GenAI

Introduction to Generative AI

Course Plan

WHAT IS GENAI?

GENAI APPLICATIONS

AI PROBLEM SOLVING APROACHES
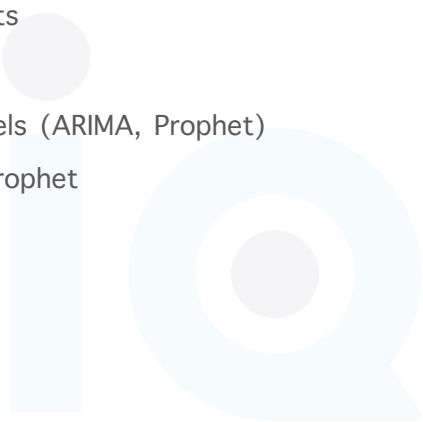
PREDICTIVE AI AND GENAI

WHEN TO USE GENAI

Comparing Predictive AI and GenAI:
Predictive AI

Comparing Predictive AI and GenAI: Predictive AI

- Predictive Modeling Techniques

  - Regression Analysis

  - Decision Trees and Random Forests

  - Support Vector Machines (SVM)

  - Neural Networks Time Series Models (ARIMA, Prophet)

  - Tools: Scikit-learn, Statsmodels, Prophet

- Applications of Predictive AI

  - Financial forecasting

  - Customer behavior prediction

  - Healthcare diagnostics

  - Weather prediction

  - Predictive maintenance

  - Tools: H2O.ai, DataRobot, RapidMiner

Comparing Predictive AI and GenAI: Predictive AI

- Predictive AI in Business

  - Demand forecasting Risk assessment

  - Fraud detection

  - Customer churn prediction

  - Personalized recommendations

  - Tools: SAS Predictive Analytics, IBM SPSS

- Evaluation Metrics for Predictive AI

  - Accuracy, Precision, Recall, F1-score

  - Mean Absolute Error (MAE), Root Mean Square Error (RMSE)

  - Area Under the ROC Curve (AUC-ROC)

  - R-squared (R^2)

  - Tools: Scikit-learn Metrics, MLflow

- Challenges in Predictive AI
    - Data quality and quantity
    - Feature selection and engineering
    - Model interpretability
    - Handling concept drift
    - Balancing model complexity and generalization

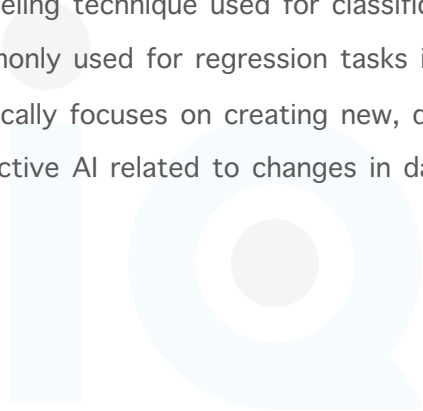# Comparing Predictive AI and GenAI: Predictive AI

- Predictive AI vs. Generative AI
  - Predictive AI:
    - Forecasts outcomes based on existing patterns
    - Typically produces single-point predictions or probabilities
    - Focus on accuracy and reliability
  - Generative AI:
    - Creates new data instances
    - Produces diverse outputs
    - Focus on creativity and novelty

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Comparing Predictive AI and GenAI: Predictive AI

- Quiz Questions:
    1. What is the primary goal of Predictive AI?
    2. Name a common predictive modeling technique used for classification tasks.
    3. Which evaluation metric is commonly used for regression tasks in Predictive AI?
    4. **True or False:** Predictive AI typically focuses on creating new, diverse data instances.
    5. What is a key challenge in Predictive AI related to changes in data patterns over time?

Comparing Predictive AI and GenAI: Predictive AI

- Quiz Questions:

  1. What is the primary goal of Predictive AI? **Key: To forecast future outcomes or behaviors based on historical data**

  2. Name a common predictive modeling technique used for classification tasks. **Key: Decision Trees, Random Forests, or Support Vector Machines**

  3. Which evaluation metric is commonly used for regression tasks in Predictive AI? **Key: Mean Absolute Error (MAE) or Root Mean Square Error (RMSE)**

  4. **True or False:** Predictive AI typically focuses on creating new, diverse data instances. **Key: False**

  5. What is a key challenge in Predictive AI related to changes in data patterns over time? **Key: Handling concept drift**

