# Research on Online Scene Teaching Mode of Tobacco Picking Decision Tree Construction Process Integrating Deep Learning

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**Objectives: In view of the characteristics of online teaching during the coronavirus pandemic and the importance of practical teaching in training students' skills in the process of graduate education, this paper proposes an online scene teaching mode that takes projects as the carrier and integrates with deep learning. In order to meet the demand for information and communication engineering professionals in the big data context, the whole teaching process is divided into four stages: Topic selection, Teaching project setting, online teaching interaction and teaching evaluation. In the teaching process of Python Data Analysis Foundations, the project "establishment process of tobacco picking decision tree based on information gain" is taken as the teaching case. Prior knowledge and references are pushed through the cloud platform before class, and The scene of tobacco picking affected by the weather is set in the online classroom to guide students to seek solutions to problems, and the results are presented with graphics to assist students to summarize, and then reset the scene to promote knowledge transfer, so as to integrate deep learning into the teaching process, and modify the corresponding stages according to the teaching evaluation results. The content of the scene is gradually increased from easy to difficult, from simple to complex, and from least to most, gradually increasing the difficulty, which enhances students' learning interest and sense of achievement. Meanwhile, students ' initiative to participate in curriculum research further strengthens the effectiveness of the course in serving scientific research, which has a certain value of popularization and application.**

**Key words:deep learning; scene setting; tobacco picking; online teaching**
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At the beginning of 2020, affected by the epidemic, the Ministry of Education successively issued the "Notice of the Ministry of Education on the Postponement of the 2020 Spring Semester" and the " Guidance on Organization and Management of Online Teaching in Colleges and Universities during the Epidemic Prevention and Control Period " to encourage all localities to use the Internet and information-based education resources to provide remote learning support for students. The measures ensure "suspension of classes but non-stop teaching and learning",[1] thus spawning the widespread use of online education, which gradually make online teaching, online meetings, etc. become the trend of the development of modern educational technology.[2] Different from traditional education, the key of online education lies in cultivating students' autonomous learning ability and mobilizing students' initiative to participate in online teaching. Only in this way can the teaching efficiency be improved, the teaching quality ensured, and the teaching task successfully completed at the same time.[3] Based on various online course platforms at all levels and online learning spaces on campus, teachers have chosen MOOCS, SPOC, virtual simulation experiments, and other online teaching activities.However, the current situation of "separation of teachers and students, students and students, teachers and schools, and students and schools" makes online education teaching models face unprecedented challenges.[4] How to further promote learners' Deep Learning on the basis of ensuring learners' advantages in shallow learning is worthy of in-depth research.

With the continuous development of artificial intelligence, Deep Learning has had a profound impact in the fields of computer and education. Especially after AlphaGo lost to the world Go champion Lee Sedol in 2016, Deep Learning has attracted more and more scholars' attention. In the field of artificial intelligence, deep learning is defined as "a series of algorithms that attempt to abstract data at multiple levels through multiple non-linear transformations." Its core is the computer's in-depth simulation of human consciousness, thinking and information processing, and complex calculation and optimization of data by computer. At present, deep learning has been well applied in the fields of speech recognition, face recognition, etc.

The idea of Deep Learning in the education field can be traced back to Bruner's division of target dimensions in the cognitive field, that is, from recognition, understanding, application, analysis, synthesis and evaluation. This process from shallow to deep means "learning has deep and shallow levels ".[5]On this basis, American scholars Marton and Saljo clearly explained the concept of deep learning and shallow learning for the first time in an experimental study on reading ability.[6] After that, Ramsden, Entwistle, Biggs and other scholars explored and developed relevant theories of deep learning from different perspectives.[7] In recent years, Egan, a Canadian scholar who has made great achievements in deep Learning research of basic education, has deeply discussed the basic principles and methods of deep learning based on the new views on learning, knowledge, students and teachers in his research papers.[8] In addition, Eric Jensen and Leann Nickelsen clearly put forward the connotation of deep learning from the perspective of cognition. They believe that deep learning is essentially the construction process of the meaning of structural and unstructured knowledge, as well as the complex process of information processing. The activated prior knowledge and acquired new knowledge must be effectively and finely processed.[9] In domestic, the representative definition of deep learning is: Deep learning means that on the basis of understanding, learners are able to critically learn new ideas and facts, integrate them into the original cognitive structure, connect various ideas, and transfer the existing knowledge to a new situation, so as to make decisions and solve problems.[10]

This paper proposes an online scene teaching model integrating deep learning, taking the construction of decision tree based on information gain as an example.According to the situation of students, push relevant knowledge before class. In the online class, select the weather influencing factors in the process of tobacco picking as the scene, show the

construction process of decision tree through graphic analysis, and reset the scene after class to promote knowledge transfer and integrate in-depth learning, so as to further deepen students' understanding and mastery of the knowledge.

