ARTIFICIAL INTELLIGENCE DATA TECHNICIAN

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LEARNER GUIDE

National Vocational Certificate Level 4

Version 1 - November, 2019

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Introduction

Welcome to your Learner's Guide for the Artificial Intelligence Data Technician programme. It will help you to complete the programme and to go on to complete further study or go straight into employment.

The Artificial Intelligence Data Technician programme is to engage young people with a programme of development that will provide them with the knowledge, skills and understanding to start this career in Pakistan. The programme has been developed to address specific issues, such as the national, regional and local cultures, the manpower availability within the country, and meeting and exceeding the needs and expectations of their customers.

The main elements of your learner's guide are:

- **Introduction:**
  - o This includes a brief description of your guide and guidelines for you to use it effectively
- **Modules:**
  - o The modules form the sections in your learner's guide
- **Learning Units:**
  - o Learning Units are the main sections within each module
- **Learning outcomes**:
  - o Learning outcomes of each learning units are taken from the curriculum document
- **Learning Elements:**
  - o This is the main content of your learner's guide with detail of the knowledge and skills (practical activities, projects, assignments, practices etc.) you will require to achieve learning outcomes stated in the curriculum
  - o This section will include examples, photographs and illustrations relating to each learning outcome
- **Summary of modules**:
  - o This contains the summary of the modules that make up your learner's guide
- **Frequently asked questions**:
  - o These have been added to provide further explanation and clarity on some of the difficult concepts and areas. This further helps you in preparing for your assessment.
- **Multiple choice questions for self-test**:
  - o These are provided as an exercise at the end of your learner's guide to help you in preparing for your assessment.

Module: 061900931 Scrape data from the web

After the completion of this module the candidate will be able to Scrape different types of data from the Web, build web pages and extract data from a variety of e-sources

Duration 130 hours **Theory:** 20 hours **Practical:** 110 hours

Learning Unit	Learning Outcomes	Learning Elements	Materials Required
LU1: Build a static web page	**You will be able to** 1. Implement basic HTML tags 2. Implement basic HTML attributes usage. 3. Implement basic JavaScript behaviors. 4. Perform inspection of a webpage. Create a basic webpage	• Describe basics of Internet and the World Wide Web • Demonstrate basic HTML tags • Demonstrate basic attributes of HTML tags • Demonstrate syntax of HTML document • Describe and demonstrate basic syntax of JavaScript • Demonstrate basic functionality of web browser • Demonstrate understanding of developer tools in web browsers	• Computer system • Internet facility • Python • Beautiful Soup • Request Drivers
		• Demonstrate understanding of basic web development tools Demonstrate understanding of web process development Practical-1 View a simple webpage and explore its structure using a web browser's developer	

Learning Unit	Learning Outcomes	Learning Elements	Materials Required
		tools. Practical-2 Create a website consisting of multiple static webpages using basic HTML tags or Java Script view it in a browser	
LU2: Extract data as per requirement	**You will be able to** 1. Set request headers. 2. Set request cookie values where required 3. Configure a driver to some browser as required 4. Generate a request to webserver 5. Load response stream 6. Convert stream to page source/content Read response headers	• Perform installation requests library for python • Demonstrate basics of Internet and the World Wide Web • Demonstrate basic HTML tags • Demonstrate basic attributes of HTML tags • Demonstrate syntax of HTML document • Describe and demonstrate basic syntax of JavaScript • Demonstrate basic functionality of web browser • Demonstrate understanding of developer tools in web browsers • Demonstrate understanding of basic web development tools	
		• Demonstrate understanding of web process development basic functionality of requests module • Describe methods of requests module • Describe common request headers	

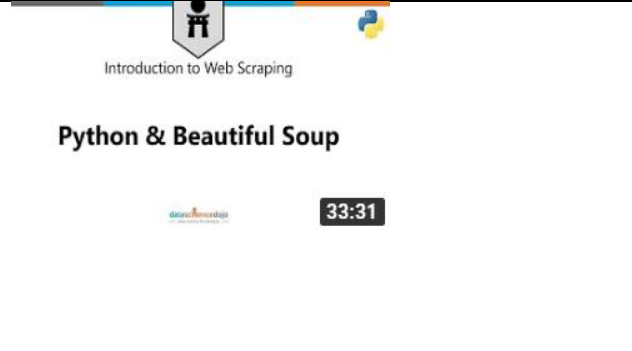| Learning Unit	Learning Outcomes	Learning Elements	Materials Required
		• Demonstrate usage of get method in requests module	
		• Describe functionality of HTTP cookie	
		• Demonstrate usage of Cookie and RequestsCookieJar objects in python	
		• Describe basic functionality of web driver for various browsers	
		• Install and configure various web drivers	
		• Demonstrate usage of get method in requests module to generate HTTP GET request	
		• Describe basic functionality of Response object	
		• Demonstrate usage of content method in Response object	
		• Demonstrate decoding HTML data	
		Demonstrate usage of header method in Response object	
		Practical-1	
		Develop a python program that downloads a webpage also display headers of webpage and raw data of webpage.	
		Practical-2	
		Develop a python program that sends cookies to a webserver while requesting a webpage	

