decisions without being explicitly programmed** for every possible scenario.

What is Machine Learning?

- Common applications of machine learning include
 - Image and speech recognition
 - Recommendation systems
 - Predictive analytics, and
 - Natural language processing.

What is Deep Learning?

- Deep learning or DL is a subset of ML that **uses artificial neural networks to model and solve complex problems**. Deep learning algorithms are **inspired by** the structure and function of the **human brain**.
- Deep learning has gained popularity in recent years due to its ability to automatically learn representations from data, significantly outperforming traditional machine learning methods in various applications.

What is Deep Learning?

- Training process of DL models is computationally intensive and typically requires large amounts of data, but the results can be highly accurate and robust across different domains.

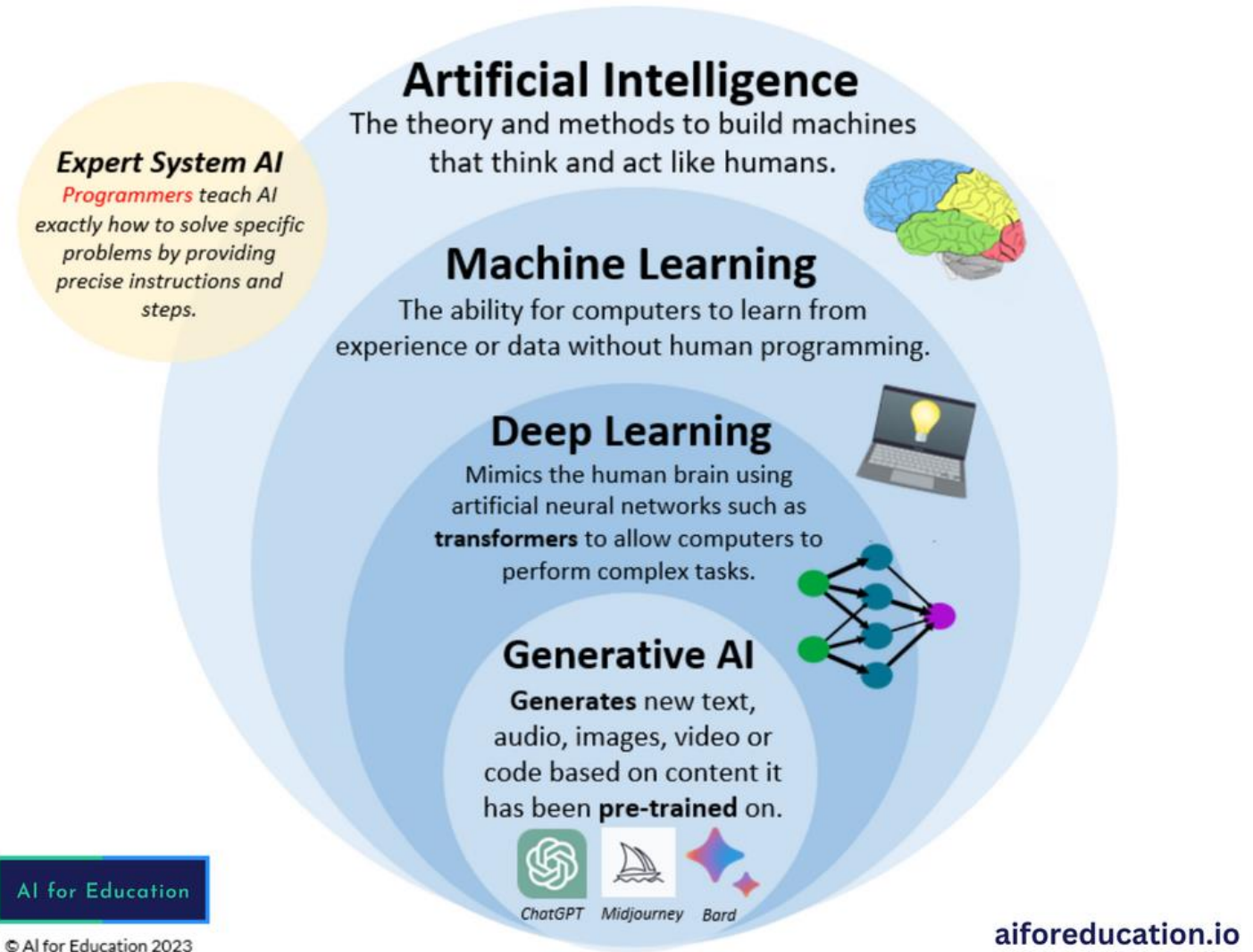
What is Generative AI?