## PROBLEMPRESENTATION

Online teaching can break through the limitation of time and space, and can provide abundant shared resources. The scale of online teaching has been expanded in an unprecedented way especially after the outbreak of COVID-19.[11] While the scale expanding, and it has gradually won the majority of college teachers and students, and parents. Therefore, a large number of excellent teaching cases have been produced.Especially, the current online teaching in China has certain problems, such as learners' insufficient attention to individualized needs, learner' low participation, lack of learning initiative and self-consciousness of learners, etc. [12] These problems will cause learners to stay at the low level of thinking, such as memory and understanding, while the higher level of thinking, such as transfer and innovation, is relatively rare, and the ability to solve practical problems is relatively weak.[13] Deep learning, which takes learners as the center, emphasizes learners' initiative, enthusiasm and critical thinking, pays attention to situational transfer, problem-solving and innovation ability, and advocates interpersonal social interaction. By cultivating their deep level of learning, learners would have better emotional experiences and pay more attention to the development of their individual learning ability.Teaching activities are carried out around meeting learners' individual needs.[14,15] How to realize deep learning in online teaching, how to build an online teaching model based on deep learning, and how to guide the occurrence of deep learning are urgent problems to be solved in online teaching.

Therefore, this paper proposes an online scene teaching model integrating with deep learning based on projects. The course Python Data Analysis Foundations is selected as an example for graduate students who major in information and communication engineering, and the project about how to build a decision tree based on information gain is selected. Through the introduction of deep learning mode in the process of scene teaching, the process of students' active participation in curriculum research and learning is enhanced, and the efficiency of curriculum service in scientific research is further strengthened, which has a certain popularization and application value.

## DESIGN OF ONLINE SCENE TEACHING MODE BASED ON DEEP LEARNING

Gestalt psychology and cognitive load theory point out that learners' learning level can be represented by "schema structure" .[16] The cognitive process is the process of schema construction, with different learning contents, methods and resource representation forms at each stage. In the process of deep learning, learners mainly complete the construction of schema through four stages: perception, reconciliation, induction and transfer.[17,18] Aiming at this cognitive process, the online scene teaching mode based on deep learning can be divided into four stages: determining teaching projects, selecting and reconstructing teaching content, online teaching interaction and teaching evaluation. Among them, the corresponding stages will be modified according to the teaching evaluation results, and the online teaching interaction will be carried out in the form of personalized learning and group cooperation. The implementation process is shown in Fig.1.