Learning Unit	Learning Outcomes	Learning Elements	Materials Required
LU3: Parse a web page with appropriate package	**You will be able to** 1. Perform installation of beautiful soup 2. Import package into program 3. Request a content to download 4. Find required content from page source 5. Append content 6. Convert content to a data frame 7. Export data	• Describe the basic steps for installing python packages • Describe the basic steps for importing packages into python programs • Demonstrate how to generate web request using Requests package • Describe basic steps to search for specific content using find_all method of beautiful soup method • Demonstrate steps required to append strings to HTML content • Describe basic functionality of Dataframe • Demonstrate steps required for extracting tabular data from a webpage and convert to Dataframe • Describe common file formats for storing data	
		Demonstrate steps required to export data to files using BeautifulSoap package Practical-1 Develop a python program that can download a webpage and find specific text and append specified content with in the page using BeautifulSoup package	

Learning Unit	Learning Outcomes	Learning Elements	Materials Required
		Practical-2	
		Develop a python program that can extract tabular data from a webpage and convert it into Dataframe object. Also export data scraped from the web into CSV/text file format.	
LU4: Extract data from an HTML tag	**You will be able to** 1. Find tag by name 2. Find tag by attribute values 3. Navigate through values. 4. Retrieve tag values Retrieve attribute values.	• Describe various find methods available in BeautifulSoap package • Demonstrate how to use the find methods to locate HTML tags in a webpage • Demonstrate how to use to find method to locate HTML tags in a webpage have specific values for an attribute	
		• Demonstrate how to iterate through all tag/attribute values • Demonstrate how to get values of tags Demonstrate how to get values of attributes Practical-1 Develop a python program that can find and display all or specific HTML tag from within a webpage. Also display all HTML tags that have a specific value for a given attribute. Practical-2 Develop a python program that can display	

Learning Unit	Learning Outcomes	Learning Elements	Materials Required
		the values and their attributes of HTML tags in a webpage	
LU5: Parse xml /JSON	**You will be able to** 1. Read xml/json file. 2. Create xml/json object. 3. Forward navigating through elements. 4. Backward navigation through elements. 5. Navigate through XPath.	• Describe basic syntax of XML • Describe basic syntax of JSON • Install minidom and ElementTree modules • Demonstrate how to read XML/JSON files using minidom and ElementTree in python • Demonstrate how to create XML/JSON objects in python. • Describe the basic steps of navigating XML/JSON files • Demonstrate the steps required to navigate through XML/JSON file using python	
		Demonstrate how to use XPath for navigating XML/JSON files in python Practical-1 Develop a python program that can perform following: • Read XML/JSON file and XML/JSON file • Display contents of XML/JSON file by navigating the file in forward and reverse. Navigate and display the contents of	

Examples and illustrations

Videos

	Intro to Web Scraping with Python and Beautiful Soup URL https://www.youtube.com/watch?v=XQgXKtPSzUI
	Parse a web page with appropriate package URL https://www.youtube.com/results?search_query=Parse+a+web+page+with+appropriate+package
	Parse xml /JSON URL https://www.youtube.com/results?search_query=Parse+xml+%2FJSON

Example and Illustrations

Relevant topics and web links

S.No	Links and definitions
1	Web Scraping using Python URL https://www.datacamp.com/community/tutorials/web-scraping-using-python

Module: 061900932 Process Images through Image Processing software

This competency standard deals with the skills and knowledge required to perform basic image manipulation/Editing operation.

Duration   120 hours   **Theory:**   50 hours   **Practical:**   70 hours
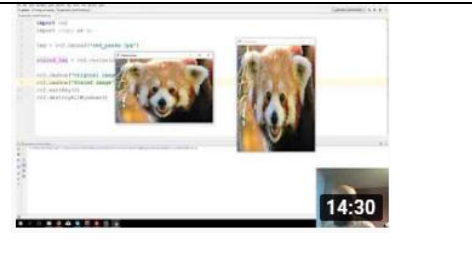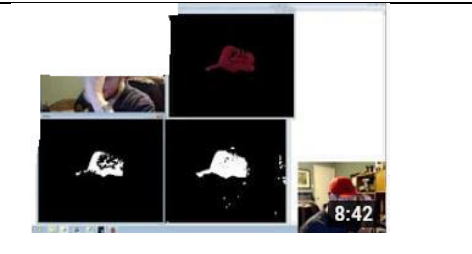
Learning Unit	Learning Outcomes	Learning Elements	Materials Required
LU1: Perform Basic Image Operations	Y**ou will be able to** 1. Read image from file 2. Display an image from data 3. Perform global threshold 4. Perform adaptive thresholding 5. Perform image sharpening 6. Perform image blurring using averaging 7. Perform image blurring using median 8. Perform image blurring using Gaussian 9. Perform image cropping Find image contours	Understand the meaning of various image editing operations and image contours Practical-1 Using a specified software, read an image, display that image, perform global thresholding and display the image after performing these operations. Practical-2 Perform cropping, adaptive thresh holding, image sharpening and blurring -using averaging, median and Gaussian filters- on a given image. And use suitable filters to find image contours	• Computer system with high performance GPU(s) with graphic card • High speed high capacity storage • High resolution display • Suitable compiler to install and run OpenCV OpenCV software package, latest version
LU2: Apply Image Filters	**You will be able to**	Understand the concept of filters in images.	

