

# The Application of Case Teaching in Python Language and Applications

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**Abstract**— With the rapid development of big data and artificial intelligence, colleges and universities pay more attention to the cultivation of students' computer application ability and innovation ability. Based on the simplicity of Python and its powerful artificial intelligence algorithm library, it is particularly important to integrate machine learning methods into the teaching of "Python Language and Application". This study explores the application of case teaching method in the Python language courses and practice, elaborates on the application of case teaching method and the use principle, in order to rise the "Python language and application" course teaching effect through case teaching in colleges and universities, at the same time, it is also conducive to the cultivation of students' comprehensive computer application ability and innovative practice ability.

**Keywords**—Python language, Case teaching, Machine learning, Application and practice.

## I. INTRODUCTION

With the advent of the era of big data, higher requirements are put forward for students majoring in economics and management. Data analysis has become one of the basic skills that students majoring in economics and management must master. Python language is very popular internationally right now. Among the many programming languages and analysis tools available, Python is one of the best data analysis tools available. The Python programming mode is also very consistent with human thinking habits, which will help us to integrate the teaching concept of computational thinking into experimental teaching.

In order to meet the requirements of the development of the era of big data, our university has set up Python language and application compulsory courses for economics and management majors since 2018. It is one of the first institutions of higher learning of Finance and economics in China to set up Python language. After several years of construction, our university has set up a series of Python courses successively, taking the lead in finance and economics universities.

Through the introduction of case teaching and the integration of Python teaching, students can intuitively learn and master different machine learning methods, and then expand to a wider field of artificial intelligence [1]. The cultivation of artificial intelligence talents is a long-term process, which needs to penetrate into every link of teaching. We need to combine new ideas, reform teaching methods and

change educational concepts to cultivate talents and promote the development of artificial intelligence technology [2].

Our school has actively carried out teaching reform in the course of computer and information technology, and has carried out in-depth research and exploration on the application of case teaching method in computer teaching. For non-computer majors, Python is simple to get started and easy to use. It also has a powerful third-party library, which can be widely used in various fields to help students improve their ability to analyze, solve and practice practical problems.

## II. TEACHING FOCUS OF PYTHON LANGUAGE COURSE

### A. Python Features

Python is simple and easy to understand. It has a complete package management system PIP command, which makes it easy to install and write packages. Python provides a wealth of data analysis modules, with a high reuse mechanism, portability of different platforms, built-in powerful standard modules, can be mixed with other languages programming, its application fields are quite wide, including game programming, image processing, artificial intelligence, natural language analysis and so on.

### B. Basic Syntax

Since the new Version of Python is incompatible with the earlier version, it is recommended to use the syntax structure of the new version of Python3 in the teaching process. Common data types are tuple, list, dictionary, and set. The elements inside the tuple are written in parentheses, separated by commas. The type of each element can be different, but the element cannot be modified. A list is an ordered collection of "sequence" types. Elements are written in square brackets. The types of elements can be different and can be nested. A dictionary, identified by curly braces, is a mapping type. The internal elements appear as key-value pairs. The key must be an immutable type. A set is an unordered sequence of non-repeating elements, created with the set () function or curly braces, that can be used to delete duplicate elements.

### C. Commonly Used Machine Learning Methods

Machine learning itself is a technology that uses experience to improve the system itself through computational means. Its purpose is to generate data models based on empirical data and provide corresponding judgments for new situations by using learning algorithms. There are many machine learning methods, among which the more classical

clustering analysis method, classification method, association analysis method, sequence pattern analysis method and so on. In the course of teaching Python, these algorithms are very concise and clear, which can be used as teaching cases.

### III. APPLICATION OF CASE TEACHING IN "PYTHON LANGUAGE AND APPLICATION"

Students are encouraged to develop small projects based on the nature of the Python course to gain hands-on experience. Existing textbooks introduce more basic grammar and programming structure, and the application cases of artificial intelligence methods are relatively complex, which makes students feel abstract [3]. Due to the limited experimental class, in order to master more knowledge in a short experimental class, it is necessary to design the experimental content carefully, and at the same time, introduce cases in the practice teaching link to help students enhance their deep understanding of artificial intelligence algorithm. Through case teaching, machine learning method is further promoted to practical application.

#### A. Common Standard Modules

The standard modules for machine learning in Python include numpy, pandas, Scipy, matplotlib, sklearn, etc. In the practical teaching section, we can introduce several standard modules of machine learning methods, such as numpy, Pandas, sklearn, etc. numpy is a high-performance foundation package for scientific computation and data analysis that can be used to store and process large matrices much more efficiently than Python's own nested list structure. sklearn is an important machine learning library that is widely used. It encapsulates a large number of machine learning algorithms, such as classification, clustering, regression, dimensionality reduction, etc. It also contains three modules: supervised learning, unsupervised learning and data transformation. matplotlib is a graphic library that can generate histogram, power spectrum, histogram, error graph, scatter graph, etc. on various platforms, providing high quality effect rendering.