- Generative AI or GenAI refers to a type of artificial intelligence that can **create new content**, such as text, images, or music, by learning patterns and structures from existing data.
- It is often used in fields like creative arts, content creation, and even language translation.

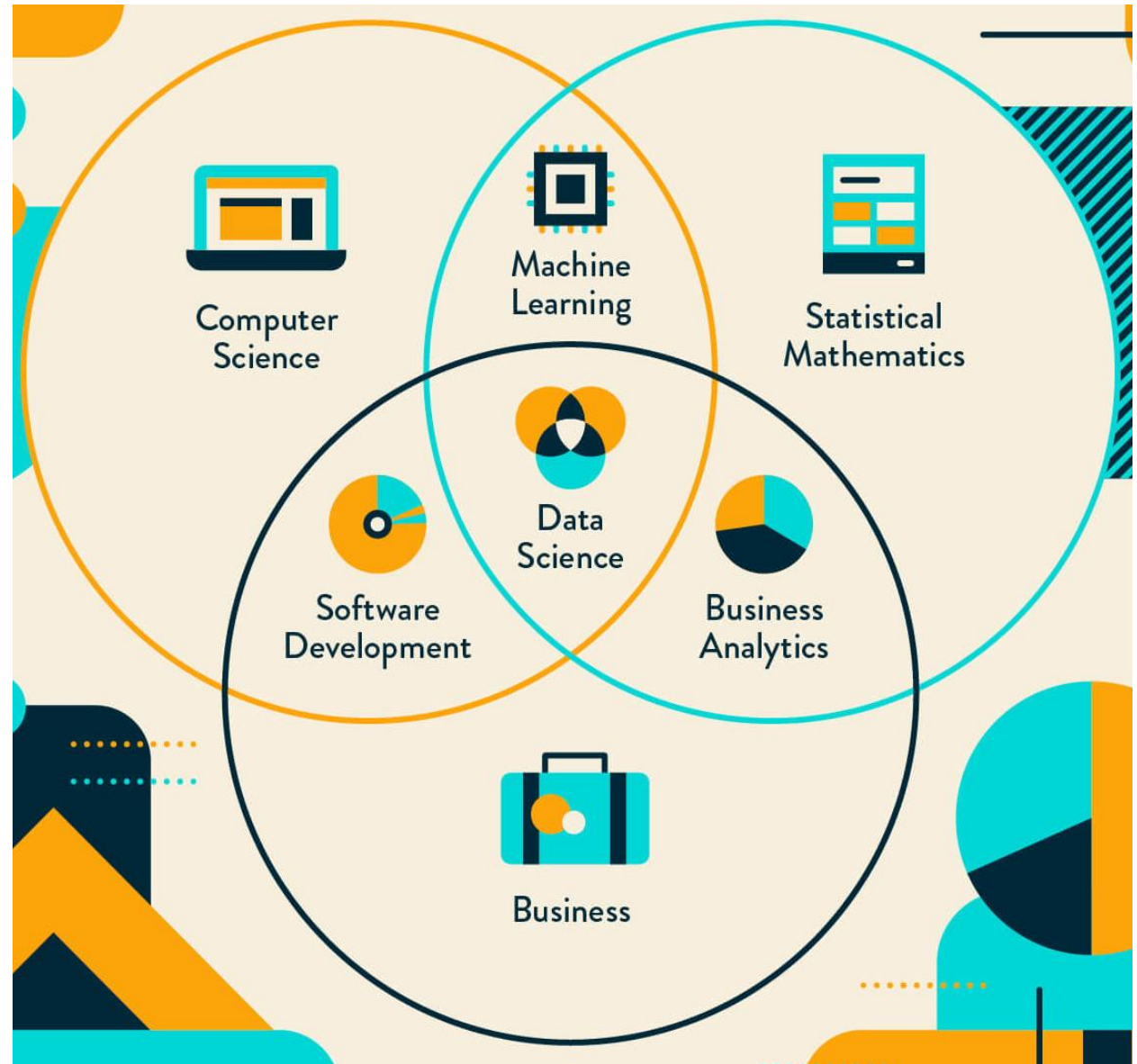
What is Generative AI?