Learning Unit	Learning Outcomes	Learning Elements	Materials Required
	1. Creating 2D convolution filter 2. Apply Laplacian filter for edge detection 3. Apply X, Y Sobel filter on noisy images 4. Apply canny edge detection filter 1. Plot filtered images	**Practical-1** Given a series of images, apply the assigned filters and display the results.	
LU3: Change Color Spaces	**You will be able to** 1. Perform RGB to greyscale conversion 2. Perform RGB to HSV conversion 3. Perform RGB to LAB colour conversion **1.** Perform RGB to YCrCb color conversion	Understand what are image color spaces. **Practical-1** Apply specified color space conversions using built-in functions.	
LU4: Perform Geometrical Transformation	**You will be able to** 1. Perform scaling operation on image	Understand the concept of geometrical transformations **Practical-1** Apply following transformations on a given	

Learning Unit	Learning Outcomes	Learning Elements	Materials Required

	2. Perform image translation
	
	3. Perform image rotation to any angle
	
	4. Perform affine transformation
		image using built-in functions:
		
		  1. Scaling
		  2. Translation
		  3. Rotation
		
		Affine transformation	

LU5: Perform Morphological Operations	**You will be able to**
	
	1. Perform image opening
	
	2. Perform image erosion
	
	3. Perform image dilation
	
	4. Perform image closing
	
	5. Perform morphological erosion
	
	6. Perform top hating on image
		Understand the effects and importance of morphological operations.
		
		Practical-1
		
		Apply following morphological operations on a given image using built-in functions:
		
		  1. Image opening
		  2. Erosion
		  3. Dilation
		  4. Image closing
		  5. Morphological erosion
		
		Top hating	

LU6: Match Image Templates for object Recognition	**You will be able to** 1. Apply min max lock function 2. Perform template based object matching	Understand the concept of image templates for object recognition Practical-1 Perform min-max lock function and template	

Learning Unit	Learning Outcomes	Learning Elements	Materials Required
	3. Perform feature based object matching Perform area based object matching	based object matching Practical-2 Perform feature based and area based object matching	
LU7: Extract Foreground from the Image	**You will be able to** 1. Apply grabcut technique for foreground extraction 2. Prepare image mask of suitable size 3. Apply image mask for foreground extraction Perform series of basic image operations to extract foreground	Understand the importance of foreground extraction Practical-1 Perform foreground extraction using grabcut technique or using series of basic image operations. Practical-2 Prepare and apply image masks for foreground extraction	

Videos

	Python Tutorial: Image Manipulation with Pillow URL https://www.youtube.com/watch?v=6Qs3wObeWwc
	Image Processing in Python-Tutorial 3-Gaussian Filter URL https://www.youtube.com/results?search_query=Apply+Image+Filters+python
	Perform Geometrical Transformation URL https://www.youtube.com/results?search_query=perform+geometrical+transformation+python
	Perform Morphological Operations python URL https://www.youtube.com/results?search_query=Perform+Morphological+Operations+python

	Match Image Templates for object Recognition URL https://www.youtube.com/results?search_query=%3A+Match+Image+Templates+for+object+Recognition
	Extract Foreground from the Image URL https://www.youtube.com/results?search_query=%3A+Extract+Foreground+from+the+Image

Example and Illustrations

Relevant topics and web links

S.No	Links and definitions
1	Image Recognition and Image Processing Techniques URL https://medium.com/@Adoriasoft/image-recognition-and-image-processing-techniques-fe3d35d58919
2	Geometric Transformations of Images URL https://opencv-python-tutroals.readthedocs.io/en/latest/py_tutorials/py_imgproc/py_geometric_transformations/py_geometric_transformations.html

3	Morphological Transformations URL https://opencv-python-tutroals.readthedocs.io/en/latest/py_tutorials/py_imgproc/py_morphological_ops/py_morphological_ops.html
4	Template Matching URL https://opencv-python-tutroals.readthedocs.io/en/latest/py_tutorials/py_imgproc/py_template_matching/py_template_matching.html

Module: 061900933 Work with Data Manipulation Toolkit

After the completion of this module the candidate will be able to operate the manipulation toolkit, perform a variety of manipulation operations to import/export the data.

Duration   150 hours   **Theory:**   30 hours   **Practical:**   120 hours

Learning Unit	Learning Outcomes	Learning Elements	Materials Required
LU1: Import Data	**You will be able to** 1. Open a python script 2. Import pandas 3. Import a csv file using "read_csv" function 4. Import an excel file using "read_excel" function Import from any other file type using appropriate "read" function	• Importing Pandas library • Understand of plain data, columnar data, array data and its operations. Understand data-stream and data-frame Practical-1 Write the program to Load atleast one of each csv, text and excel file types and display output	• Computer system with python installed • Pip package manager • Stable version of pandas • Text/Code editing application Terminal/cmd application
LU2: Index and Filter Data	**You will be able to** 1. Import data in a python script 2. Index columns using a list of columns 3. Index rows based on a list of index values 4. Index rows based on a	Understanding columns operations and row operations Practical-1 Program to Load all column(s), renames specified column(s), mask specified columns, drop specified column(s) and create column(s) as desired at runtime.	

