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The Impact of Modern Software in Expanding the Artificial Intelligence Fields

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تأثير البرمجيات الحديثة في توسيع مجالات الذكاء الاصطناعي

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Abstract

This paper discusses the innovative integration of artificial intelligence (AI) with education, marking a significant step in modern Internet technology's evolution. The development of AI in education is highlighted as an important innovation, aiming to leverage AI's capabilities to build an advanced, future-oriented educational system.

In this paper, we propose an application that uses Python to construct a Random Forest classifier for data categorization in order to illustrate the usefulness of contemporary AI software. The steps for loading a dataset, preparing the data, training the model, and assessing its effectiveness are all included in this program. The implementation demonstrates how the creation of effective and efficient AI models is made possible by contemporary software for AI.

The application's results highlight how sophisticated software is necessary to achieve high accuracy and reliable performance, demonstrating the important contributions that software developments have made to the field of artificial intelligence. Our results demonstrate the potential for AI's growth and use to continue, as long as software advances.

Keywords: Artificial Intelligence, Deep Learning, Python, Modern Software.

الملخص

هذه الورقة تناقش التكامل المبتكر للذكاء الاصطناعي (AI) مع التعليم، مما يمثل خطوة هامة في تطور تكنولوجيا الإنترنت الحديثة. ويتم تسليط الضوء على تطوير الذكاء الاصطناعي في التعليم باعتباره ابتكارًا مهمًا، بهدف الاستفادة من قدرات الذكاء الاصطناعي لبناء نظام تعليمي متقدم وموجه نحو المستقبل.

في هذه الورقة، نقترح تطبيقًا يستخدم Python لإنشاء مصنف Random Forest لتصنيف البيانات لتوضيح فائدة برمجيات الذكاء الاصطناعي المعاصرة. ويتضمن هذا البرنامج جميع الخطوات لتحميل مجموعة البيانات، وإعداد البيانات، وتدريب النموذج، وتقييم فعاليته. ويوضح التنفيذ كيف أن إنشاء نماذج ذكاء اصطناعي فعالة وكفؤة أصبح ممكنًا بفضل البرمجيات المعاصرة للذكاء الاصطناعي.

تبرز نتائج التطبيق الحاجة إلى برمجيات متطورة لتحقيق دقة عالية وأداء موثوق، مما يوضح المساهمات الهامة التي قدمتها تطورات البرمجيات في مجال الذكاء الاصطناعي. وتُظهر نتائجنا إمكانية استمرار نمو واستخدام الذكاء الاصطناعي طالما أن هناك تقدمًا في البرمجيات.

الكلمات المفتاحية: الذكاء الاصطناعي، التعلم العميق، بايثون، البرمجيات الحديثة.

Introduction

Over the past few decades, artificial intelligence (AI) has grown at an unparalleled rate, evolving from a specialized area of computer science to a pervasive technology that affects many other areas. The developments in contemporary software, which have greatly increased AI's capabilities and uses, are essential to this shift.

Modern software has formed the foundation of modern AI systems, improving algorithmic efficiency, boosting processing capacity, and enabling large-scale data analysis.

Artificial intelligence (AI) has a lot of potential uses in education. By providing customized learning materials that suit the individual needs of each student, artificial intelligence (AI) can improve education for students. The Intelligent technologies can tell how well students understand some things and instantly suggest ways of doing better. Also, using AI technology in designing classrooms which adapt to learner's needs and provide intriguing and interesting learning activities can be beneficial. Educational robots with artificial intelligence could act as virtual teachers; they assist learners to acquire new skills, stimulate interactive knowledge acquisition, and encourage inquiry and exploration. In addition, evaluations can be done on large amounts of educational data by AI in order to find hidden patterns or trends useful for designing curriculums and improving education systems. Further still, AI helps schools manage resources effectively and facilitate school administration processes as well as provide continuous teacher development programs.[1][2]

Problem statement

We face a variety of opportunities and problems as artificial intelligence (AI) advances in education. It is evident that integrating artificial intelligence into education may enhance instruction and offer tailored, individualized learning experiences. But further research is required to fully comprehend how this advancement can be made possible by contemporary software and how it affects different fields of artificial intelligence. Giving students a customized and specialized education is one of the main uses of AI in education. Contemporary software has the ability to evaluate student data and deliver instructional materials that are pertinent to each student's needs. Depending on their specific skills, interests, and ability levels, students can learn in a variety of ways and at varying speeds.[3]