- Generative AI models, such as Generative Adversarial Networks (GANs) or Variational Autoencoders (VAEs), are designed to generate original and novel content based on the patterns they have learned from large datasets during their training process.

Relation between AI, ML, DL & GenAI



Scope of Data Science and ML



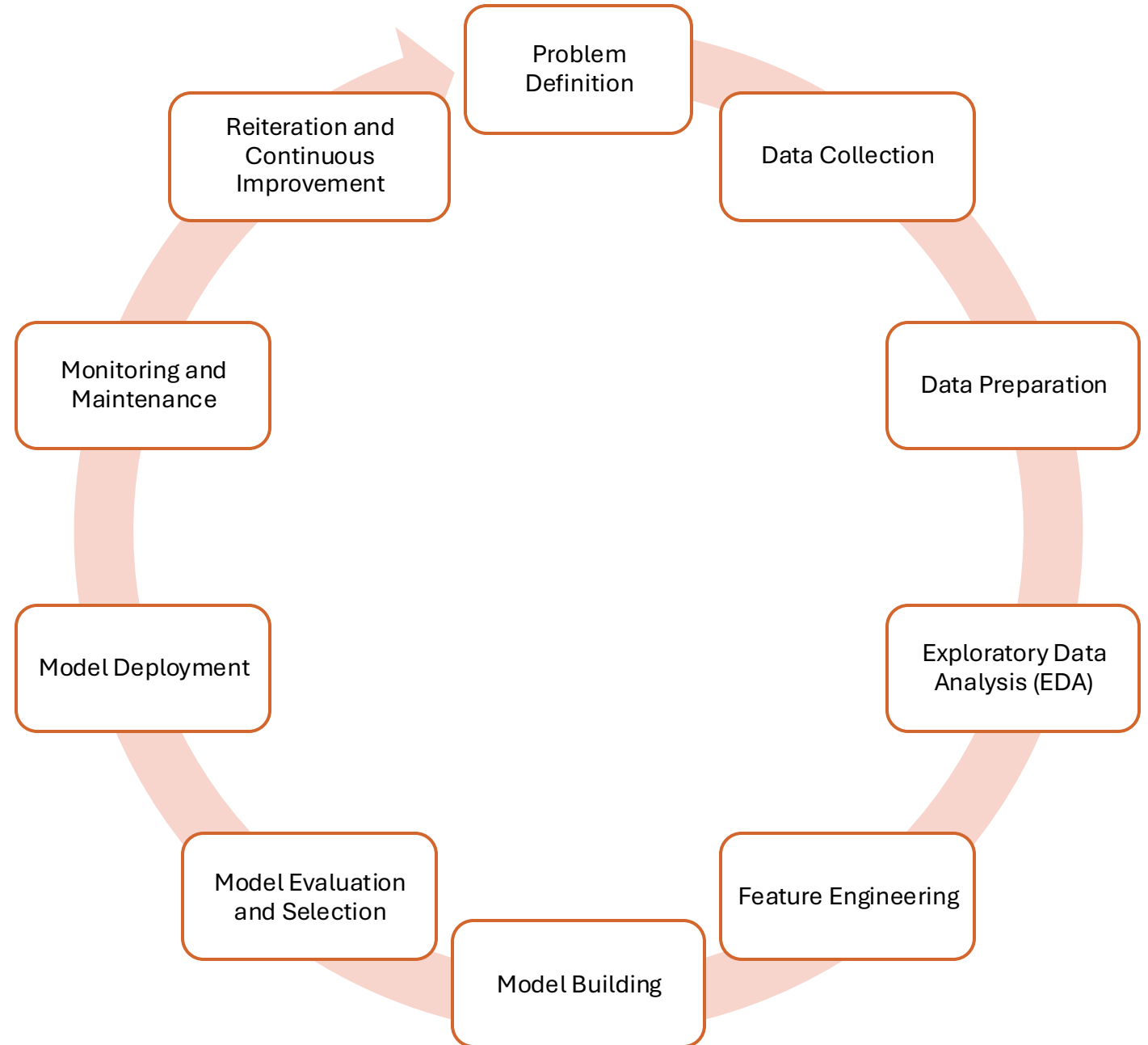
Scope of Data Science

- Analyzing, interpreting, and deriving **meaningful patterns and trends** from large volumes of data.
- Helping businesses make **informed decisions** by uncovering hidden patterns and correlations within data.
- Applying **techniques from statistics, mathematics, computer science, and domain-specific knowledge**.
- Collecting, cleaning, and processing data to derive actionable insights.
- Using machine learning algorithms and statistical models for data analysis.

Skills Required for Data Science Fresher

- Proficiency in programming languages such as Python or R.
- Strong foundation in statistics.
- Knowledge of machine learning techniques.
- Familiarity with data visualization tools.
- Curious mindset to explore and analyze data effectively.

Data Science Workflow and Lifecycle



Data Science Workflow and Lifecycle

Problem Definition

Involves understanding business problem that data science aims to address. It is essential to clearly define the goals and objectives of the project.

Data Collection

Relevant data is collected from various sources, such as databases, APIs, or external datasets. Data quality and quantity are crucial factors at this stage.

Data Preparation

Involves cleaning and preprocessing data to make it suitable for analysis. Tasks include handling missing values, removing duplicates, standardizing formats, and transforming variables.

Exploratory Data Analysis (EDA)

Involves exploring data to identify patterns, trends, and relationships. Data visualization techniques are often used to gain insights into the data.

Feature Engineering

Focuses on creating new features or variables from existing data to improve the performance of machine learning models. Requires domain knowledge and creativity.

Data Science Workflow and Lifecycle