Learning Unit	Learning Outcomes	Learning Elements	Materials Required
	conditional statement (mask) 5. Index columns based on a conditional statement (mask) 6. Index columns based on a range of columns 2. Index rows based on a range of index value	Practical-2 Write logic to load even/odd columns, even/odd rows, range of columns, merge columns, select columns and rows based on condition(s) from user.	
LU3: Perform Basic Column Level Operations	**You will be able to** 1. Rename column 2. Apply a function element-wise to a column using "apply" 3. Get value counts of a column 4. Get sum of values in a column 5. Get basic stats of a column (mean/median/standard deviation etc.) 6. Change type of a column 7. Perform a vectorized arithmetic operation on a column	Understanding columns operations and row operations. Practical-1 Write a program to get data set information like columns count, rows count, sum of a columns, conditional sum of a column, Detect and change datatypes of columns. Practical-2 Perform basic arithmetic operations over rows and columns, over conditionally selected rows and columns.	

Learning Unit	Learning Outcomes	Learning Elements	Materials Required
	8. Delete a column 9. Duplicate a column 10.Group values of a column and apply an operation on each group **2.**		
LU4: Handle missing data	**You will be able to** 1. Count number of missing values in each column 2. Fill missing values with a specific string 3. Fill missing values with mean of the column Delete rows with missing values	Understanding columns operations and row operations. Practical-1 Write a program to detect missing values or null fields. Program will delete missing fields. Practical-2 Program will detect datatype of missing value and fill. String value will be replaced with given string and numeric with adjacent rows mean/median or average as asked.	
LU5: Perform string level operations and Regex	**You will be able to** 1. Convert a column to string 2. Divide a column into two	Understanding of string operations like concatenation, trimming, length calculation and other Practical-1	

Learning Unit	Learning Outcomes	Learning Elements	Materials Required
	based on a separator 3. Check if each row contains a specific substring 4. Extract substring out of each row in a column 5. Check if each row starts with a specific substring 6. Replace a specific substring in each row in a column 7. Change case of a string column 8. Strip spaces from the sides of each row in a column 9. Concatenate a value to each row in a column 10. Concatenate another column with a string column elementwise	Create a program that can perform following: • Select specified column, split selected column from specified delimit, Practical-2 Create a program to subtract given number of characters from left, right of the column strings. As well as take defined number of columns from starting mentioned index. Practical-3 Create a program to replace specific characters from each row's defined column(s), trim spaces from start and end.	

Learning Unit	Learning Outcomes	Learning Elements	Materials Required
	Perform custom operations using "apply"		
LU6: Merge Data	**You will be able to** 1. Merge two data frames using merge functions 2. Perform different types of joins on two dataframes 3. Concatenate two or more dataframes row wise Concatenate two or more dataframes column wise	Understand dataframe formation, loading and reading dataframes Practical-1 Code program to use dataframe merge function and use its variants/joins like Left, right, sort and copy. Also write code to concatenate dataframes' rows and columns in separate functions	
LU7: Reshape Data	**You will be able to** 1. Stack a dataframe 2. Unstack a dataframe 3. Create a pivot table 4. Melt a dataframe 5. Pivot a dataframe	• Understanding of stacked and unstacked data Understanding of pivot formation Practical-1 Write a program to load plane dataframe and apply stack/unstacked function. Practical-2 Write a program to create pivot table with single and multiple lists.	

Learning Unit	Learning Outcomes	Learning Elements	Materials Required
		Also code dataframe and melt data according to single and multiple variables	
LU8: Apply level Row/Cell Operations	**You will be able to** 1. Count null values in a row 2. Drop/select specific rows based on a condition 3. Drop/select rows by index 4. Reset index of rows Set a custom index of rows	• Understanding columns operations and row operations Practical-1 Write a program to drop columns and rows against given conditions of null value or given indexes	

Videos

	work with data manipulation toolkit python URL https://www.youtube.com/results?search_query=work+with+data+manipulation+toolkit+python
	Index and Filter Data work with data manipulation toolkit python URL https://www.youtube.com/results?search_query=Index+and+Filter+Data+work+with+data+manipulation+toolkit+python
	handle missing data work with data manipulation toolkit python URL https://www.youtube.com/results?search_query=handle+missing+data++work+with+data+manipulation+toolkit+python

Example and Illustrations

Relevant topics and web links

S.No	Links and definitions
1	One-stop Guide to Data Manipulation in Python
	URL
	https://medium.com/analytics-vidhya/python-data-manipulation-fb86d0cdd028

Module: 061900934 Work with Multidimensional Arrays' Manipulation and Computation Package

After the completion of this module the candidate will be able to work efficiently with Multidimensional Arrays to perform variety of programming/control jobs.

