



## CADVertex Solutions

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# CAD Automated Machine Learning

Language: Python

**Master CAD Automation and Machine Learning in One Integrated Training**

## Training Plan

**4 Sections, 12 modules, 18 Projects**

### Section 1 - Programming

Python Programming.  
Tkinter GUI Programming.

### Section 2 - Libraries

Numpy - Numerical and Scientific Processing.  
Pandas - Big Data Processing.  
Matplotlib and Seaborn - Visualization.

### Section 3 - CAD Automation

CAD UI and Document Automation.  
Drawing Automation.  
Part Automation.  
Assembly Automation.

### Section 4 - Machine Learning

Supervised Learning .  
Unsupervised Learning.  
Linear Regression .  
Logistic Regression.  
Decision Trees.  
K-Means Clustering.

## Projects for Machine Learning using Python

### Project 1 - Decision Tree

Bearing Selection: Decide between choosing a Needle Bearing or Ball Bearing based on the Material, Usage, and Load on the bearing.

### Project 2 - Decision Tree

Circuit Breaker Failure Prediction: Predicting if a circuit breaker will fail or not based on factors like operating temperature, altitude, orientation.

### Project 3 - Linear Regression Model - Single Variable

Castor Wheel Life Prediction: Estimating the life of a castor wheel based on the load on the castor Top Plate.

### Project 4 - Linear Regression Model - Single Variable

Circuit Breaker Life Prediction: Estimating the life of a Circuit Breaker based on the electric current flow.

### Project 5 - Linear Regression Model - Multiple Variables

Castor Wheel Life Prediction: Estimating the life of a castor wheel based on various factors like the strength of the material used, the number of wheels, load on the castor Top Plate.

### Project 6 - Linear Regression Model - Multiple Variables

Circuit Breaker Life Prediction: Estimating the life of an electric circuit breaker based on various factors like the operating temperature, altitude, and Orientation.

### Project 7 - Polynomial Regression

Fluid Flow Through Orifice: Predict the fluid flow volume and rate with changes in the cross-sectional area of a orifice plate.

### Project 8 - K-Means Clustering

Clustering GDT Symbol Errors: based on Drawing Sheet Zones.

## Projects for CAD Automation using Python

- |                                |                                 |
|--------------------------------|---------------------------------|
| 1. Geometric Calculator        | 6. Automatic Title Block Update |
| 2. Batch Processor             | 7. Estimate Cutting Cost        |
| 3. Paper Estimation            | 8. Estimate Machining Cost      |
| 4. Create 3 Standard Dwg Views | 9. Parametric Parts             |
| 5. Modify Dimensions in Bulk   | 10. Product Configurator        |

## Module 1 : Python

- ❖ Installing Python
- ❖ Running Python programs
- ❖ Syntax, Comments, User Input, Print results, and control Program Flow
- ❖ Variables: Decimal, Integer, Strings, Boolean
- ❖ String Variables: Find, Replace, Formatting and Slicing
- ❖ Datatypes, Typecasting and Validations
- ❖ Arithmetic Operations
- ❖ Math Library and Functions
- ❖ Lists, Tuples, Dictionaries and Sets
- ❖ List Operations - Slicing and Data Extraction
- ❖ String Operations - Slicing and Manipulations
- ❖ Conditionals : If and Elif
- ❖ Chaining Comparison Operators
- ❖ Loops: For, While
- ❖ Functions: Arguments, Return Statements and values
- ❖ Functions: Optional Arguments
- ❖ Functions: Multiple Return Values
- ❖ Function Help and DocStrings
- ❖ Modules and the Python standard library
- ❖ Exceptions Handling: Try Catch Except
- ❖ Debugging
- ❖ Variables scope
- ❖ Lambda functions
- ❖ Installing 3rd party packages using pip
- ❖ List comprehensions

## Bonus Module: Excel Automation

- ❖ Connect to Excel
- ❖ Access existing workbooks
- ❖ Create new workbooks
- ❖ Create new worksheets
- ❖ Access cells using names and indices
- ❖ Print a range of cells
- ❖ Write values to cells
- ❖ Write formulas to cells
- ❖ Evaluate formulas
- ❖ Access a range of cells and parse a range
- ❖ Read values from a range
- ❖ Save workbooks