Comparing Predictive AI and GenAI: Generative AI

Comparing Predictive AI and GenAI: Generative AI

- Generative AI: Core Characteristics

    - Creates new, original content

    - Learns underlying data distributions

    - Produces diverse outputs

    - Balances novelty and coherence

- Unique Features of Generative AI

    - Data generation capability

    - Latent space representation

    - Unsupervised learning potential

    - Multi-modal generation

    - Style transfer and domain adaptation

Comparing Predictive AI and GenAI: Generative AI

- Key Generative AI Technologies
    - Generative Adversarial Networks (GANs)
    - Variational Autoencoders (VAEs)
    - Transformer-based models
    - Diffusion models Tools: TensorFlow, PyTorch, Hugging Face Transformers

- Text Generation Use Cases
    - Creative writing assistance
    - Chatbots and conversational AI
    - Code generation
    - Language translation
    - Tools: GPT-3, BERT, T5
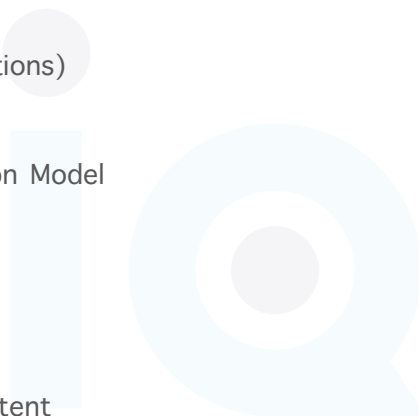
Comparing Predictive AI and GenAI: Generative AI

- Image Generation Applications

    - Art creation

    - Photo editing and enhancement

    - Fashion design

    - Architectural visualization Tools: DALL-E, Midjourney, Stable Diffusion

- Audio and Music Generation

    - Text-to-speech synthesis

    - Music composition

    - Sound effect creation

    - Voice conversion

    - Tools: WaveNet, Jukebox, DDSP

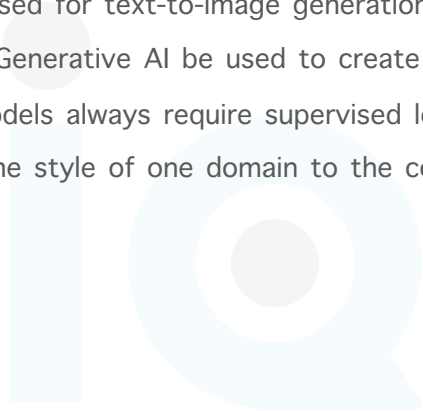# Comparing Predictive AI and GenAI: Generative AI

- Video and Animation Generation
  - Video synthesis from text
  - Motion transfer
  - Deepfakes (with ethical considerations)
  - Special effects generation
  - Tools: StyleGAN, First Order Motion Model

- Emerging Applications
  - Drug discovery
  - Synthetic data generation
  - Virtual and augmented reality content
  - Personalized product design
  - Challenges: Ethical use, copyright issues, bias mitigation

Comparing Predictive AI and GenAI: Generative AI

- Quiz Questions:

  1. What is a key characteristic of Generative AI that allows it to create content across different modalities?

  2. Name a popular tool or model used for text-to-image generation in Generative AI.

  3. In which application area might Generative AI be used to create new molecular structures?

  4. **True or False:** Generative AI models always require supervised learning with labeled datasets.

  5. What is the term for applying the style of one domain to the content of another in Generative AI?

# Comparing Predictive AI and GenAI: Generative AI

- Quiz Questions:

  1. What is a key characteristic of Generative AI that allows it to create content across different modalities? **Key: Multi-modal generation**

  2. Name a popular tool or model used for text-to-image generation in Generative AI. **Key: DALL-E, Midjourney, or Stable Diffusion**

  3. In which application area might Generative AI be used to create new molecular structures? **Key: Drug discovery**

  4. **True or False:** Generative AI models always require supervised learning with labeled datasets. **Key: False**

  5. What is the term for applying the style of one domain to the content of another in Generative AI? Key: Style transfer

Comparing Predictive AI and GenAI:
Strengths and Limitations

Predictive AI and GenAI: Strengths and Limitations

- Comparing Predictive and Generative AI

  - Different approaches to AI problem-solving

  - Distinct strengths and limitations

  - Complementary roles in AI applications
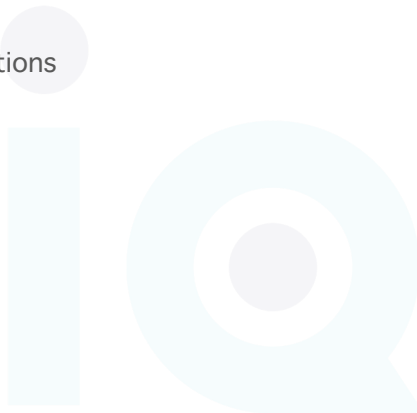
Predictive AI and GenAI: Strengths and Limitations