Duration 150 hours **Theory:** 30 hours **Practical:** 120 hours

Learning Unit	Learning Outcomes	Learning Elements	Materials Required
LU1: Handle ndArray	**You will be able to** 1. Read ndArray from pickle file 2. Write ndArray to a pickle file 3. Iterate over arrays 4. Append elements to an ndArray Drop elements from ndArray	• Describe serializing and de-serializing of objects. • Describe pickling in python. • Demonstrate importing a pickle file. • Describe read and write operation on a pickle file • Demonstrate read and write operations on a pickle file. • Describe iteration over n-dimensional array. • Demonstrate iteration operation over n-dimensional array. • Describe append operation on an array. • Describe drop operation on an array. Demonstrate append and drop operations, to and from an array.	• Computer system with python installed • Pip package manager • Stable version of numpy and pickle • Text/Code editing application Terminal/cmd application
	3.	Practical-1 Develop python program to perform following:	

Learning Unit	Learning Outcomes	Learning Elements	Materials Required
		• Import read and write operations on a pickle file. • Iteration operations over n-dimensional array. • Append or extend operations on an array. Four drop operations from an array.	
LU2: Perform Index ndArray	**You will be able to** 1. Perform basic slicing and indexing on ndArray 2. Index ndArray using a mask (Boolean array indexing) **3.** Index ndArray using integer array indexing	• Describe slicing of an array (one-dimensional or two-dimensional). • Describe indexing of an array. • Demonstrate slicing and basic indexing of n-dimensional array. • Describe basic Boolean operations. • Demonstrate Boolean indexing using basic operators. • Describe integer array indexing. • Describe advanced index for column. Demonstrate selection of arbitrary items based on array dimension. Practical-1 Develop python program to perform following: • Basic slicing and indexing of n-dimensional array using ndArray • Boolean indexing using basic operators	

Learning Unit	Learning Outcomes	Learning Elements	Materials Required
		• Boolean indexing using advance operations Selection of arbitrary items based on array dimension.	
LU3: Operate on ndArray	**You will be able to** 1. Perform binary operations on arrays 2. Perform string operations on arrays 3. Perform comparison operations on arrays 4. Change type of an array 5. Split arrays (split, dsplit, vsplit, hsplit) 6. Tile arrays Rearrange array (reshape, roll, flip)	• Describe binary operation on arrays • Demonstrate bitwise binary operation on arrays • Describe string operation on arrays • Demonstrate various string operation on arrays • Demonstrate various comparison of arrays. • Describe various array types. • Demonstrate changing the type of an array. • Describe various split operations that can be performed on ndarrays • Demonstrate various split operations that can be performed on ndarrays • Describe basic functionality of tile arrays • Demonstrat how to construct tile array • Describe operations for rearranging arrays Demonstrate various functions to rearrange array Practical-1 Develop a python program to perform	

Learning Unit	Learning Outcomes	Learning Elements	Materials Required
		following:	
		- Bitwise binary operation on arrays - Various string operation on arrays - Comparison of arrays. - Change the type of an array. Practical-2 Develop a python program to perform following: - Split operations that can be performed on ndarrays - Construct tile array Rearrange array	
LU4: Reshape ndArray	**You will be able to** 1. Change dimensions with "reshape" 2. Flatten array with "ravel" 3. Move axis of an array 4. Roll axis of an array 5. Swap axes of an array 6. Take transpose of an array 7. Broadcast an array	- Describe basics of reshape method using numpy - Describe basics of ravel method using numpy - Demonstrate reshape and ravel operation on ndarrays - Describe basics of move axis operation of an array to a new position - Describe the basics of roll axis operation - Describe the basics of swap axis operation - Demonstrate move, roll, swap axis operations on arrays - Describe the purpose of transpose	
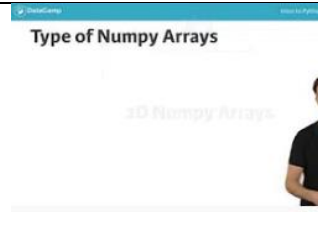
Learning Unit	Learning Outcomes	Learning Elements	Materials Required
		operation • Demonstrate transpose operation on arrays • Describe the broadcast operations on an array Demonstrate Broadcasting on ndarrays Practical-1 Develop a python program to: • Perform reshape and ravel operations on ndarrays • Move, roll, swap axis operations on arrays • Transpose operation on arrays Broadcasting on ndarrays	
LU5: Merge ndArrays	**You will be able to** 1. Concatenate arrays 2. Stack arrays 3. Stack 1D arrays as columns in a 2D array (column stack) Perform stacking on particular axes (dstack, hstack, vstack)	• Describe concatenate functionality of arrays in numpy package • Demonstrate concatenation of arrays using numpy package • Describe various stacking operations for arrays • Demonstrate staking of arrays using numpy • Describe column stacking • Demonstrate stacking 1D array as columns in 2D array	

