Final Project

Data Mining & Neural Networks

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2025

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Final Project: Data Mining & Neural Networks

- **Objective:** Apply Data Mining and Neural Networks techniques.
- **Format:** Practical project with student-chosen dataset and theme.
- **Duration:** 9-day course, submission on the last day.

Suggested Project Themes

- **TOPIC 1:** Text Analysis & Natural Language Processing (NLP)
- **TOPIC 2:** Computer Vision
- **TOPIC 3:** Tabular Data Analysis (Num & Categ)
- **TOPIC 4:** Time Series Analysis

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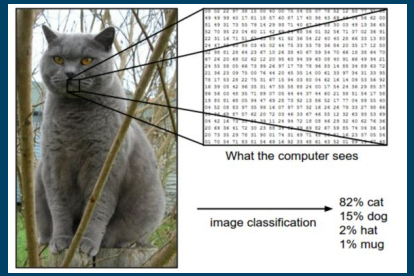
TOPIC 1: Text Analysis & Natural Language Processing (NLP)

Description: Ideal for combining text mining with neural networks.

Examples:

- **Sentiment Classification**: Reviews, social media comments.
- **Spam/Fraud Detection:** Emails, messages.
- **Document Classification:** News, articles.
- **Text Summarization:** Generating concise summaries.

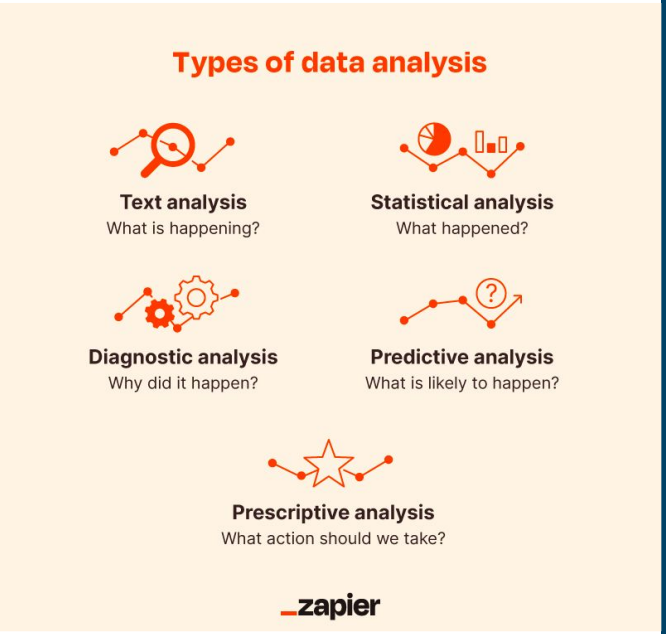
TOPIC 2: Computer Vision



Description: Preparing and analyzing large volumes of image data.

Examples:

- **Image Classification**: Objects, animals, scenes, medical diagnoses.
- **Facial/Object Recognition**: Detection and recognition.
- **Anomaly Detection**: Industrial quality control, security.



TOPIC 3: Tabular Data Analysis (Num & Categ)

- **Description:** Basis for many business and scientific applications.
- **Examples:**
  - **Fraud Prediction:** Financial transactions.
  - **Customer Churn Prediction:** User retention.
  - **Product/Service Recommendation:** Purchase history.
  - **Price Prediction:** Goods, stocks.
  - **Medical Diagnosis:** Disease prediction.