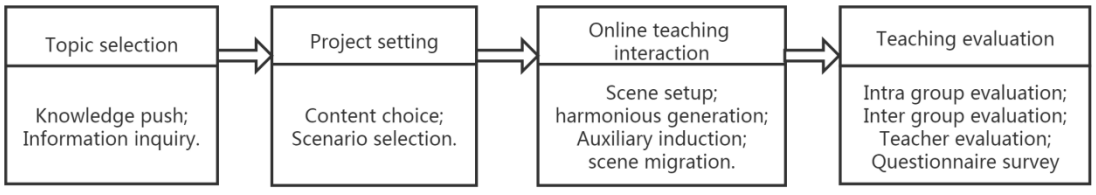

Fig.1 teaching mode implementation process

In the teaching process, first of all, the topic should be determined according to the research field of information and communication engineering major and the characteristics of graduate students themselves, and the prerequired knowledge are supposed to be pushed to students, and students are encouraged to inquire and discuss the related research materials with lecturers. Teachers choose the appropriate scene and teaching content according to the needs of the project. In the interactive stage of online teaching, the scene is set to cultivate students' understanding of new knowledge, and the deduction and induction process is displayed in the form of graphics to deepen students' understanding of knowledge points. However, this process only belongs to the initial stage of deep learning and is also the minimum standard of "Mastery". In the deep learning stage, professor need to reset the scene to promote knowledge transfer. This kind of transfer can be divided into two types: internal connection transfer and external expansion transfer. The internal relation transfer includes: the solution of well-structured problems based on the original form of knowledge; Transfer from the original form of knowledge, but not beyond the scope of stage learning, unit learning or discipline learning. External extension and transfer are both the traditional remote transfer or advanced application that enables learners to break away from the limitations of the new knowledge structure itself and face more comprehensive problems under the stimulation of complex situations. More importantly, during this students can master solution to ill-structured problems at higher levels compared to the original form of knowledge, and these problems are not uncommon in practical situations or real life. The teaching evaluation stage is divided into three forms: intra-group evaluation, inter-group evaluation and teacher evaluation. In addition, a questionnaire will be set for each topic. Teachers will make appropriate modifications to the teaching content and online interaction mode according to the feedback of the questionnaire, so as to better improve the efficiency of deep learning.

## TEACHING CASE DESIGN

This case aims to explain the construction of the decision tree model based on the obtained information, which is one of the construction algorithms of decision tree. In order to enable students to thoroughly grasp the knowledge involved in the decision tree, the relevant knowledge is pushed before class; the scene is set in class, gradually analyzed and deduced, and presented in the form of icon for induction and summary; the new scene is constructed after class so that students can carry out in-depth learning, so as to promote the improvement of students' ability to participate in scientific research.

### Preparation stage

In order to achieve a good teaching effect, the preparation stage is particularly important. In this stage, we should not only push relevant mathematical knowledge related to the construction process of decision trees to students but also let students consult a large number of materials to understand how domestic and foreign scholars use these decision trees to carry out relevant research.

The cloud platform is used to push related mathematics knowledge for students to learn and understand, mainly including:

(1) Basic knowledge about decision tree

(2) Information entropy

(3) ID3 algorithm

(4) Information entropy and information gain

Through the study of prior knowledge, students can master the concept of entropy, which represents the degree of the chaos of a state. The higher the entropy, the more chaotic it is. The change of entropy can be regarded as information gain. The core idea of decision tree ID3 algorithm is to measure attribute selection with information gain, and the attribute with the largest information gain after splitting is selected for splitting.

The following are the important theories and calculation formulas involved in this project.[19]

According to the definition of entropy, if D is the division of the training tuple by (output) category, then the entropy of D is expressed as formula (1).

$$Ent(D) = -\sum_{i=1}^{m} p_i \log_2(p_i) \quad (1)$$

Where Pi represents the probability of occurrence of the ith category in the whole training tuple. Generally speaking, the proportion of the number of samples in this category to the total amount will be used as the probability estimate. The actual meaning of entropy is expressed as the average amount of information required for the class label of a tuple in D.

If the training tuple D is divided according to attribute A, the expected information of A on D can be described by formula (2) .

$$Ent(D, A) = -\sum_{value(A)} \frac{|D_V|}{|D|} Ent(D_V) \quad (2)$$

**Table 1**
**Weather Forecast Data Set**

| number | Outlook | Temperature | Humidity | Windy | Pick? |
|---|---|---|---|---|---|
| 1 | sunny | hot | high | false | no |
| 2 | sunny | hot | high | true | no |
| 3 | overcast | hot | high | false | yes |
| 4 | rainy | mild | high | false | yes |
| 5 | rainy | cool | normal | false | yes |
| 6 | rainy | cool | normal | true | no |
| 7 | overcast | cool | normal | true | yes |
| 8 | sunny | mild | high | false | no |
| 9 | sunny | cool | normal | false | yes |
| 10 | rainy | mild | normal | false | yes |
| 11 | sunny | mild | normal | true | yes |
| 12 | overcast | mild | high | true | yes |
| 13 | overcast | hot | normal | false | yes |
| 14 | rainy | mild | high | true | no |

Thus, the information gain is the difference between the two, which can be expressed by formula (3).

$$Gain(D, A) = Entropy(S) - \sum_{value(A)} \frac{|D^v|}{D} Entropy(D^v) \quad (3)$$

Where D is the set of all samples, a is an attribute of D, $D^v$ is the set of samples whose value of attribute a is V in D, and $|D^v|$ is the number of samples contained in $D^v$.

Students can have a clear grasp of relevant knowledge through the preview of the above knowledge, and the preview content can be predicted and evaluated by pushing discussion topics on the cloud platform.

