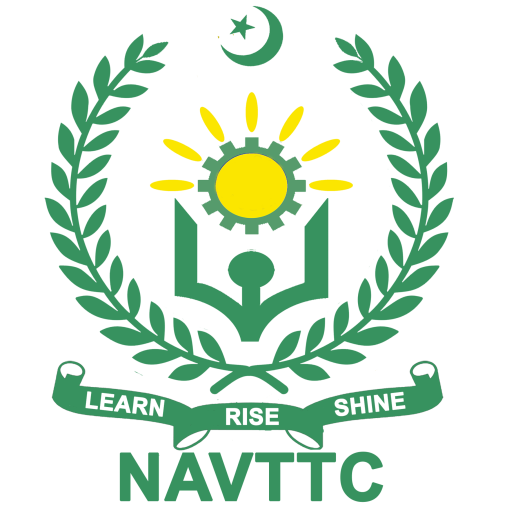
Government of Pakistan

**National Vocational and Technical Training Commission**

Prime Minister’s Kamyab Jawan Program

"Skills for All"



**Course Contents/ Lesson Plan**

**Course Title:** Artificial Intelligence

**Duration:** 6 Months

|  |  |
| --- | --- |
| **Trainer Name** |  |
| **Course Title** | **Artificial Intelligence (Machine Learning and Deep Learning)** |
| **Objective of Course** | **Employable skills and hands on practice for Artificial Intelligence, including specialization in NLP or computer vision**  The aim for the team of staff responsible for delivery of the advanced IT curriculum is to provide knowledge and develop skills related to the IT. The course will allow participants to gain a comprehensive understanding of all the aspects. It will also develop the participant’s ability to act in a professional and responsible manner.  Teaching staff will provide the technical knowledge and abilities required to solve tasks and problems that are goal-oriented. They will use participant-centered, practically oriented methods. They will also develop a program of practical assessment that reflects the learning outcomes stated in the curriculum. Trainees of the IT curriculum will also develop their willingness and ability as individuals to clarify issues, as well as think through and assess development opportunities.  Teaching staff will also support trainees in developing characteristics such as self-reliance, reliability, responsibility, a sense of duty and a willingness and ability to criticize and accept criticism well and to adapt their future behavior accordingly.  Teaching staff also use the IT curriculum to address the development of professional competence. Trainees will acquire the ability to work in a professional environment.  By the end of this course, the trainees should gain the following competencies:   * Understanding of core concepts of artificial intelligence and machine learning * State of the art machine learning techniques * Hands-on exposure to exploratory data analysis * Practical exposure to model design, evaluation * Familiarity with tools and libraries such as scikit learn, pandas numpy, tensorflow, pytorch and keras |
| Learning Outcome of the Course | After taking this course, you will be familiar with the fundamentals of Artificial Intelligence. You will gain practical experience in applying AI for problem solving, and will develop a deep understanding of the core concepts by implementing solutions to real world problems.  By the end of this course, the trainees should gain the following competencies:   * Understanding of core concepts of artificial intelligence and machine learning * State of the art machine learning techniques * Hands-on exposure to exploratory data analysis * Practical exposure to model design, evaluation * Familiarity with tools and libraries such as scikit learn, pandas numpy, tensorflow, pytorch and keras   After the specialization in NLP, you will be comfortable using TensorFlow pipelines for NLP at the end of the course. Moreover,   * You will learn to build your own models which will extract information from textual data * You will learn text processing fundamentals, including text normalization, stemming and lemmatization * You will learn about different evaluation metrics for models trained for NLP tasks * You will learn about statistical language models like Hidden Markov Model (HMM) * You will learn to make a part of speech (POS) tagging model * You will learn about named entity recognition * You will learn advanced techniques including word embeddings, deep learning (DL) techniques like RNNs and LSTMs, and more * You will learn how to deploy a NLP model * You will learn about Flask, and Django frameworks |
| Companies Offering Jobs in the respective trade | 1. Careem 2. Afiniti 3. Addo.ai 4. Arbisoft 5. I2c 6. xavor 7. Fiverivers Technologies 8. confiz 9. Crossover 10. NetSol 11. Research institutes 12. All Private Institutes who have an ML department |
| Job Opportunities | AI is the buzzword of the century, attracting attention across industries, motivating changes in products as well as services. It is the very nature of the subject that makes its applications infinite, in multiple domains. Whether you belong to a technical background or not, chances are that AI can make your job easier, and push it in the right direction. Dive in to develop an understanding of the core concepts, while gaining hands on experience and training from the industry’s finest. Trained resources can find work as one of the following roles     * AI Engineer * Machine Learning Engineers * Data Analyst * Research Assistant * NLP Engineer * Deep Learning Engineer |
| **No of Students** | 20-24 |
| **Learning Place** | Classroom / Lab |
| **Instructional Resources** | **Development Platform:**   * <https://github.com/> **,** * <https://www.anaconda.com/distribution/> * <https://www.jetbrains.com/pycharm/> * <https://jupyter.org/>   **Frameworks and Libraries:**   * <https://www.tensorflow.org/> * <http://keras.io/> * <https://pytorch.org/> * <https://caffe.berkeleyvision.org/>   **Learning Material:**   * <https://www.kaggle.com/> * <https://www.youtube.com/watch?v=UzxYlbK2c7E> * <https://www.youtube.com/watch?v=UzxYlbK2c7E&list=PLA89DCFA6ADACE599> |

