# fundamentals of ai – Lesson Plan

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\*\*Fundamentals of AI - 12 Week Lesson Plan (Intermediate Level)\*\*  
  
\*\*Assumed Prior Knowledge:\*\* Basic programming concepts (loops, conditionals, functions), familiarity with data structures (arrays, lists). Basic Java knowledge is required.  
  
\*\*Weekly Schedule (2 hours/week):\*\*  
  
\* \*\*Week 1: Introduction to AI and its Applications\*\*  
 \* \*\*Topics:\*\* What is AI? Types of AI (Narrow/General/Super). AI applications across various industries (healthcare, finance, etc.). Ethical considerations in AI.  
 \* \*\*Subtopics:\*\* Defining intelligence, the Turing Test, Machine Learning vs. Deep Learning.  
 \* \*\*Activities:\*\* Brainstorming session on AI applications. Discussion on ethical dilemmas in AI development. Reading assignment: introductory AI article.  
  
\* \*\*Week 2: Introduction to Python for AI (Transition from Java)\*\*  
 \* \*\*Topics:\*\* Setting up Python environment. Basic Python syntax (data types, variables, operators). Control flow (if/else, loops). Data structures (lists, dictionaries, tuples). Key differences between Java and Python.  
 \* \*\*Subtopics:\*\* Installing necessary libraries (NumPy, Pandas). Working with Jupyter Notebooks.  
 \* \*\*Activities:\*\* Hands-on exercises involving basic Python programming. Conversion of a simple Java program to Python. Individual coding assignments.  
  
\* \*\*Week 3: Data Preprocessing and Handling\*\*  
 \* \*\*Topics:\*\* Data cleaning (handling missing values, outliers). Data transformation (normalization, standardization). Feature engineering (creating new features from existing ones). Data visualization using libraries like Matplotlib.  
 \* \*\*Subtopics:\*\* Different types of data (numerical, categorical). Exploratory Data Analysis (EDA).  
 \* \*\*Activities:\*\* Practical exercises on data cleaning and transformation using a sample dataset. Data visualization assignment.  
  
\* \*\*Week 4: Supervised Learning: Linear Regression\*\*  
 \* \*\*Topics:\*\* Introduction to supervised learning. Linear regression model. Cost function, gradient descent. Model evaluation metrics (RMSE, R-squared).  
 \* \*\*Subtopics:\*\* Simple linear regression, multiple linear regression. Regularization techniques (L1, L2).  
 \* \*\*Activities:\*\* Implementing linear regression from scratch in Python. Using scikit-learn library for linear regression. Analyzing model performance.  
  
\* \*\*Week 5: Supervised Learning: Logistic Regression and Classification\*\*  
 \* \*\*Topics:\*\* Logistic regression for binary and multi-class classification. Cost function, gradient descent for logistic regression. Model evaluation metrics (accuracy, precision, recall, F1-score).  
 \* \*\*Subtopics:\*\* Confusion matrix, ROC curve, AUC.  
 \* \*\*Activities:\*\* Implementing logistic regression using scikit-learn. Working with a classification dataset. Interpreting model performance metrics.  
  
\* \*\*Week 6: Supervised Learning: Decision Trees and Random Forests\*\*  
 \* \*\*Topics:\*\* Decision trees: building and visualizing decision trees. Information gain, Gini impurity. Random forests: ensemble learning, bagging.  
 \* \*\*Subtopics:\*\* Overfitting and underfitting in decision trees. Hyperparameter tuning.  
 \* \*\*Activities:\*\* Building and visualizing decision trees using scikit-learn. Implementing random forests. Comparing the performance of decision trees and random forests.  
  
\* \*\*Week 7: Unsupervised Learning: Clustering\*\*  
 \* \*\*Topics:\*\* Introduction to unsupervised learning. K-means clustering. Hierarchical clustering. Evaluating clustering performance.  
 \* \*\*Subtopics:\*\* Choosing the optimal number of clusters. Different distance metrics.  
 \* \*\*Activities:\*\* Implementing K-means and hierarchical clustering using scikit-learn. Visualizing clustering results.  
  
\* \*\*Week 8: Unsupervised Learning: Dimensionality Reduction\*\*  
 \* \*\*Topics:\*\* Principal Component Analysis (PCA). Singular Value Decomposition (SVD). Feature selection techniques.  
 \* \*\*Subtopics:\*\* Reducing dimensionality to improve model performance and reduce computational cost.  
 \* \*\*Activities:\*\* Applying PCA and SVD on a high-dimensional dataset. Visualizing the reduced dimensionality data.  
  
\* \*\*Week 9: Introduction to Neural Networks\*\*  
 \* \*\*Topics:\*\* Perceptrons, Multilayer Perceptrons (MLPs). Activation functions (sigmoid, ReLU). Backpropagation.  
 \* \*\*Subtopics:\*\* Understanding the architecture of neural networks.  
 \* \*\*Activities:\*\* Building a simple neural network from scratch (optional). Using a library like TensorFlow/Keras to build and train a neural network.  
  
\* \*\*Week 10: Deep Learning with Convolutional Neural Networks (CNNs)\*\*  
 \* \*\*Topics:\*\* Introduction to CNNs. Convolutional layers, pooling layers. Applications of CNNs in image recognition.  
 \* \*\*Subtopics:\*\* Using pre-trained CNN models. Transfer learning.  
 \* \*\*Activities:\*\* Using a pre-trained CNN model for image classification. Fine-tuning a pre-trained model.  
  
\* \*\*Week 11: Deep Learning with Recurrent Neural Networks (RNNs)\*\*  
 \* \*\*Topics:\*\* Introduction to RNNs. Applications of RNNs in natural language processing (NLP). LSTM and GRU networks.  
 \* \*\*Subtopics:\*\* Dealing with vanishing/exploding gradients.  
 \* \*\*Activities:\*\* Using a pre-trained RNN model for a NLP task (e.g., sentiment analysis).  
  
\* \*\*Week 12: Project and Review\*\*  
 \* \*\*Topics:\*\* Final project presentations. Course review and Q&A. Discussion of future trends in AI.  
 \* \*\*Subtopics:\*\* Project feedback and evaluation.  
 \* \*\*Activities:\*\* Student project presentations. Final exam (optional).  
  
  
This plan is a suggestion and can be adjusted based on student progress and interests. The emphasis should be on hands-on activities and practical application of the concepts learned. Consider incorporating group projects to encourage collaboration and problem-solving.

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