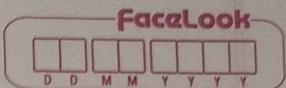


Unit - 6

Applications of ML



Explain Image Recognition application in ML.

Image Recognition :-

- Image recognition is a subset of computer vision that enables machines to identify and classify objects, people, places or actions in an image.

- It involves processing and analyzing visual data to extract meaningful information.

How It works in ML :-

① Data collection :-

- collect labeled datasets of images

② Preprocessing :-

- Resize, normalize and augment images for consistency.
- convert images into numerical matrices.

③ Feature Extraction :-

- identify edges, textures, colors and patterns.
- use methods like convolutional filters in deep learning.

④ Model Training :-

- Train models using labeled data
- The model learns to map image features to their labels.

⑤ Prediction :-

- When a new image is input, the model predicts its label based on learned patterns.

Applications :-

- 1) Healthcare
- 2) security and surveillance
- 3) retail and e-commerce
- 4) Autonomous vehicle
- 5) Social media
- 6) Agriculture
- 7) Gaming and AR/VR

Challenges in image Recognition :-

- 1) Data quality
- 2) Variability
- 3) computational Requirements
- 4) Bias
- 5) Real-Time processing.

Future Trends :-

- 1) 3D image recognition
- 2) Explainable AI
- 3) Edge computing
- 4) Integration with IoT

Ques- Explain Speech Recognition in ML.
 →

→ Speech recognition is a technology that enables machines to convert spoken language into text. It allows computers to process, interpret and respond to human speech, forming the foundation for voice-controlled applications.

How speech recognition works in ML :-

D	D	M	M	Y	Y	Y

1) Audio input :-

- The system captures audio through a microphone or audio file.
- Audio signals are stored as a waveform.

2) Preprocessing :-

- Noise reduction :- Filter out background noise.
- Segmentation :- Divide audio into smaller frames for analysis.
- Feature extraction :- Convert audio into features.

3) Model Training :-

- Use labeled datasets of audio with corresponding text transcriptions.
- Train machine learning models to map audio features to text.

4) Speech-to-text conversion :-

- The trained model predicts phonemes.
- Combines phonemes into words and phrases using language models for context.

5) Post-Processing :-

- Correct errors using dictionaries, grammar rules, or context awareness.
- Enhance accuracy with Natural Language Processing.

Machine Learning Techniques used :-

1) Traditional Approaches :-

- Hidden Markov Models (HMMs)
- Gaussian mixture models (GMMs)

D	D	M	M	Y	Y	Y	Y
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2) Deep Learning Approaches :-

- 1) Recurrent Neural Networks (RNNs)
- 2) convolutional Neural Networks (CNNs)
- 3) Transformer models.
- 4) Long short-Term memory Networks (LSTMs)

Applications:-

- 1) Virtual Assistants
- 2) Healthcare
- 3) customer support
- 4) Education
- 5) smart Devices
- 6) Media & Entertainment

challenges in speech Recognition:-

- 1) Accents and Dialects
- 2) Background noise
- 3) Multiple speakers
- 4) Language complexity
- 5) Resource-Intensive.

Future Trends:-

- 1) multilingual support
- 2) Edge computing
- 3) real-time transcription
- 4) Emotion and sentiment Analysis

D	D	M	M	Y	Y	Y	Y

Explain Email spam and malware filtering in ML.

-Email spam and malware filtering using ML is a widely adopted approach that leverages data-driven algorithms to detect and block unwanted or harmful emails.

1) Email Spam Filtering :-

-spam filtering focuses on identifying unsolicited or junk emails and keeping them out of the inbox.

How it works :-

1) Data collection :-

-collect a dataset containing labeled examples of spam and non-spam emails.

2) Feature Extraction :-

-convert emails into numerical representations that algorithms can process.

3) Model Training :-

-train an ML algorithm using labeled data.

-common algorithms include :-

1) Naive Bayes

2) Logistic Regression

3) Support vector machines (SVM)

4) Prediction :-

-The trained model predicts whether new emails are spam or not based on their features.

D	D	M	M	Y	Y	Y

② Email Malware Filtering :-

- Malware filtering identifies and blocks emails containing malicious content, such as attachments or links leading to harmful software.

How it works :-

1) Data collection :-

- Gather a dataset of emails labeled as "malicious" or "safe", including metadata, attachments and links.

2) Feature Extraction :-

- Extract features that indicate malicious intent.

3) Model Training :-

- Use ML algorithms such as :-

1) Random Forests

2) Gradient Boosting

3) Neural Networks.

4) Detection mechanism :-

- The trained model scans incoming emails for signs of malware and assigns a risk score or classifies them as "safe" or "malicious".

Key ML Techniques used in Both :-

1) Supervised Learning

2) Unsupervised Learning

3) Natural Language Processing (NLP).

Advantages :-

1) Dynamic Learning.

- 2) High Accuracy
- 3) Scalability
- 4) Automation

Challenges :-

- 1) Imbalanced Data
- 2) Evasion Techniques
- 3) Interpretability.

Applications :-

- 1) Gmail's Spam Filter
- 2) Enterprise Email Gateways
- 3) Custom models.

Ques- Explain online fraud detection using ML

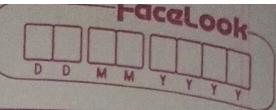
→ - online fraud detection using ML involves the application of algorithms and models to identify and prevent fraudulent activities in online platforms such as e-commerce, banking and social media.