TOPIC 4: Time Series Analysis

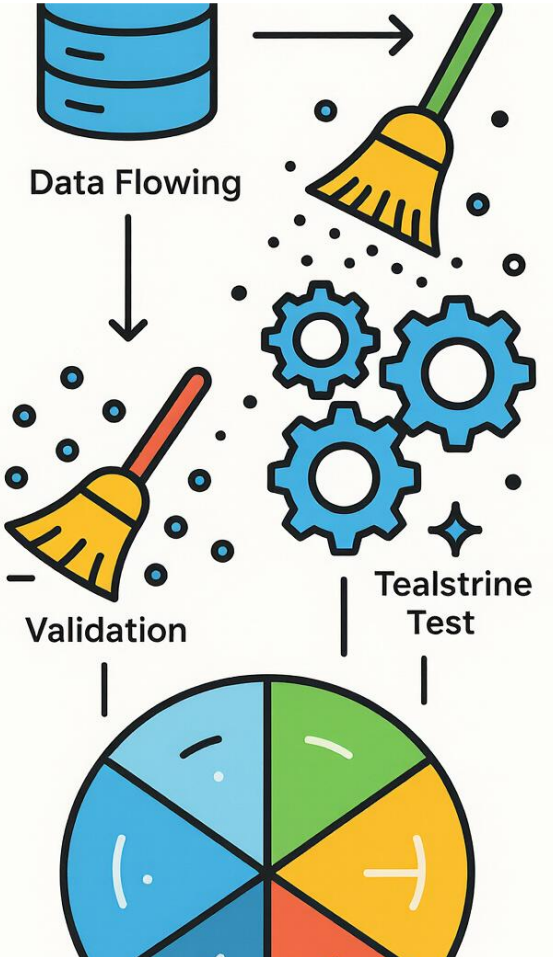
- **Description:** Data that changes over time, using RNNs/LSTMs.
- **Examples:**
  - **Stock/Price Prediction:** Price movements.
  - **Demand Forecasting:** Inventory optimization.
  - **Weather Prediction:** Weather patterns.
  - **Signal Analysis:** Audio, vibration, sensor data.

Project Phases

- **Phase 1:** Ideation & Proposal (Day 3 - Day 4)
- **Phase 2:** Data Exploration & Preprocessing (Day 4 - Day 5)
- **Phase 3:** Neural Network Design & Training (Day 5 - Day 7)
- **Phase 4:** Evaluation, Analysis, & Conclusions (Day 8)
- **Phase 5:** Project Presentation (Day 9 - Final Presentation)

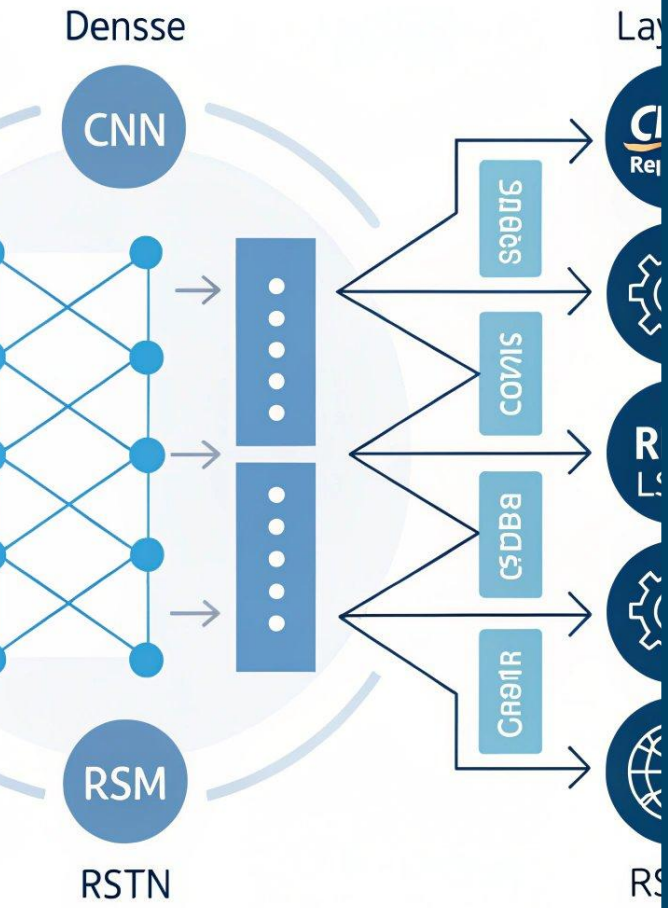
Phase 1: Ideation & Proposal (Day 3 - Day 4)