Model Building	Various machine learning algorithms are applied to the data to build predictive models. Models are trained using historical data and validated using different techniques.
Model Evaluation and Selection	Involves evaluating the performance of the models using metrics such as accuracy, precision, recall, or F1 score. The best-performing model is selected for deployment.
Model Deployment	Model is deployed into production where it can make predictions on new data. Involves integrating the model into existing systems or apps.
Monitoring and Maintenance	Model's performance is monitored to ensure that it continues to perform well over time. Monitoring involves tracking model accuracy, detecting drift, and retraining the model when necessary.
Reiteration and Continuous Improvement	Improves models and processes based on feedback and new data. Continuous improvement involves refining models, updating data collection strategies, and adapting to changing business requirements.

Data Science key applications & use cases

Data science has a wide range of applications and use cases across various industries.

- **Predictive analytics**: To predict future trends and outcomes based on historical data. This is widely used in areas such as finance, healthcare, marketing, and e-commerce.
- **Customer segmentation and targeting**: To segment customers based on behavior and preferences, allowing for targeted marketing campaigns and personalized customer experiences.

Data Science key applications & use cases

- **Fraud detection**: To detect fraudulent activities in industries such as banking, insurance, and e-commerce by analyzing patterns and anomalies in transaction data.
- **Recommendation systems**: To suggest products, movies, music, or content based on user preferences and behavior. This is commonly used in e-commerce, streaming platforms, and social media.

Data Science key applications & use cases

- **Sentiment analysis:** To analyze and interpret customer feedback, reviews, and social media data to understand sentiment and extract insights.
- **Healthcare analytics:** To improve patient outcomes, optimize treatment plans, predict disease outbreaks, and personalize medicine through analysis of electronic health records and medical imaging data.