## Online Teaching

### Scene Settings

In the teaching process, students are guided to understand the construction process of decision tree based on information gain by setting teaching scenes. We set the scene: the picking time of tobacco leaves is usually in autumn, but the picking time of different parts is different. Generally, the lower leaves need to be harvested between June 25 and July 1, when the bottom leaves are mature. The central leaves are generally picked between July 5th and July 10th. The surface of the leaves at this time is light yellow. In addition, the upper part of the leaves was selected for a one-time harvest around September 20, when the leaf surface was slightly covered with yellow spots.[20] Tobacco picking is also affected by the weather. The teaching goal of

this lesson is to build a decision tree based on information gain according to the weather forecast issued by the meteorological department.

**Process Analysis**

Through preview, students can understand that before each non-leaf node of the decision tree is divided, we need to calculate the information gain brought by each attribute and select the attribute with the maximum information gain to divide. Because the greater the information gain, the stronger the ability to distinguish samples, and the more representative. Obviously, this is a top-down greedy strategy. The following describes the construction process of the decision tree based on information gain by analyzing and calculating the data in Table 1.

**Step1:** Find the root node

As you can see from Table 1, there are a total of 14 samples with binary categories, i.e. K =2. There are 9 positive cases (yes) and 5 negative cases (no). Thus, According to formula (1), the information entropy of data set D can be calculated as formula (4).

$$Ent(D) = -\frac{9}{14}\log_2\frac{9}{14} - \frac{5}{14}\log_2\frac{5}{14} = 0.940286 \quad (4)$$

In decision tree classification problem, information gain is the difference of information before and after attribute selection division by decision tree. It can be seen from the data set that the feature set is: {Outlook, Temperature, Humidity, Windy}. Let's calculate the information gain of each feature. Start with the Outlook attribute, which has three possible outliers:{sunny, overcast, rainy}. If Outlook is used to divide data set D, three subsets are obtained, as shown in Fig.2.

In this case, the learning objective is to pick or not pick. Specific data are shown in Table 1.

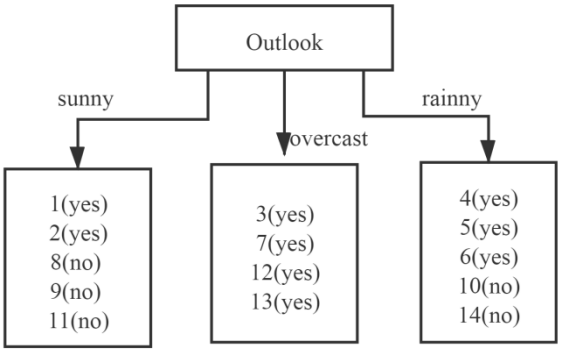


Fig.2 Divided by Outlook

The three subsets are $D^1$(Outlook=sunny), $D^2$(Outlook=overcast) and $D^3$(Outlook=rainy). From Fig.2, we can see that D1 contains 5 sample sets {1,2,8,9,11}, in which the proportion of positive and negative examples is 2/5 and 3/5, respectively. Thus, the information entropies of the three branch nodes obtained after Outlook division according to characteristics can be calculated by formulas (5) to (7) respectively.

$$Ent(D^1) = -\frac{2}{5}\log_2\frac{2}{5} - \frac{3}{5}\log_2\frac{3}{5} = 0.970951 \quad (5)$$

$$Ent(D^2) = -\frac{4}{4}\log_2\frac{4}{4} - 0\log_2 0 = 0 \quad (6)$$

$$Ent(D^3) = -\frac{3}{5}\log_2\frac{3}{5} - \frac{2}{5}\log_2\frac{2}{5} = 0.970951 \quad (7)$$

Then, according to formula (3), the information gain brought by the characteristic outlook is as formula (8).

$$Gain(D, Outlook) = Ent(D) - \sum_{v=1}^{3}\frac{|D^v|}{|D|}Ent(D^v)$$
$$= 0.94.286 - (\frac{5}{14}\times 0.970951 + \frac{4}{14}\times 0 + \frac{5}{14}\times 0.970951)$$
$$= 0.24675 \quad (8)$$

Similarly, the information gain of other features can be calculated by formulas (9) to (11) respectively.

$$Gain(D, Temperature) = 0.029224 \quad (9)$$

$$Gain(D, Humidity) = 0.278623 \quad (10)$$

$$Gain(D, Windy) = 0.048127 \quad (11)$$

According to the above analysis, the information gain of temperature is the largest, so it is selected as the root node to divide, as shown in Fig.3.