Learning Unit	Learning Outcomes	Learning Elements	Materials Required
		Demonstrate stacking on various axes Practical-1 Develop a python program that can: • Concatenates multiple arrays using numpy package • Perform stacking of arrays • Perform column stacking Perform stacking on various axes	
LU6: Process Text Data	**You will be able to** 1. Read text documents into variables 2. Tokenize text documents 3. Count number of unique words in a document 4. Convert a text document into a label encoded array 5. Encode a document phrase using one hot encoding	• Describe basic list of packages available for processing text in python • Demonstrate installing relevant text processing package • Describe text tokenization concept • Demonstrate reading text document in python and perform tokenization • Describe basic counting principles • Demonstrate counting number of unique words in documents using relevant python package • Describe label encoding • Describe on hot encoding Describe packages available for label Practical-1	

Learning Unit	Learning Outcomes	Learning Elements	Materials Required
		Develop a python program that can: • Reads a text document and performs tokenization • Count the number of unique words in a text document Practical-2 Develop a python program to: • Convert text document to label Perform one hot encoding on text data	
LU7: Handle new sources of Data	**You will be able to** 1. Read Audio data as numpy array 2. Read Image data as numpy array 3. Read LIDAR data as numpy array Read Time Series data as numpy array	• Install PyAudio package • Describe basic functionality of PyAudio • Demonstrate recording audio with PyAudio • Demonstrate conversion of audio data buffer to numpy ndArray • Install python package for image processing • Describe basic functionality of image processing package • Demonstrate loading image data • Demonstrate conversion of image data to numpy ndArray • Install suitable python package to process LIDAR data • Demonstrate loading LIDAR data	

Learning Unit	Learning Outcomes	Learning Elements	Materials Required
		• Demonstrate conversion of LIDAR data to numpy ndArray • Install suitable python package to process time series data • Demonstrate loading time series data • Demonstrate conversion of time series data to numpy ndArray Practical-1 Develop a python program to: • Load audio data and convert it to numpy ndArray • Load image data and convert it to numpy ndArray • Load LIDAR data and convert it to numpy ndArray Load time series data and convert it to numpy ndArray	

Videos

Python 3 Basics - #27 Multi-dimensional Lists	Python 3 Programming Tutorial - Multi-dimensional List URL https://www.youtube.com/results?search_query=Work+with+Multidimensional+Arrays%E2%80%99+Manipulation+and+Computation+Package+python
Type of Numpy Arrays	handle perform operatre ndarray python URL https://www.youtube.com/watch?v=8Mpc9ukltVA
Array Manipu reshape & resize Python Programming numpy	Array Manipulation | reshape and resize | NumPy Tutorials | Python Programming tract Foreground from the Image URL https://www.youtube.com/watch?v=KehyltXMrZE

Example and Illustrations

Relevant topics and web links

S.No	Links and definitions
1	Python Numpy Array Tutorial
	URL https://www.datacamp.com/community/tutorials/python-numpy-tutorial
2	How To Concatenate Arrays in NumPy? URL https://cmdlinetips.com/2018/04/how-to-concatenate-arrays-in-numpy/

Module Summary

Module Title and Aim	Learning Units	Duration
Module 22: Contribute to Work Related Health and Safety (WHS) Initiatives **Aim:** This module aims to develop the knowledge, skills and understanding needed to Contribute to Work Related Health and Safety (WHS) Initiatives	**LU1:** Contribute to initiate work-related health and safety measures **LU2:** Contribute to establish work-related health and safety measures **LU3:** Contribute to ensure legal requirements of WHS measures **LU4:** Contribute to review WHS measures **LU5:** Evaluate the organization's WHS system	
Module 23: Comply with Workplace Policy and Procedures **Aim:** This module aims to develop the knowledge, skills and understanding needed to Comply with Workplace Policy and Procedures	**LU1:** Respect work timeframes **LU2:** Preparation for meeting **LU3**: Decision making at workplace **LU4**: Set and meet own work priorities **LU5:** Develop and maintain professional competence **LU6:** Follow and implement work safety requirements	
Module 24: Perform Advanced Communication **Aim:** This module aims to develop the knowledge, skills and understanding needed to Perform Advanced Communication	**LU1**: Demonstrate professional skills **LU2**: Plan and Organize work **LU3**: Provide trainings at workplace	

Module Title and Aim	Learning Units	Duration
Module 25: Manage Human Resource Services **Aim:** This module aims to develop the knowledge, skills and understanding needed to Manage Human Resource Services	**LU1:** Determine strategies for delivery of human resource services **LU2:** Extract data as per requirement **LU3:** Parse a web page with appropriate package **LU4:** Extract data from an HTML tag **LU5:** Parse xml /JSON	
Module 26: Scrape data from the web **Aim:** This module aims to develop the knowledge, skills and understanding needed to Scrape data from the web	**LU1:** Build a static web page **LU2:** Create and manage specific working environment **LU3:** Install Packages with Pip	
Module 27: Process Images through Image Processing Software **Aim:** This module aims to develop the knowledge, skills and understanding needed to Process Images through Image Processing Software	**LU1**: Perform Basic Image Operations **LU2:** Apply Image Filters **LU3:** Change Color Spaces **LU4:** Perform Geometrical Transformation **LU5**: Perform Morphological Operations **LU6**:　　Match Image Templates for object Recognition **LU7:**　　Extract Foreground from the Image	