## Module 2 : Tkinter GUI

- ❖ Geometry and mainloop
- ❖ Project - Geometric calculator
- ❖ Setting dialog box properties, title, icon, size and location
- ❖ Adding widgets and adjusting their properties and placement
- ❖ Tkinter Datatypes - Double, Integer, Strings, and Boolean
- ❖ Data Type Conversion - tkinter variables and python variables
- ❖ Labels - static and dynamic
- ❖ Entry Textboxes - storing user input from textboxes into variables
- ❖ Setting default values and last used values in text boxes
- ❖ Button widget - formatting and calling functions
- ❖ Check boxes and radio buttons
- ❖ Listboxes - single selection and multiple selections
- ❖ Listboxes - adding items static and dynamic
- ❖ Listbox selection event binding
- ❖ Listbox display total count and selection count
- ❖ Listbox, remove selected item and remove all items
- ❖ Listbox - add items from textbox
- ❖ Scrollbar - adding scrollbar to a listbox
- ❖ Spinner widget - setting range and layout
- ❖ Scale widget - setting range and layout
- ❖ Images - displaying images in a dialog box
- ❖ File selection dialog
- ❖ Single and multiple files
- ❖ Adding file filters
- ❖ Folder selection dialog
- ❖ Selecting all files from folder dialog
- ❖ Adding file filters for folder dialog
- ❖ Opening files in associated application
- ❖ Message boxes - information, query and warning
- ❖ Configuring single line and multiline messages
- ❖ Button configurations and icon synchronizing
- ❖ Checking message box responses against button configurations
- ❖ Reading single and multiple files from a file dialog
- ❖ File and directory functions
- ❖ File and folder operations
- ❖ Text files - read, append and write with practical applications
- ❖ Manipulating file paths and extensions
- ❖ Option menu, add and remove items
- ❖ Handling multiple dialogs
- ❖ Adding pulldown menus, adding menu items
- ❖ Cascading menus and adding commands to menu items

## CAD Automation using Python

Choose from:

- ❖ CATIA Automation.
- ❖ Solid Edge Automation.
- ❖ SolidWorks Automation.
- ❖ Inventor Automation.

### Module 3: CAD UI & Document

- ❖ Connect to CAD
- ❖ Traversing the CAD object model
- ❖ CAD interface elements
- ❖ CAD document type
- ❖ Read-write various properties of the CAD interface
- ❖ Create new CAD files - Part, Drawing and Assembly
- ❖ Open, Close, Save and SaveAs CAD files
- ❖ Close all documents in the Session
- ❖ Export documents to other formats
- ❖ Activate files in a session
- ❖ Loop through files in the session
- ❖ Standard file dialogs to select CAD files
- ❖ Setting CAD file filters
- ❖ Single and multiple file selection
- ❖ [Industry Project](#) - Create a Batch Processor for Handling CAD documents
- ❖ Use the Folder selection dialog, gather all files of a specified type into a collection
- ❖ Export the batch of documents to formats like DWG, STP, etc.

### Module 4: CAD Drawing Automation

- ❖ Creating drawing sheets
- ❖ Accessing, counting sheets
- ❖ Extracting sheet info
- ❖ Switching between sheets
- ❖ Deleting sheets
- ❖ [Industry Project](#) - Estimating Paper Requirement for Printing Drawings
- ❖ Create drawing views
- ❖ Create the front view and projection views
- ❖ Zoom fit, in and out
- ❖ [Industry Project](#) - Creating Standard Views of a Model in CAD
- ❖ Learn to handle Dimensions In CAD Drawings
- ❖ Traversing dimensions and checking dimension types
- ❖ Getting and setting properties of dimension like prefix and suffix
- ❖ [Industry Project](#) - Modifying Dimensions in Bulk

- ❖ Access text objects in a drawing document
- ❖ Persistent text objects in drawing
- ❖ [Industry Project](#) - Automatic Title Block Update program
- ❖ Creating 2D objects in a drawing document
- ❖ Accessing 2D elements and its geometrical properties
- ❖ [Industry Project](#) - Estimate Cutting Cost of a Milling Profile

