A Preliminary Study on the Design Principles of Artificial Intelligence Courses for the Lower Grades of Application-oriented Universities

Yi QI *

School of Artificial Intelligence, Chongqing University of Arts and Sciences, Chongqing 402160, China
*Corresponding author

Keywords: Application-oriented University, Undergraduates of lower grades, Curriculum design, Artificial intelligence, Python.

Abstract. In view of the difficulties existing in the teaching process of artificial intelligence courses in application-oriented universities, such as the difficulties in understanding, the lack of strong correlations among the contents of chapters, insufficient training of practical ability and so on, this paper considers a new learning framework of AI course which can be constructed based on Python and its ecological environment with practical teaching experiences. The new framework will stimulate undergraduates of lower grades to explore professional theories and algorithms, and then lay a theoretical and practical foundation to them for the following advanced courses of artificial intelligence.

The Importance of Artificial Intelligence Technology Learning

In recent years, the Internet and big data have promoted a rapid development of AI in theoretical researches and industrial applications. Especially, the performance of new AI technologies based on deep learning has reached the level of commercialization in such fields as face recognition, machine translation and unmanned driving. As a result, AI has become the core driving force for a new round of industrial changes[1]. Therefore, it is particularly urgent to carry out the training of applied talents of artificial intelligence in colleges and universities in China.

Analysis of the Problems in the Teaching of Artificial Intelligence Courses

In the field of information science, artificial intelligence is an important branch with theoretical research significance and extensive application values. Previously, the computer science and technology department in many universities have set up courses of artificial intelligence. These courses usually faced to senior students. The main theoretical contents of courses have covered many fields of AI, such as knowledge representation, classical logic reasoning, uncertain and non-monotonic reasoning, planning problem solving, state space search strategy, expert system and machine learning[2]. These teaching contents have the following problems for senior students of application-oriented universities: 1) the limited class hours of senior students has increased the difficulty of theoretical teaching; 2) Less relevance of knowledge points before and after so as to result in one-sided learning; 3) the lack of a unified platform for practice as to be hard for students to practice by hands-on practice. Therefore, there are some problems in training of AI application-oriented talents has about overweight tasks, fragmentation and hollowness of knowledge points, which makes the students’ practical ability far away from the needs of talents so that it is urgently needed that is to research a new mode of talent training[3]. Faced with problems mentioned above, this paper considers with teaching practices that relevant AI courses will gradually open to students of lower grades to alleviate the pressure of insufficient class hours, and combines the construction of a new teaching environment which will be integrating theoretical teaching and practical projects to improve the teaching quality of artificial intelligence courses effectively.
**Analysis of the Necessity for Python Learning**

Recently, the rapid development of AI depends on mainly the emergence new algorithms, powerful computing power and big data. At present, Python is the popular kind of computer programming languages which is be good at data processing and scientific computing. Its specialties correspond to two factors: new algorithms and big data mentioned above[4]. Python is also a kind of object-oriented and interpretative computer programming language. Its original purpose is to reduce the workload of programming and make Python to be especially suitable for beginners (such as students of lower grades). Another advantage of Python for promoting AI developments is its greater scalability and embeddability compared with other popular languages. Because of smooth learning curve, it has rapidly become an effective tool for scientists in many fields (especially data science and artificial intelligence), and has accumulated a large number of tool libraries and architectures so as to be also known as "glue language". Using Python's rich ecological environment, various AI tasks can be accomplished efficiently. Therefore, the convenience of Python is an effective way to construct a new teaching environment which integrates theory teaching and practice projects of AI courses.

**Discussion about a Universal Platform of AI Course Learning Based on Python and Its Ecological Environment Architecture**

The purpose of AI is to enable computers to think liked-human beings and make machines to be competent for complex tasks that usually require human intelligence. There are many related research fields, such as natural language processing, machine learning and symbol processing. The emergence of deep learning has promoted the development of machine learning and set off a new upsurge of artificial intelligence researches and applications[5]. Therefore, artificial intelligence courses of application-oriented universities should be designed around deep learning. Python and its ecological environment are the most powerful supporting platform for deep learning. Its structure is shown in Fig. 1 below. In view of the problems mentioned above, with the help of Python and its rich ecological environment and facing deep learning and teaching, this paper puts forward to designing reasonably contents of AI courses for applied undergraduates, realizing the complementarity of teaching and practice, and enabling students to branch in Python. It can not only better understand abstract theories through practice, but also improve practical skills and to enhance students' interest in learning and employability.

![Python and its ecological environment](image_url)  
*Figure 1. Python and its ecological environment.*
Analysis of Establishment Rules of Course Contents

The goal of basic AI courses is to enable students to understand basic concepts and theoretical systems of AI discipline, and then main research contents, frontiers and application technologies in this field, and to master basic principles, classical methods and application technologies such as knowledge acquisition, knowledge modeling, searching, reasoning, learning and optimization; and to be familiar with the definitions, connotations and cognitive problems of AI and AI science; then to be able to adapt to the rapid development of AI discipline and to learn constantly. From this, we can see that the theoretical part of the curriculum is very hard to learn, and we should design suitable practical contents to match theory learning.

Python has many tool kits or libraries such as numpy, scipy, Matplotlib and Enthought libraries, which can efficiently process data, analyze and implement AI-related algorithms. According to the teaching content modules to support AI courses, the Python libraries have been organized in Table 1 as below.

<table>
<thead>
<tr>
<th>PYTHON and its ecological environment</th>
<th>Development of Applications</th>
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<tr>
<td>Data processing</td>
<td>Artificial intelligence</td>
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<td>Numpy</td>
<td>PyBrain</td>
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<td>Scipy</td>
<td>PyML</td>
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<td>matplotlib</td>
<td>scikit-learn</td>
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It can be seen there are effective Python toolkits or popular frameworks to support the overall design of relevant practical training projects within the teaching contents of AI courses in application-oriented universities with deep learning as the core content. Therefore, the construction of Python unified teaching platform to achieve the integration of theoretical knowledge in each chapter can effectively overcome the fragmentation of teaching knowledge.

Therefore, we can consider to offer AI courses for the students of lower grades in application-oriented universities and to guide them to familiarize themselves gradually with the
Python ecological environment, which will help them to deepen an intuitive understanding of the basic concepts of AI and the subsequent learning and practice of relevant courses.

**Summary**

In the new era of the development of artificial intelligence as a national strategy, it has become an urgent task for local application-oriented universities to establish and improve AI curriculum design, to train qualified applied AI professionals so as to meet the needs of local social and economic intelligent developments. From a practical point of view, there are some difficulties in the teaching process such as students' difficulties in understanding the relevant concepts of AI, weak relevance among curriculum contents of chapters, and limited teaching hours. Therefore, to consider to construct a general platform of AI courses learning based on Python and its ecological environment, with the convenience of Python programming, to realize the integration of theoretical teaching and practical projects gradually, which enables undergraduates of lower grades to deepen their intuitive understandings on AI related theories and classical algorithms through relevant practical projects as to lays a theoretical and practical foundation of advanced AI courses learning.

**Acknowledgement**

This research was financially supported by Chongqing Research Program of Basic Research and Frontier Technology, China (Grant No. cstc2017jcyjAX0045), Yongchuan Natural Science Foundation Program, Chongqing, China (Grant No. Ycstc2017nc2001), Science Research Program of Chongqing University of Arts and Sciences (Grant No. 2017YRJ47, R2018RJ09, R2018RJ08).

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