- **1.1. Theme Exploration & Problem Definition:**
  - Choose a specific problem from the suggested themes.
  - Key question: What problem do I want to solve?
- **1.2. Dataset Search & Selection:**
  - Find a relevant public dataset (Kaggle, UCI ML, open data).
- **1.3. Proposal Formulation (Written):**
  - Project Title.
  - Problem to Solve.
  - Dataset Description (name, source, size, characteristics).
  - Project Objectives.



Phase 2: Data Exploration & Preprocessing (Day 4 - Day 5)

- **2.1. Initial Loading & Exploration:**
  - Load dataset, exploratory analysis: data types, nulls, distribution.
- **2.2. Data Cleaning:**
  - Handle nulls, duplicates, errors, outliers.
- **2.3. Feature Transformation & Preparation (Feature Engineering):**
  - **Text:** Tokenization, stop-words, lemmatization, TF-IDF, Word Embeddings.
  - **Images:** Resizing, normalization.
  - **Tabular:** Categorical encoding, numerical scaling.
  - **Time Series:** Lag creation, window-based features.
- **2.4. Dataset Splitting:**
  - Separate into training, validation, and test sets



Phase 3: Neural Network Design & Training (Day 5 - Day 7)

- **3.1. Neural Network Architecture Selection:**
  - Choose and justify architecture: Dense, CNN, RNN/LSTM.
- **3.2. Model Construction:**
  - Implement in TensorFlow/Keras: layers, activations, output.
- **3.3. Compilation & Training:**
  - Configure: loss function, optimizer (Adam, RMSprop), metrics (accuracy, precision, recall, F1-score).
  - Train model and monitor validation.
- **3.4. Hyperparameter Tuning (Optional/Advanced):**
  - Experiment with learning rates, epochs, batch sizes, layers.

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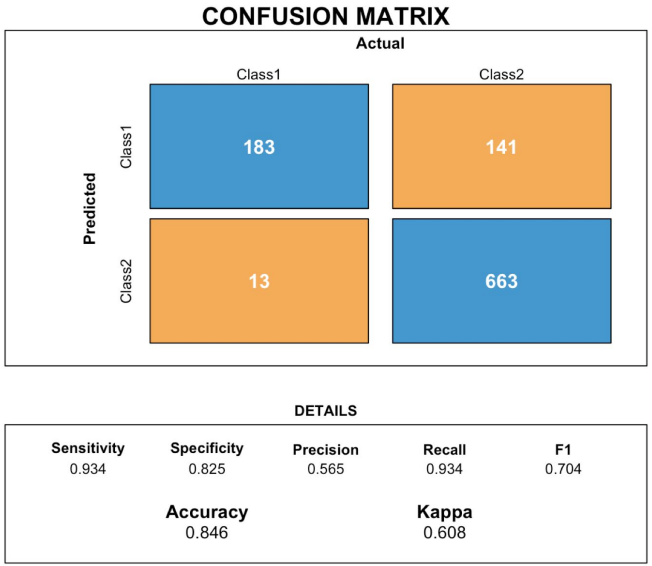

Phase 4: Evaluation, Analysis & Conclusions (Day 8)

- **4.1. Model Evaluation:**
  - Use test set for final performance metrics.
- **4.2. Results Analysis:**
  - Interpret metrics, visualize (confusion matrix, ROC curves).
  - Analyze strengths and weaknesses.
- **4.3. Conclusions & Future Improvements:**
  - Reflect on findings, limitations, possible improvements.

Phase 5: Project Presentation (Day 9 - Final Presentation)

- **5.1. Report/Presentation Preparation:**
  - Summarize work: Introduction, methodology, results, conclusions, future work.
- **5.2. Demonstration & Defense:**
  - Brief model demonstration and Q&A session.

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