## **Module 5:** CAD Parts Automation

- ❖ Traversing the features of a CAD model
- ❖ Determine type of features like hole, pocket, draft, fillet, etc.
- ❖ Determine features sub-type like various hole types
- ❖ [Industry Project](#) - Estimate machining cost for a plate with various holes
- ❖ Create and control parametric part in CAD
- ❖ [Industry Project](#) - Modify parameters of a parametric shaft with a keyway.
- ❖ Creating variations of a part by manipulating features
- ❖ [Industry Project](#) - Build a Part Configurator from scratch

## **Module 6:** CAD Assembly Automation

- ❖ Traverse through all components of a CAD Product
- ❖ Extract physical properties like area, mass, volume, etc.
- ❖ [Industry Project](#) - Material estimation for spray painting
- ❖ [Industry Project](#) - Create a CAD Product Configurator.
  - Automatically generate custom assemblies.
  - Create and set up a parts library.
  - Build a UI to choose parts from the library.
  - Traverse a CAD assembly & build the product configuration as specified by the user.

## **Module 7 : Numpy - Numerical and Scientific Processing**

- ❖ Arrays
- ❖ One Dimensional Array
- ❖ Multidimensional Array
- ❖ Create Arrays from Data
- ❖ Create array from Ranges
- ❖ Shape
- ❖ Array Intersection
- ❖ Array Difference
- ❖ Sum
- ❖ Matrices
- ❖ Transpose of Matrix
- ❖ Matrix Dot Product
- ❖ Matrix Cross Product
- ❖ Slicing Array
- ❖ Slicing Matrices

## **Module 8 : Pandas - Big Data Processing**

- ❖ Series
- ❖ DataFrames
- ❖ Drop Entry
- ❖ Rank and Sort
- ❖ Missing Data
- ❖ Dataframe Indexing
- ❖ Reindexing
- ❖ Dataframe Head, Tail
- ❖ Dataframe Shape
- ❖ Selection iLoc, Loc
- ❖ Drop Entry
- ❖ Range Min, Max
- ❖ Range Median
- ❖ Read DataFrame from CSV

## **Module 9 : Matplotlib - Visualization**

- ❖ Line Plots
- ❖ Sub Plots
- ❖ Plot Properties - Color, Style
- ❖ Grid, xLabel, yLabel
- ❖ Bar Plots
- ❖ Bar SubPlots and Orientation
- ❖ Scatter Plots
- ❖ Scatter Subplots
- ❖ Mixed Plots and Overlapping
- ❖ Markers and LineWidth
- ❖ Exporting Plots
- ❖ Histograms
- ❖ Histograms from Imported Data
- ❖ Pie Charts

## Module 10 : Seaborn- Advanced Visualization and Plotting

- ❖ Line Plots
- ❖ Bar Plots
- ❖ Bar Plot From Data
- ❖ Scatter Plots

## Module 11 : Machine Learning using the Scikit-Learn Library

### **Decision Trees**

- ❖ DecisionTree Classifier
- ❖ Extracting Features & Labels from a Dataframe
- ❖ Fitting Features & Labels into a decision algorithm
- ❖ Predicting values based on classification
- ❖ Dual Classification and Multiclass classification

## Module 12 : Machine Learning Projects

### **Project 1 - Decision Tree**

#### **Bearing Selection**

Decide between choosing a Needle Bearing or Ball Bearing based on the Material, Usage, and Load on the bearing.

- ❖ Reading CSV data using Pandas
- ❖ Separating input and output columns
- ❖ Dropping frames from data
- ❖ Label Encoders
- ❖ Fit Transforms
- ❖ Predicting results



## **Project 2 - Decision Tree**

### **Circuit Breaker Failure Prediction**

Predicting if a circuit breaker will fail based on operating data like temperature, altitude, and orientation.