Data Science key applications & use cases

- **Image and video recognition**: For object and pattern recognition in images and videos, enabling applications such as facial recognition, autonomous vehicles, and quality control in manufacturing.
- **Financial risk management**: To assess and manage risks in financial markets by analyzing market data, credit scores, and other factors to make informed investment decisions.

Data Science key applications & use cases

- **Supply chain optimization**: To optimize supply chain operations by predicting demand, identifying bottlenecks, and improving inventory management through data-driven decision-making.
- And many more..

Types of Machine Learning

Machine learning can be broadly categorized into three main types:

1. Supervised learning
2. Unsupervised learning, and
3. Reinforcement learning.

Supervised Learning

- Model is trained on **labeled data**, where each data point is paired with the corresponding **target or label**. The goal is to learn the mapping between input features and output labels to make predictions on unseen data.
- Supervised learning tasks include **classification** (predicting a discrete label), **regression** (predicting a continuous value), and recommendation systems.

Supervised Learning

- Examples of supervised learning algorithms include Linear Regression, Logistic Regression, Support Vector Machines (SVM), Decision Trees, Random Forest, K-Nearest Neighbors (KNN), and Neural Networks.
- Supervised learning involves two main phases: training, where the model learns from labeled data, and testing, where the model is evaluated on unseen data to assess its performance.

Unsupervised Learning

- Model is trained on **unlabeled data**, where the **goal is to find hidden patterns or structures in the data** without explicit labels.
- Unsupervised learning tasks include **clustering** (grouping similar data points together), **dimensionality reduction** (reducing the number of features), and **anomaly detection** (identifying outliers).

Unsupervised Learning

- Examples of unsupervised learning algorithms include K-Means Clustering, Hierarchical Clustering, Principal Component Analysis (PCA), t-SNE, and Gaussian Mixture Models.
- Unsupervised learning is used for exploratory data analysis, data preprocessing, and generating insights from unstructured data.

Reinforcement Learning

- Model learns to make sequential decisions through **trial-and-error interactions** with an environment. The model learns to **maximize a reward** signal by taking specific actions in a given state.
- Reinforcement learning tasks include **game playing, robotics control, autonomous driving, and recommendation systems.**

Reinforcement Learning

- Examples of reinforcement learning algorithms include Q-Learning, Deep Q Network (DQN), Policy Gradient methods, and Actor-Critic algorithms.
- Reinforcement learning is used in dynamic and complex environments where the model needs to learn a policy through exploration and exploitation.

Tools and frameworks for Data Science

- Programming Language: Python, R
- Python packages:
 - NumPy - Numerical computation library
 - Pandas - Data manipulation tools
 - Matplotlib and Seaborn - Data visualization library
 - Scikit-learn - Machine learning library
 - TensorFlow and PyTorch - Deep learning frameworks
 - Keras - High-level deep learning
- IDEs: Jupyter Notebook, Jupyter Lab, Visual Studio Code, R Studio
- SQL
- Git, and GitHub
- Cloud Technologies – AWS, GCP

Summary

What we've learned so far

Artificial Intelligence

- Makes machines smart like humans. It helps them see, hear, understand language, and make decisions.

Data Science

- Helps people find valuable information in data. It involves analyzing and visualizing data to see patterns and make better decisions.

Summary

What we've learned so far

Machine Learning

- Teaches computers to learn from data and make predictions without being explicitly programmed. It helps machines get better at tasks over time.

Deep Learning

- Inspired by the human brain. It uses neural networks to learn complex patterns in data, like recognizing images or understanding speech.

Summary

What we've learned so far

Generative AI

- A smart machine that can create new things, such as writing stories, drawing pictures, or composing music. It learns from existing examples and data to produce its own original creations.

Summary

What we've learned so far

Data Science Lifecycle

- Problem definition, Data preprocessing, Model development, evaluation, selection and deployment, Monitoring and Continuous Improvement

Applications of Data Science

- Fraud detection, Sentiment Analysis, Recommendation systems, Customer Segmentation, etc.,

Summary

What we've learned so far

Types of Machine Learning

- Supervised, unsupervised and Reinforcement Learnings

Tools and Frameworks for Data Science

Thank you!

Please send all your queries to nandini@datavalley.ai