- Strengths of Predictive AI
  - High accuracy in well-defined problems
  - Interpretability in many models
  - Efficient with structured data
  - Established evaluation metrics
  - Robust performance in specific domains
  - Tools: Scikit-learn, XGBoost, LightGBM

- Limitations of Predictive AI
  - Struggles with novel scenarios
  - Limited creativity
  - Dependent on historical data quality
  - May perpetuate existing biases
  - Difficulty handling unstructured data

Predictive AI and GenAI: Strengths and Limitations

- Strengths of Generative AI
  - Creates novel content
  - Handles unstructured data well
  - Learns complex data distributions
  - Potential for unsupervised learning
  - Versatile across multiple domains
  - Tools: TensorFlow, PyTorch, OpenAI Gym

- Limitations of Generative AI
  - Output quality can be inconsistent
  - Challenging to control precisely
  - High computational requirements
  - Potential for misuse (e.g., deepfakes)
 - Difficulty in evaluation and benchmarking

Predictive AI and GenAI: Strengths and Limitations

- Comparative Analysis
  - Predictive AI:
    - Excels in forecasting and classification
    - Better for decision support systems
  - Generative AI:
    - Superior in content creation and exploration
    - Ideal for creative and open-ended tasks

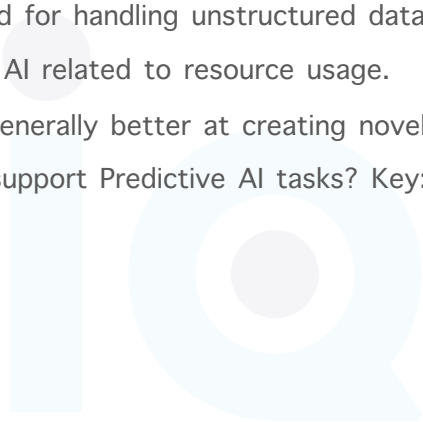# Predictive AI and GenAI: Strengths and Limitations

- Synergies and Hybrid Approaches

  - Combining predictive and generative models

  - Predictive AI guiding generative processes

  - Generative AI augmenting predictive datasets

  - Example: GANs for data augmentation in predictive tasks

- Future Directions

  - Improving interpretability in generative models

  - Enhancing control in generative outputs

  - Developing robust evaluation metrics for generative AI

  - Ethical frameworks for AI development and deployment

  - Exploring quantum computing for both paradigms
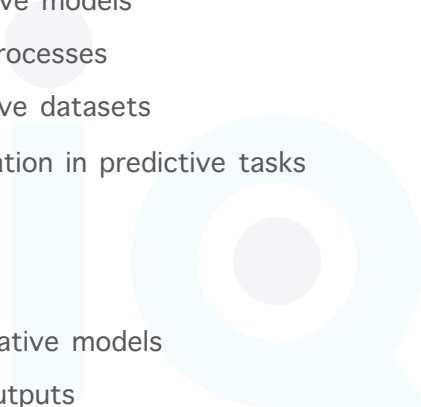
Predictive AI and GenAI: Strengths and Limitations

- Quiz Questions:
    1. What is a key strength of Predictive AI compared to Generative AI?
    2. Which type of AI is better suited for handling unstructured data?
    3. Name a limitation of Generative AI related to resource usage.
    4. **True or False**: Predictive AI is generally better at creating novel content than Generative AI.
    5. In what way can Generative AI support Predictive AI tasks? Key: Data augmentation or generating synthetic datasets

Predictive AI and GenAI: Strengths and Limitations

- Quiz Questions:
  1. What is a key strength of Predictive AI compared to Generative AI? *Key: High accuracy in well-defined problems or Interpretability*
  2. Which type of AI is better suited for handling unstructured data? Key: *Generative AI*
  3. Name a limitation of Generative AI related to resource usage. *Key: High computational requirements*
  4. True or False: Predictive AI is generally better at creating novel content than Generative AI. *Key: False*
  5. In what way can Generative AI support Predictive AI tasks? *Key: Data augmentation or generating synthetic datasets*