#### B. Building Case Data Sets

The datasets module of sklearn library integrates some classical datasets of data analysis. You can use these datasets for data preprocessing, modeling and other operations, and get familiar with the data processing and modeling process of sklearn.

The loading functions and explanations of common datasets of the datasets module are shown in the follow.

Data preprocessing uses sklearn Transformer, a unified interface provided by sklearn. The loaded dataset can be treated as a dictionary. Almost all sklearn datasets can use data, target, feature\_names, and DESCR to obtain data, tags, feature names, and descriptions of datasets, respectively.

Take face recognition security as an example, the characteristic data of each picture can be regarded as a data point in space. For simplicity, we can call related functions to import these sample points directly from the file to form a data set for data analysis, and the display results are shown in Figure 1. Codes of importing a dataset is as follows:

```
%matplotlib inline
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns;sns.set()
from matplotlib.font_manager import FontProperties
font=FontProperties(fname=r'c:\windows\fonts\simhei.ttf',
size=15)
from sklearn.datasets import fetch_lfw_people
faces=fetch_lfw_people(min_faces_per_person=60,data_home='c:\\')
fig,ax=plt.subplots(3,5)
for i,axi in enumerate(ax.flat):
    axi.imshow(faces.images[i],cmap='bone')
    axi.set(xticks=[], yticks=[], xlabel= faces.target_names
[faces.target[i]])
```

In which Fetch\_lfw\_people is the image sample library. Next, we discuss how to build a prediction model to predict the current data set.

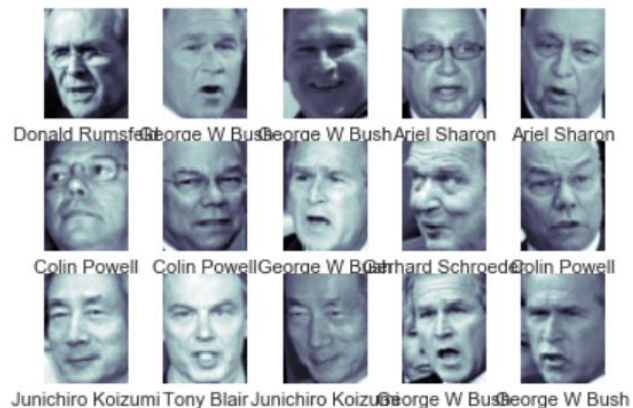


Fig. 1. The display results of case data sets.

#### C. Divide Training Set and Test Set and Build Prediction Model

In the process of data analysis, in order to ensure that the model can play the expected role in the actual system, it is generally necessary to divide the sample into three independent parts:

*Train sets:* Used to estimate models.

*Validation Set:* Parameters used to determine the structure of a network or control the complexity of a model.

*Test set:* Used to verify the performance of the optimal model.

The typical division is that the training set accounts for 50% of the total sample, while the validation set and test set account for 25% each.

When the total amount of data is small, it is not appropriate to divide the data into three parts using the above method.

The commonly used method is to leave a small part of the test set, and then adopt k-fold cross verification method for the remaining N samples. The basic steps are as follows:

Divide the sample into K parts evenly.

Take turns selecting k-1 of them for training and the remaining one for validation.

The sum of squares of prediction errors was calculated, and the mean of the sum of squares of prediction errors of K

times was taken as the basis for selecting the optimal model structure.

The model\_selection module of sklearn provides the train\_test\_split function to split data sets. In addition to providing the basic feature transformation function, sklearn also provides dimensionality reduction algorithm, feature selection algorithm, the use of these algorithms is also through the converter. Below, k-fold cross validation method is used to divide the data set, PCA dimension reduction algorithm function is used to reduce dimension, and the prediction model is established. Example of dividing a dataset is as follows:

```
from sklearn.cross_validation import train_test_split
Xtrain,Xtest,ytrain,ytest=train_test_split(faces.data,faces.ta
rget,random_state=42)
from sklearn.svm import SVC
from sklearn.decomposition import PCA
from sklearn.pipeline import make_pipeline
pca=PCA(n_components=150,whiten=True,random_state=
42,svd_solver='randomized')
svc=SVC(kernel='rbf',class_weight='balanced')
model=make_pipeline(pca,svc)
```

D. Prediction Results and Evaluation

Codes of displaying the prediction results is as follows and the prediction results are shown in Figure 2.

```
fig,ax=plt.subplots(4,6)
for i,axi in enumerate(ax.flat):
    axi.imshow(Xtest[i].reshape(62,47),cmap='bone')
    axi.set(xticks=[],yticks=[])
    axi.set_ylabel(faces.target_names[yfit[i]].split()[-1],
        color='black' if yfit[i]==ytest[i] else 'red')
fig.suptitle('error in Red',size=14)
```

The accuracy obtained by the classification model for predicting the test set cannot well reflect the performance of the model. In order to effectively judge the performance of a prediction model, it is necessary to calculate the accuracy rate, recall rate, F1 value and Cohen's Kappa coefficient by combining the real value.