- ❖ Reading CSV data
- ❖ Separating input and output columns
- ❖ Dropping frames from data
- ❖ Label Encoders
- ❖ Fit Transforms
- ❖ Predicting results

## **Linear Regression Analysis**

### **Project 3 - Linear Regression Model - Single Variable**

#### **Castor Wheel Life Prediction**

Estimating the life of a castor wheel based on the load on the castor top plate.

- ❖ Reading a CSV data file
- ❖ Create Linear regression model
- ❖ Fit data columns directly to the algorithm
- ❖ Determine coefficient and intercept
- ❖ Reading bulk inputs data from CSV
- ❖ Predicting output for entire column
- ❖ Exporting output dataframes to CSV
- ❖ Create a scatter plot of the data

### **Project 4 - Linear Regression Model - Single Variable**

#### **Circuit Breaker Life Prediction**

Estimating the life of an electric circuit breaker based on the electric current flow.

- ❖ Reading a CSV data file
- ❖ Create Linear regression model
- ❖ Fit data columns directly to the algorithm
- ❖ Determine coefficient and intercept
- ❖ Reading bulk inputs data from CSV
- ❖ Predicting output for entire column
- ❖ Exporting output dataframes to CSV
- ❖ Create a scatter plot of the data

### **Project 5 - Linear Regression Model - Multiple Variables**

#### **Castor Wheel Life Prediction**

Estimating the life of a castor wheel based on various factors like the strength of the material used, the number of wheels, load on the castor Top Plate.

- ❖ Reading a CSV data file
- ❖ Create Linear regression model
- ❖ Finding the median of data
- ❖ Filling NA values
- ❖ Determine coefficient and intercept
- ❖ Predicting the output

### **Project 6 - Linear Regression Model - Multiple Variables**

#### **Circuit Breaker Failure Prediction**

Estimating the life of an electric circuit breaker based on various factors like the operating temperature, altitude, and Orientation.

- ❖ Reading a CSV data file
- ❖ Create Linear regression model
- ❖ Finding the median of data
- ❖ Filling missing values
- ❖ Determine coefficient and intercept
- ❖ Predicting the output

### **Project 7 - Polynomial Regression**

#### **Fluid Flow Through Orifice**

Predicting the fluid flow volume and rate with changes in the cross-sectional area of a orifice plate.

- ❖ Plotting study data using matplotlib
- ❖ Creating a Linear Regression model
- ❖ Algorithm & training
- ❖ Predicting and printing results
- ❖ Level-2 polynomial fitting
- ❖ Creating a scatter plot of the input and predicted data

## **K-Means Clustering**

### **Project 8 - Clustering GDT Symbol Errors based on Drawing Sheet Zones**

- ❖ Importing data
- ❖ Determining clusters
- ❖ Determining the cluster to which a point belongs
- ❖ Visualize cluster using scatter plots
- ❖ Visualize cluster centers

## Master CAD Automation and Machine Learning in One Integrated Training



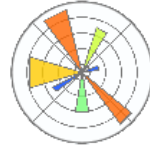
Python



Pandas



Numpy



Matplotlib



Seaborn



Scikit Learn

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### Other eBooks and Training Programs from CADVertex:

- ❖ CATIA Automation: VB.Net or CSharp or Python
- ❖ SolidWorks Automation: VB.Net or CSharp or Python
- ❖ Solid Edge Automation: VB.Net or CSharp or Python
- ❖ Inventor Automation: VB.Net or CSharp or Python
- ❖ NX Open: VB.Net or CSharp with Win Forms
- ❖ NX Open: VB.Net or CSharp with Block UI Styler
- ❖ Knowledge Fusion
- ❖ Knowledge Fusion with Block UI Styler
- ❖ cMayoCAD: Learn to build a new CAD program from scratch using a Geometric Modeling Kernel and CSharp
- ❖ Machine Learning for Engineers with Python
- ❖ CATIA Automation with Python and Machine Learning
- ❖ NX Automation and Machine Learning with Python
- ❖ Solid Edge Automation with Python + Machine Learning
- ❖ SolidWorks Automation with Python + Machine Learning
- ❖ Inventor Automation with Python + Machine Learning
- ❖ Fast track course in Python with Machine Learning for VB.Net experts
- ❖ Fast track course in Python with Machine Learning for CSharp experts

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