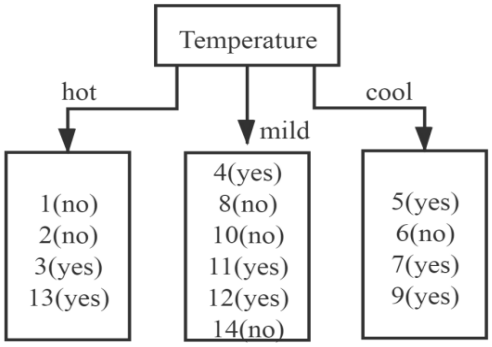


Fig.3 Root node (temperature) partition

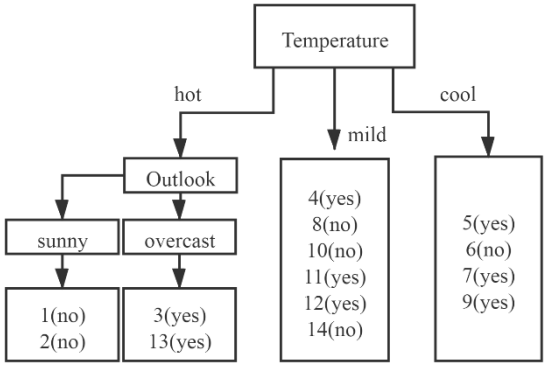


Fig.4 First level branch division

**Step2:** First level branch division

Continue to divide each branch in Fig.3. Take the first branch node "Temperature=hot" as an example to divide this node. Let the sample set of this node be {1,2,3,13}, and the available feature set be {Outlook, Humidity, Windy}. Therefore, the information gain of each feature can be calculated by formulas (12) to (14)respectively based on D1 according to formula (3).

$$Gain(D1, Outlook) = 1 \quad (12)$$

$$Gain(D1, Humidity) = 0.08171 \quad (13)$$

$$Gain(D1, Windy) = 0.08171 \quad (14)$$

The comparison shows that the Outlook attribute has the largest information gain, so Outlook is selected as the first layer of the branching attribute. Thus, Fig.4 is obtained.

**Step3:** The next branch or regression node division

As you can see from Fig.4, the "Outlook=rainy" attribute does not appear, indicating that there is no rainy situation in weather conditions when Temperature=hot.In "Outlook= Sunny" and "Outlook= Overcast", the sample set of each node contains two samples. For example, the sample set of "Outlook= Sunny" is {1,2}, and the play of these two samples is "no". Therefore, when the current node contains samples all belonging to the same category, there is no need for division. The current node is marked as a leaf node of class C (in this case, "no"), and the recursive return is made. Similarly, "Outlook=overcast" is marked yes and returns recursively. So Fig.5 is obtained.

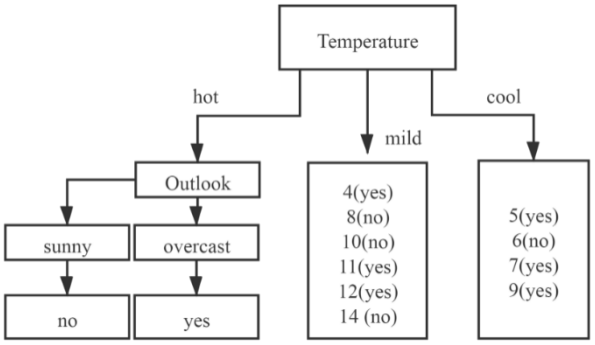


Fig.5 The next branch or regression node division

It is explained that if all the samples contained in the current node do not belong to the same category, it is necessary to continue the division according to the second step method; If the gain of attribute information is zero, we assume that Gain(D1, rainy )= 0, it means that D1 cannot be divided by attribute rainy, that is, D1 cannot obtain any information from attribute rainy.

Similarly, the partition of hot and cool nodes can be completed. Finally, the decision tree based on information gain is constructed.The following part is completed by students' exercises in class.