Online Fraud Detection :-

- online fraud detection is the process of identifying suspicious activities in digital transactions, accounts or platforms.

- common examples of fraud include :-

- 1) credit card fraud
- 2) Identity theft
- 3) Phishing attacks
- 4) Fake accounts
- 5) Money laundering.



Why ML?

- 1) Scalability
- 2) Adaptability
- 3) Accuracy
- 4) Efficiency

key steps in Fraud Detection using ML :-

1) Data collection :-

- collect the Data to identify Fraud.

2) Data Preprocessing :-

- perform Data cleaning, Feature Engineering, Normalization.

3) Model selection :-

- select ML algorithm for fraud detection.

4) Model Training :-

- Train model on known fraud labels.

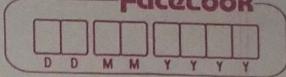
5) Model Evaluation :-

- Evaluate model using Accuracy, Precision, recall, F1-score and ROC-AUC.

~~6) Prediction~~

Application :-

- 1) E-commerce
- 2) Banking
- 3) Social media
- 4) Insurance



challenges :-

- 1) Data Imbalance
- 2) Evolving Techniques
- 3) Real-Time Processing
- 4) Privacy concern.

Ques Explain Medical Diagnosis using ML.



- Medical diagnosis using ML is a cutting-edge approach where algorithms are employed to assist healthcare professionals in diagnosing diseases more accurately and efficiently.
- ML leverages data from medical records, imaging, test results, and patient history to identify patterns and provide diagnostic predictions.

Steps of medical diagnosis :-

1) Data collection :-

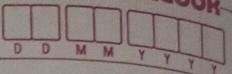
- collect the data from various sources like Electronic Health records (EHRs), Imaging data, Pathology reports.

2) Data Preprocessing :-

- perform Preprocessing operations on data like cleaning, formatting, Normalization and standardization etc.

3) Feature Engineering :-

- Perform feature selection, Feature Extraction, Dimensionality Reduction.



④ split Data :-

- Training set :- used to train the model.
- Validation set :- used to fine-tune the model.
- Test set :- used to evaluate the final model's performance.

⑤ select and Train an ML model :-

• Model Selection :-

- use classification models for disease detection
- use deep learning models for complex patterns

• Training :-

- Input the training data into the model and adjust parameters to minimize error.

⑥ Model Evaluation :-

- Evaluate Accuracy, Precision and Recall, F1 Score, ROC-AUC etc.

Key Applications in Diagnosis :-

• Medical Imaging Analysis :-

- Detecting tumors in CT scans, MRI and X-rays.
- Identifying retinal diseases from eye scans.

• Predictive Analytics :-

- Forecasting disease progression or risk.

• Genomics and Drug Discovery :-

- Identifying genetic predispositions to diseases using genome sequencing.

• Remote patient Monitoring :-

- using wearable devices for continuous health monitoring.

Advantages :-

- 1) Early Detection
- 2) Accuracy
- 3) Efficiency
- 4) Personalization

challenges :-

- 1) Data quality
- 2) Interpretability
- 3) Ethical concerns
- 4) Regulation.

Real-world Examples :-

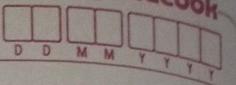
- 1) IBM Watson Health
- 2) Google DeepMind
- 3) PathAI

Cue- Explain Product recommendations using ML.



- Product recommendation system are a critical application of ML that enhance user experiences by suggesting relevant products based on preferences, behavior or contextual data.

- These systems are widely used in e-commerce, streaming platforms and online services.



Steps of Product recommendation :-

1) Data collection :-

- collect Input Data like user-item interaction data, Product metadata, contextual information.

2) Data preprocessing :-

- Perform preprocessing on Input Data like clean Data, Transform Data, split Data etc.

3) Algorithm selection :-

choose ML algorithms like :-

1) collaborative Filtering

2) content-Based filtering

3) Hybrid models.

4) Model Training :-

1) collaborative Filtering (Matrix Factorization) :-

- Decompose the user-item matrix into two smaller matrices.

- Use algorithms like singular value decomposition (SVD) to learn latent factors.

2) Content-based Filtering :-

- Train a model to predict a user's preference for an item based on its features.

5) Prediction :-

- Predict the recommendation using ML models.

DD MM YY YY YY

6) Evaluation :-

- Evaluate using Precision, recall, RMSE, etc.

Real-World Examples :-

1) Amazon :-

- uses collaborative filtering, deep learning and context-aware recommendations to suggest product.

2) Netflix :-

- suggests movies/shows using a hybrid model combining user preferences and content similarity.

3) Spotify :-

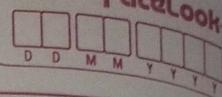
- creates personalized playlists like "Discover weekly" based on user listening habits and content feature.

Benefits :-

- 1) Personalization
- 2) Increased Revenue
- 3) Efficiency.

Advantages :-

- 1) Personalization
- 2) Increased Sales and Revenue
- 3) Improved User Experience
- 4) Scalability
- 5) Continuous Learning.



Disadvantages:

- 1) Cold Start Problem
- 2) Data Dependence
- 3) Privacy Concerns
- 4) Lack of Diversity
- 5) Bias and Fairness Issues