Fig. 2. The prediction results.

In addition to using numerical values and tabulation to evaluate the performance of the classification model, the classification model can also be evaluated by drawing ROC curves.

The range of the horizontal and vertical coordinates of the ROC curve is [0,1]. Generally, the larger the area formed by the ROC curve and the X-axis, the better the model performance is. However, when the ROC curve is at the position of the blue dotted line in the figure below, it indicates that the calculation results of the model are basically obtained randomly. In this case, the role of the model is almost zero. Therefore, in practice, the farther the ROC curve is from the blue dotted line in the figure, the better the model effect is, as shown in Figure 3.

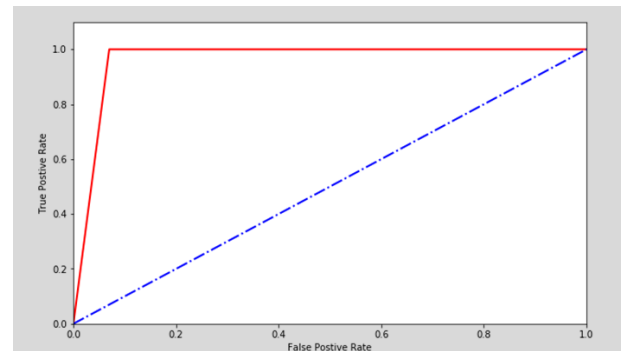


Fig. 3. The ROC curve.

IV. ANALYSIS OF APPLICATION POINTS OF CASE TEACHING

In the specific application process of case teaching, the main line of our teachers includes the processes of screening cases - introducing cases - explaining cases - expanding cases - operating cases - evaluating cases. Through the detailed case teaching process design, the effect of case teaching is improved to the greatest extent. However, in the specific implementation process of case teaching method. The following points should also be clearly noted in each link:

A. Select Teaching Cases Based on Professional Characteristics

Teachers should take teaching objectives and students' needs as the prerequisite, and select case teaching according to students' professional characteristics, so as to maximize the teaching effect. In this way, the targeted selection of cases according to majors can more easily arouse students' career resonance and career yearning, stimulate students' interest in learning, and make computer courses more appealing and persuasive.

B. Appropriate Use, Do not Put the Cart before the Horse

In the process of interpretation of the case should be clear learning objectives, stressing the cultivation of students learning methods, reasonable use of teaching resources, timely introduction of case teaching, according to the requirements of knowledge cannot be used for case teaching case, cannot be used where not applicable case teaching hard case teaching, the use of case teaching should be timely proper, appropriate, Teachers should not rely too much on case teaching and lose the ability of rigorous thinking and innovative teaching methods. They should not put the cart before the horse and turn computer class into "watching examples" and "watching videos". They should grasp the amount and degree of case use

to ensure the smooth and normal development of teaching activities.

### C. Optimize Application Skills Based on Practical Operation

Case implementation also broaden the case and case study, should require students to pay attention to during the process of the implementation of the specific reference to specific case to explore independently, according to the different professional talent training scheme and the social demand for the corresponding teaching focus adjustment, improve the practice of computer application ability of students, cultivate students' innovative spirit, In order to ensure that students learn more optimized development, but also to the greatest extent to enhance students' computer technology learning effect, improve the social competitiveness of students.

### D. Scientific and Objective Evaluation, Adjustment and Improvement of Teaching Methods

Science evaluation effect of case teaching and students' practical operation effect, through the objective, comprehensive and scientific evaluation, help teachers find and solve the specific problems in the process of students' practice, to help teachers improve the implement method of case teaching, help teachers to assess the actual teaching effect of case teaching, so as to ensure implementation of case teaching more reasonably and effectively.

## V. CONCLUSION

This paper introduces cases in Python Language and Applications courses to intuitively compare the effects presented by two different machine learning methods, which can help students combine theory with practice, and practice with the background of The Times, so as to improve their learning enthusiasm and meet the requirements of talent

cultivation in the field of artificial intelligence. The characteristics of The Python language determine that the teaching content of this course needs to be in line with The Times. In terms of teaching methods, the introduction of cases avoids boring narration and integrates theories into practical hot topics to improve students' learning enthusiasm. Therefore, it is of practical significance to use cases to promote the integration of Python language courses and artificial intelligence [4]. It is hoped that this paper can provide new teaching ideas and methods for computer courses teaching staff, which is conducive to the spread and development of artificial intelligence ideas.

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