**Scene migration and deep learning**

Through the analysis and explanation of online classrooms, students can basically master how to realize the construction process of decision tree based on information gain. However, in order to enable students to flexibly apply it to various fields for data processing and analysis, and realize it quickly through the program, it is necessary for students to carry out deep learning and expansion after class. Therefore, the teacher reconstructs the scene according to the requirements of the subject the deep learning of students. The specific practice is as follows:

**Scenario:** An enterprise T, a large-scale chain enterprise, produces a wide variety of products, and many branches are distributed in different geographical locations. It is important for executives to understand whether there is a big difference between weekend and off-weekend sales, and whether factors such as weather and promotions can affect store sales. Therefore, in order to make decision-makers accurately understand a series of influencing factors related to sales volume, decision tree model is constructed by using algorithm to analyze the influence of weather, weekend and promotion activities on sales volume. The scene data is shown in Table 2.

**Table 2**
**Scenario Data Set Example**

| number | Weather | Weekend? | Promotion? | sales |
|---|---|---|---|---|
| 1 | bad | yes | yes | high |
| 2 | bad | yes | yes | high |
| 3 | bad | yes | yes | high |
| 4 | bad | no | no | low |
| 5 | good | no | yes | high |

**Requirements:**

(1) Each student should add data in Table 2 according to his/her own understanding of the scene, and the number of rows should not be less than 30.

(2)Construct the decision tree in Python.

(3)Submit the decision graph built by yourself through the cloud platform after completing the homework.

(4)Search the literature and write a small paper on what you have learned in this class, including the research status at home and abroad, the theoretical knowledge involved, the calculation method, and the conclusion.

Through online learning, literature inquiring, data analyzing, deep learning and programming, graduate students submit their homework through the cloud platform.

## TEACHING EFFECT EVALUATION

### Student performance evaluation

As the main teaching means to evaluate and measure students' learning process and effectiveness, teaching evaluation can be divided into the process-oriented formative evaluation and result-oriented summative evaluation, which should always run through the dynamic teaching and learning situations. Reasonable evaluation of learning helps to guide and motivate students to achieve the teaching objectives of colleges and universities, and also promotes teachers to optimize the teaching mode according to the results of teaching evaluation, which is an important step to ensure the quality of teaching. In this course, we divide teaching evaluation into three aspects: intra-group evaluation, inter-group evaluation and teacher evaluation.

Before each class, the teacher will push the prior knowledge and references related to this class to the students through the cloud platform, issue relevant topics for discussion. After class, reset the scene according to the class content, and ask each student to answer according to their own understanding of the relevant knowledge, and submit the homework through the cloud platform. The teacher will score according to the students' discussion, learning and the solution of the scene assignment which will be taken as part of the final score.

To promote collaborative learning and practical learning in small groups. From the first class of this course, the requirements and implementation methods of large group work should be clarified, so that students can pay more attention to the

examples of data analysis in daily life or the subject area, and cultivate the awareness of data analysis from the very beginning. In the eighth week, students are encouraged to form groups of three freely, and then team members are supposed to collaborate on their project, from deciding on a topic, looking for data, selecting an analysis plan to write a data analysis report. At the end of the semester, each student will score the other members of the group for their performance in the group, and this will be part of the final grade. In order to ensure the authenticity of students' work and avoid possible fraud and plagiarism, one student was randomly selected from each group to report and defend on behalf of the group during the quality inspection of the projects made by other groups. The reporting and defense time is set for 10 minutes, during which teachers and students from other groups have the right to score the current presenting group according to the quality, innovation, PPT making and their performance during the defense of the project. The score is shared by each student in the group. The major assignments will account for 30% of the course grade. A mid-term spot check will be arranged in week 12 before the final defense. The preliminary work was put in place, and the final course assignment received a good effect. Students have active thinking and rich topics, such as the analysis of student consumption behavior based on-campus card swiping data and the analysis and modeling based on Wuhan Covid19 infection data. The overall defense effect is satisfying, students are willing to speak, can speak, and have good desires and ability to speak. More Importantly, All students were highly involved and actively discussed their ideas during the defense time, dramatically promoting mutual learning.

Different from the traditional offline class face to face, online learning are from the constraints of time and space and provides a free and open learning environment for students. But as for teachers, it has greatly increased the workload of online classroom management, which requires them to study and improve complex behavior system visualizations, simplification and standardization to effectively monitor and quantify online academic behaviors of students. We divided the students' final grades into three categories based on the course characteristics of Python Data Analysis Fundamentals, in which the grades accounted for 50% of the teacher's evaluation, 20% of the intra-group evaluation, and 30% of the inter-group evaluation(the score of 10% given by the teacher). The teacher gives a comprehensive score according to each student's learning of prerequired knowledge before class, literature review, online discussion participation, online homework submission after class and the final project defense. Intra-group evaluation is limited within the group, each member will score the other two members according to their participation in the selected topic and the degree of team cooperation. The inter-group evaluation is mainly based on the mutual evaluation between the members of the group in the final project defense, which together with the score of the project defense given by the teacher is the final result of the big homework.