**Course Flow Diagram:**

|  |  |  |  |
| --- | --- | --- | --- |
| Week 1 | Intro & Motivation |  |  |
| Week 2-4 | AI Fundamentals |  |  |
| Week 5-11 | Machine Learning | Fundamentals |  |
| Regression |  |
| Classification |  |
| Clustering |  |
| Neural Networks |  |
| Week 12 | Natural Language Processing | Intro to NLP |  |
| Week 13-14 | Dealing with Textual Data |  |
| Week 16-17 | Classification |  |
| Week 18 | Model Evaluation |  |
| Week 20 -22 | Deeper Networks | Project |
| Week 23-24 |  | Sequence Modelling |
| Week 25 |  | Deployment |
| Week 26 |  | Entrepreneurship |

|  |  |  |  |
| --- | --- | --- | --- |
| **Scheduled Week** | **Module Title** | **Learning Units** | **Remarks** |
| **Week 1** | * Introduction | * **Motivational Lecture** * **Course Introduction** * **Success stories** * **Job market** * **Course Applications** * **Institute/work ethics** * Introduction to Artificial Intelligence * A brief history of AI * AI terminology * State of the art techniques * Lab   + Anaconda installation   + Setting up environment and introducing Jupyter notebook   + Introduction to Python |  |
| **Week 2** | **Part – 1 AI Fundamentals**  **Chapter 1** Representations | * Problem Representation   + State Space   + Vector * Knowledge Representation   + Trees   + Graphs |  |
| **Week 3** | **Chapter 2**  Search – Part 1 | * Search Strategies * Brute force search   + Depth first search   + Breadth first search |  |
| **Week 4** | **Chapter 3**  Search – Part 2 | * Search Strategies   + Best First Search   + A\*   + Use of heuristics * Advanced ((Optional)   + Genetic Algorithms |  |
| **Week 5** | **Part – 2 AI and Machine Learning**  **Chapter 4**  Machine Learning Fundamentals | * What is Data * What is Machine Learning * Supervised vs. Unsupervised learning * Evaluation * Train-Test split * Validation |  |
| **Week 6** | **Chapter 5**  Regression | * Regression   + Univariate linear regression   + Multivariate regression   + Polynomial regression |  |
| **Week 7** | **Chapter 6**  Classification | * Algorithms   + Logistic Regression   + KNN   + Naïve Bayes   + Decision Trees   + SVMs |  |
| **Week 8** | **Chapter 7**  Clustering | * Clustering   + Classification vs. Clustering   + K-means Clustering   + Hierarchical Clustering * Optional:   + GMM |  |
| **Week 9** | **Chapter 8**  Time Series Analysis | * Time Series Analysis * Hidden Markov Models |  |
| **Week 10** | **Chapter 9**  Neural Networks | * Introduction to Neural Networks   + MLP   + Feed Forward neural networks |  |
| **Week 11** | **Chapter 10**  Neural Networks – Part 2 | * Neural Networks   + Backpropagation   + Activation Functions   + Loss Function   + Optimization| |  |