Module Title and Aim	Learning Units	Duration
Module 28: Work with Data Manipulation Toolkit **Aim:** This module aims to develop the knowledge, skills and understanding needed Work with Data Manipulation Toolkit	**LU1**: Import Data **LU2:** Index and Filter data **LU3:** Perform Basic Column Level Operations **LU4:** Handle missing data **LU5:** Perform string level operations and Regex **LU6:** Merge Data **LU7**: Reshape Data **LU8**: Apply Row/Cell level Operations	
Module 29: Work with Multidimensional Arrays' Manipulation and Computation Package **Aim:** This module aims to develop the knowledge, skills and understanding needed to Work with Multidimensional Arrays' Manipulation and Computation Package	**LU1**: Handle ndArray **LU2:** Perform index ndArray **LU3:** Operate on ndArray **LU4:** Reshape ndArray **LU5:** Merge ndArrays **LU6:** Process Text Data **LU7**: Handle new sources of Data	
Module 30: Develop Advance Computer Application Skills **Aim:** This module aims to develop the	**LU1**: Manage Information System to complete a task **LU2:** Prepare Presentation using computers **LU3:** Use Microsoft Access to manage database **LU4:** Develop graphics for Design	

Module Title and Aim	Learning Units	Duration
knowledge, skills and understanding needed to Develop Advance Computer Application Skills		
Module 31: Develop Entrepreneurial Skills **Aim:** This module aims to develop the knowledge, skills and understanding needed to Develop Entrepreneurial Skills	**LU1**: Develop a business plan **LU2:** Collect information regarding funding sources **LU3:** Develop a marketing plan **LU4:** Develop basic business communication skills	

Module summary

Frequently Asked Questions

1.	What is Competency Based Training (CBT) and how is it different from currently offered trainings in institutes?	Competency-based training (CBT) is an approach to vocational education and training that places emphasis on what a person can do in the workplace as a result of completing a program of training. Compared to conventional programs, the competency based training is not primarily content based; it rather focuses on the competence requirement of the envisaged job role. The whole qualification refers to certain industry standard criterion and is modularized in nature rather than being course oriented.
2.	What is the passing criterion for CBT certificate?	You shall be required to be declared "Competent" in the summative assessment to attain the certificate.
3.	What are the entry requirements for this course?	The entry requirement for this course is 8th Grade or equivalent.
4.	How can I progress in my educational career after attaining this certificate?	You shall be eligible to take admission in the National Vocational Certificate Level-3 in Artificial Intelligence Data Technician). You shall be able to progress further to National Vocational Certificate Level-4 in Artificial Intelligence Data Technician (Supervisor); and take admission in a level-5, DAE or equivalent course. In certain case, you may be required to attain an equivalence certificate from The Inter Board Committee of Chairmen (IBCC).
5.	If I have the experience and skills mentioned in the competency standards, do I still need to attend the course to attain this certificate?	You can opt to take part in the Recognition of Prior Learning (RPL) program by contacting the relevant training institute and getting assessed by providing the required evidences.
6.	What is the entry requirement for Recognition of Prior Learning program (RPL)?	There is no general entry requirement. The institute shall assess you, identify your competence gaps and offer you courses to cover the gaps; after which you can take up the final assessment.

No.	Question	Answer
7.	Is there any age restriction for entry in this course or Recognition of Prior Learning program (RPL)?	There are no age restrictions to enter this course or take up the Recognition of Prior Learning program
8.	What is the duration of this course?	The duration of the course work is 3220 hours
9.	What are the class timings?	The classes are normally offered 25 days a month from 08:00am to 01:30pm. These may vary according to the practices of certain institutes.
10.	What is equivalence of this certificate with other qualifications?	As per the national vocational qualification's framework, the level-4 certificate is equivalent to Matriculation. The criteria for equivalence and equivalence certificate can be obtained from The Inter Board Committee of Chairmen (IBCC).
11.	What is the importance of this certificate in National and International job market?	This certificate is based on the nationally standardized and notified competency standards by National Vocational and Technical Training Commission (NAVTTC). These standards are also recognized worldwide as all the standards are coded using international methodology and are accessible to the employers worldwide through NAVTTC website.
12.	Which jobs can I get after attaining this certificate? Are there job for this certificate in public sector as well?	You shall be able to take up jobs in the Artificial Intelligence Data Technician industry which comprises of development of applications for play store as well as testing and optimization of the apps.
13.	What are possible career progressions in industry after attaining this certificate?	You shall be able to progress up to the level of supervisor after attaining sufficient experience, knowledge and skills during the job. Attaining additional relevant qualifications may aid your career advancement to even higher levels.
14.	Is this certificate recognized by any competent authority in Pakistan?	This certificate is based on the nationally standardized and notified competency standards by National Vocational and Technical Training Commission (NAVTTC). The official certificates shall be awarded by the relevant certificate awarding body.