It can be seen from the above that in the network teaching process during the epidemic period, teachers can track the learning progress of students in real time and evaluate their learning behavior and ability. Through this whole process evaluation, teachers can give early warning and intervention to "marginalized" students. At the same time, data-based assessment helps teachers timely adjust teaching strategies according to students' learning conditions, students timely adjust their learning status, and scientifically monitor the effect of in-depth teaching and learning.

## Evaluation and improvement of deep learning effect

As is known to all, instructional design is the key to deep learning, which should pay attention to the re-combing and analysis of teaching objectives, teaching content, teaching strategies, teaching evaluation and other elements. The key aim is to allow students to fully experience the process of deep learning and develop students' ability in deep learning. The project content and scene of the second stage are determined based on the knowledge set discussion topics and test content provided before class as well as discussion and test results. In the teaching process, we guide students to conduct in-depth learning step by step through scene setting and scene transfer. In addition, a questionnaire will be provided for each topic. Teachers will make appropriate modifications to the teaching content

and online interaction mode according to the feedback results of the questionnaire, so as to better improve the efficiency of deep learning.

The project of "decision tree constructionbased on information gain" is still taken as an example to illustrate the effect of students' deep learning. Fig.6 is the decision tree given by one of the students, where Gain is information gain, samples is the number of sample sets, and the two numbers corresponding to array value are positive and negative cases, respectively. As can be seen from Fig.6, through deep learning, students have well mastered the construction method of decision tree based on information gain.

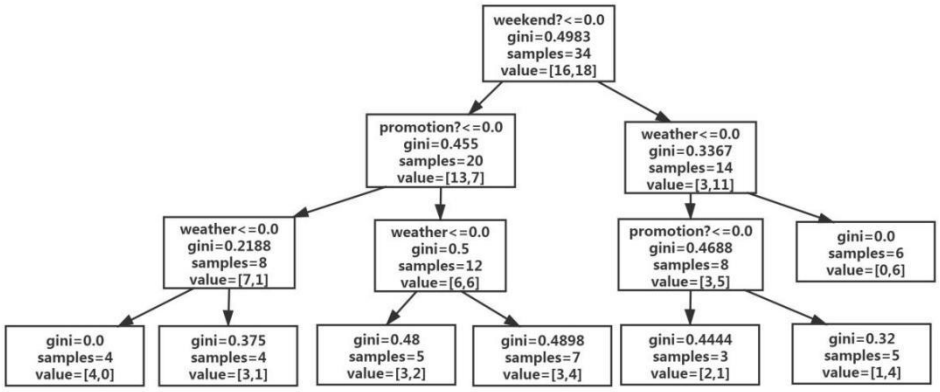


Fig.6 Decision Tree given by student

## RESULTS

In this paper, we study the online scene teaching model integrating deep learning based on practical projects. In order to meet the demand of information and communication engineering graduate talents with the development of big data, we take the project "establishment process of tobacco picking decision tree based on information gain" as the teaching case in the teaching process of Python Data Analysis Foundations. Prior knowledge and references are pushed through the cloud platform before class, and scenes are set in the online classroom to guide students to seek solutions to problems, and the results are perfectly presented with graphics to assist students to summarize, and then reset the scene to promote knowledge transfer, so as to integrate deep learning into the teaching process, and modify the corresponding stages according to the teaching evaluation results. The whole process changes from simple to complex, from least to most, step by step and gradually increase the difficulty, which enhances students' interest and sense of achievement in learning, and at the same time enables students to actively participate in the process of course research and study, which further strengthens the effectiveness of the course in serving scientific research.

In the later research, we will integrate the data of different learning types and learning behaviors in more learning scenarios. Different intelligent deep learning modes will be adopted according to the characteristics and nature of each learning scene, so as to provide more accurate prediction and intervention services for learners and educators, and form a closed loop of development between teaching, research and practice.

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## Conflicts of Interest Disclosure Statement

The authors declare no conflict of interest in the authorship or publication of this work. Author Declaration:This research is not funded by any organization related to tobacco production.

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