**Part – 3 Specialization: Natural Language Processing**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Scheduled Week** | **Module Title** | **Learning Units** | | **Remarks** |
| **Week 12** | **Chapter 11**  Introduction to NLP | * Linguistics   + NLP   + Syntax   + Semantics   + Pragmatics   + Discourse * Pandas, NLTK, WordNet * Load text data | |  |
| **Week 13** | **Chapter 12**  Dealing with Textual Data – Part 1 | * Data know-how * Data statistics (categorical data) * Text Analysis * Similarity & distance * Text normalization * Text cleaning | |  |
| **Week 14** | **Chapter 13**  Dealing with Textual Data – Part 2 | * Stemming & lemmatization * Vectorization * Pre-defined word embedding * Regular expression * Introduction to classification | |  |
| **Week 15** |  | | **Mid-Term Assignment** | |
| **Week 16** | **Chapter 14** Classification – Part 1 | * Logistic Regression   + Sigmoid function   + Activation functions   + Optimization   + Regularization | |  |
| **Week 17** | **Chapter 15**  Classification – Part 2 | * Bias vs Variance * Train, test split * Train, test, validation split * K-fold cross validation * Hyper-parameter tuning | |  |
| **Week 18** | **Chapter 16**  Model Evaluation | * Model evaluation   + Confusion matrix   + Accuracy, Precision, Recall   + F-1 Score   + Specificity & Sensitivity   + ROC & AUROC | |  |
| **Week 19** | **Chapter 17**  Language Modelling | * Language modeling * Hidden Markov Models | |  |
| **Week 20** | **Chapter 18**  Deep Neural Networks – Part 1 | * Deep Neural Networks   + Recurrent Neural Networks | |  |
| **Week 21** | **Chapter 19**  Employable Project/Assignment (6 weeks i.e 21-26) in addition of regular classes. | * Guidelines to the Trainees for selection of students employable project like final year project (FYP) * Assign Independent project to each Trainee * A project based on trainee’s aptitude and acquired skills. * Designed by keeping in view the emerging trends in the local market as well as across the globe. * The project idea may be based on Entrepreneur. * Leading to the successful employment. * The duration of the project will be 6 weeks * Ideas may be generated via different sites such as:   <https://1000projects.org/>  <https://nevonprojects.com/>  [[https://www.freestudentprojects.com/](https://technofizi.net/best-computer-science-and-engineering-cse-project-topics-ideas-for-students/)](https://www.freestudentprojects.com/)  <https://technofizi.net/best-computer-science-and-engineering-cse-project-topics-ideas-for-students/>  <https://www.kaggle.com/>   * Final viva/assessment will be conducted on project assignments. * At the end of session the project will be presented in skills competition * The skill competition will be conducted on zonal, regional and National level. * The project will be presented in front of Industrialists for commercialization | |  |
| **Week 22** | **Chapter 20**  Deep Neural Networks – Part 2 | * Deep Neural Networks   + LSTMs | |  |
| **Week 23** | **Chapter 21**  Sequence Modelling tasks – Part 1 | * Sequence Modelling   + Part of Speech Tagging | |  |
| **Week 24** | **Chapter 22**  Sequence Modelling tasks – Part 2 | * Sequence Modelling   + Named Entity Recognition   + Machine Translation | |  |
| **Week 25** | **Chapter 23**  Deployment | * Insight gathering * NLP model deployment * Flask, Django frameworks | |  |
| **Week 26** | Entrepreneurship and Final Assessment in project | * Job Market Searching * Self-employment * Freelancing sites * Final Assessment | |  |

List of Machinery / Equipment

|  |  |  |
| --- | --- | --- |
| **Sr. No** | **Name of item as per curriculum** | **Quantity physically available at the training location** |
| 1 | Computers Minimum Corei5   * LCD Display 17” with built in speakers | 25 |
| 2 | Mobiles with Android OS | 25 |
| 3 | DSL Internet Connection (Minimum 1 MB) | Available on every PC |
| 4 | Accessories/Devices  * Connectors * Multimedia * Printer (NW printer) * Audio/visual aid * White Board * Pin Board * Flip Chart Board * Hard copy of Training Material * Mobile Phones | 25 each |
| 5 | Wires, data cables, power plugs, power supply | For every PC |
| 6 | UPS | Available |
| 7 | Generator / Solar Backup | Available |
| 8 | Air Conditioner (2 Tons) | Available |

1. Software List

|  |  |
| --- | --- |
| **Sr. No** | **Software Name** |
|  | Google chrome |
|  | Anaconda |
|  | Jupyter notebook |
|  | Python / R |
|  | Weka / rapidminer / H2O / orange / KNime etc. |

1. Minimum Qualification of Teachers / Instructor

The qualification of teachers / instructor of this course should be minimum **of bachelors in Computer science with minimum 3 years of development experience** in relevant trade.

* Bachelors of Computers Science / Computer Engineering / Electrical Engineering (Hons)

1. Supportive Notes

## Teaching Learning Material

|  |  |
| --- | --- |
| **Books Name** | **Author** |
| Introduction to Machine Learning with Python: A Guide for Data Scientists | Book by Andreas Muller |
| Introduction to data mining | by Tan, Steinbach & Kumar |
| Data Mining: The Textbook | by Aggarwal |
| Introduction to Machine Learning with Python: A Guide for Data Scientists | Book by Andreas Muller |
| Python code for Artificial Intelligence: Foundations of Computational Agents | David L. Poole and Alan K. Mackworth |
| NLP at work | Sue Knight |

**Online Material:**

FukatSoft Online Learning System

Stanford Lectures on Deep Learning

Machine Learning by Andrew Ng