15.	Is on-the-job training mandatory for this certificate? If yes, what is the duration of on-the-job training?	On-the-job training is not a requirement for final / summative assessment of this certificate. However, taking up on-the-job training after or during the course work may add your chances to get a job afterwards.
16.	How much salary can I get on job after attaining this certificate?	The minimum wages announced by the Government of Pakistan in 2019 are PKR 17,500. This may vary in subsequent years and different regions of the country. Progressive employers may pay more than the mentioned amount.
17.	Are there any alternative certificates which I can take up?	There are some short courses offered by some training institutes on this subject. Some institutes may still be offering conventional certificate courses in the field.
18.	What is the teaching language of this course?	The leaching language of this course is Urdu and English.
19.	Is it possible to switch to other certificate programs during the course?	There are some short courses offered by some training institutes on this subject. Some institutes may still be offering conventional certificate courses in the field.
20.	What is the examination / assessment system in this program?	Competency based assessments are organized by training institutes during the course which serve the purpose of assessing the progress and preparedness of each student. Final / summative assessments are organized by the relevant qualification awarding bodies at the end of the certificate program. You shall be required to be declared "Competent" in the summative assessment to attain the certificate.
21.	Does this certificate enable me to work as freelancer?	You can start your small business/ software house related to Artificial Intelligence Data Technician and you can work as freelancer as well after the completion of the course. You may need additional skills on entrepreneurship to support your initiative.

Test Yourself (Multiple Choice Questions)

MODULE	Scrap data from the web

Question 1   What is the correct HTML for creating a hyperlink?

     A   `<a href="http://www.w3schools.com">W3Schools</a>`

     B   `<a>http://www.w3schools.com </a>`

     C   `<a url="http://www.w3schools.com">W3Schools</a>`

     D   `<a name="http://www.w3schools.com">W3Schools</a>`

Question 2   Which of these elements are all `<table>` elements?

     A   `<table><tr><td>`

     B   `<table><tr><tt>`

     C   `<table><head><tfoot>`

     D   `<thead><body`

Question 3 When trying to get or retrieve data from a specified resource, what HTTP method is used?

A POST

B GET

C HEAD

D CONNECT

Question 4 Which property of the requests.Response object returns the content of the response, in bytes?

A encoding

B request

C content

D cookies

Question   5   Which of the following objects from BeautifulSoup package represent the whole HTML document?

A   Tag

B   NavigableString

C   BeautifulSoup

D   Comment

MODULE	Process Images through Image Processing software

Question   6   Which is default missing value in pandas dataframe.

A   Not Found

B   NULL

C   NAN

D   NaN

Question 7 Mark the wrong statement

A Primary difference between Series and ndarray is operations between Series automatically align the data based on label

B NumPy methods accepting an ndarray can also accept Series instead.

C DataFrame behaves as fixed-size dict where you can get and set values through index labels

D DataFrames can be exported as excel files.

Question 8 Which of the following works analogously to the form of the dict constructor?

A DataFrame.from_items

B DataFrame.from_records

C DataFrame.from_dict

D DataFrame.Init

Question 9 Pandas allows to load range of columns at initialize level.

A True

B False

C

D

Question 10 Which of the following works analogously to the form of the dict constructor?

A DataFrame.from_items

B DataFrame.from_records

C DataFrame.from_dict

D DataFrame.Init

MODULE	Work with Data Manipulation Toolkit		

Question	**11**	Which of the following is contained in NumPy library?	A	n-dimensional array object
			B	tools for integrating C/C++ and Fortran code
			C	fourier transform
			D	all of the Mentioned

Question	**12**	The _____ function returns its argument with a modified shape, whereas the _____ method modifies the array itself.	A	reshape,resize
			B	resize,reshape
			C	reshape2,resize
			D	all of the Mentioned

Question 13 Which of the following function stacks 1D arrays as columns into a 2D array?

A   row_stack

B   column_stack

C   com_stack

D   all of the Mentioned

Question 14 ndarray is also known as the alias array.

A   True

B   False

C

D

Question 15 Which of the following method creates a new array object that looks at the same data

A view

B copy

C paste

D all of the Mentioned

MODULE	Work with Multidimensional Arrays' Manipulation and Computation Package

Question 16 ndarray.dataitemSize is the buffer containing the actual elements of the array

A True

B False

C

D

Question   17   How would you join the two arrays of train and test sets?

A   resulting_set = train_set.append(test_set)

B   resulting_set = np.concatenate([train_set, test_set])

C   resulting_set = np.vstack([train_set, test_set])

D   None of these

Question   18   Correct syntax of the reshape() function in Numpy array python is

A   array.reshape(shape)

B   reshape(shape,array)

C   reshape(array,shape)

D   reshape(shape)

Question   19   How we can convert the Numpy array to the list in python?

A   list(array)

B   list.array

C   array.list

D   None of the above

Question   20   How we install Numpy in the system ?

A   install numpy

B   pip install python numpy

C   pip install numpy

D   pip install numpy python

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