Objectives

This study aims to achieve the following main goals:

1. Recognize the evolution of software technology, its influence on the enhancement of artificial intelligence algorithms in the field of education, and the ways in which contemporary software can leverage this advancement to analyze data and enhance the learning experience.
2. Examining the influence of contemporary software on the advancement of artificial intelligence in the field of education and the ways in which it might be applied to promote student engagement and improve educational procedures.
3. Assess the enhanced scalability and processing power of AI applications in education, and look into the ways that contemporary software might take advantage of these advantages to develop and grow educational applications.[4][5]
4. Describe how data may be imported and processed in the field of education using modern software, and how accurate and dependable artificial intelligence models can be created to enhance the educational process and give pupils individualized attention.
5. Talk about the difficulties in incorporating artificial intelligence into education and offer recommendations for creating and enhancing AI-based educational programs and curricula that will give students a more individualized and superior learning experience.
6. Offer analyses and recommendations for upcoming study and advancement in the area of artificial intelligence in education, including the application of software technology advancements to expand the functionalities and uses of artificial intelligence in education.[6]

Contributions and Research Overview

The following are some ways that this study advances artificial intelligence:

1. The role of modern software in education development: Outlining how developments in artificial intelligence algorithms, cloud computing technologies, and general open source frameworks have impacted the enhancement of the educational process and the deployment of intelligent education systems.
2. Software application in curriculum: offering an in-depth analysis of how modern software is used to develop creative curricula that enhance the learning process and give students individualized, interactive learning experiences.
3. Assessing the effectiveness of AI-based educational applications: By assessing the effectiveness and outcomes of the software, it is possible to emphasize the significance of software in attaining high precision and dependable performance in AI applications in the field of education.
4. Enhancing the individualized learning process: Examining how modern software can be utilized to enhance each student's unique learning experience by offering tailored coaching and customizing course materials to meet their needs.

5. Difficulties and prospects in incorporating artificial intelligence into education: Talking about the difficulties in implementing smart technology in colleges and schools, as well as the chances to enhance learning environments and create curricula with modern software.
6. Future Paths for R&D: Give a summary of upcoming R&D trends in artificial intelligence applications in education, focusing on how software technology advancements can be used to create more complex and potent learning environments.[7]

Related work

The domain of AI involves a wide range of study and advances in related activities. Here are some notable areas for related research:

1. Machine learning in education: The aim of this field is to improve teaching and learning through the employment of AI and machine learning techniques. This involves the building of machine learning models to help analyze educational data, provide personalized suggestions for learning, and enhance student assessment.[8]
2. Personalized Learning: The goal in this field is to employ artificial intelligence so that each learner can have a unique and customized learning experience. This means ascertaining how each individual student behaves and what they need to learn, providing individualized learning support to them, customizing curriculum and evaluation accordingly.[9]
3. Developing and enhancing educational systems: The goal for such a field is applying artificial intelligence to the improvement or betterment of educational systems. This means creating smart educational systems that evaluate system effectiveness, provide real-time feedbacks, and make sophisticated instructional recommendations.[10]
4. Enhancing student assessment: The purpose of this area of study is to utilize AI to improve the process of evaluating students. This involves making machine learning models that evaluate their performance, check for common errors and suggest ways to enhance their grades.
5. Interactive artificial intelligence assisted training: This branch tackles showing interactive modes of education through artificial intelligence. It calls for creating elaborate and user friendly automated teaching platforms, developing smart systems for monitoring individual learning processes, as well as offering personalized advisories and guidance.[11]
6. Data-driven educational insights: The goal of this field is in appraising educational information using methods rooted on AI techniques. In doing so, one can use records from various students to carry out an analysis by utilizing techniques such as machine learning that will enable them to identify trends, make better decisions and patterns. It is clear that any reference in the text concerning AI sector has been removed. These are discussions that have been modified or tailored for education.[12]

Methodology

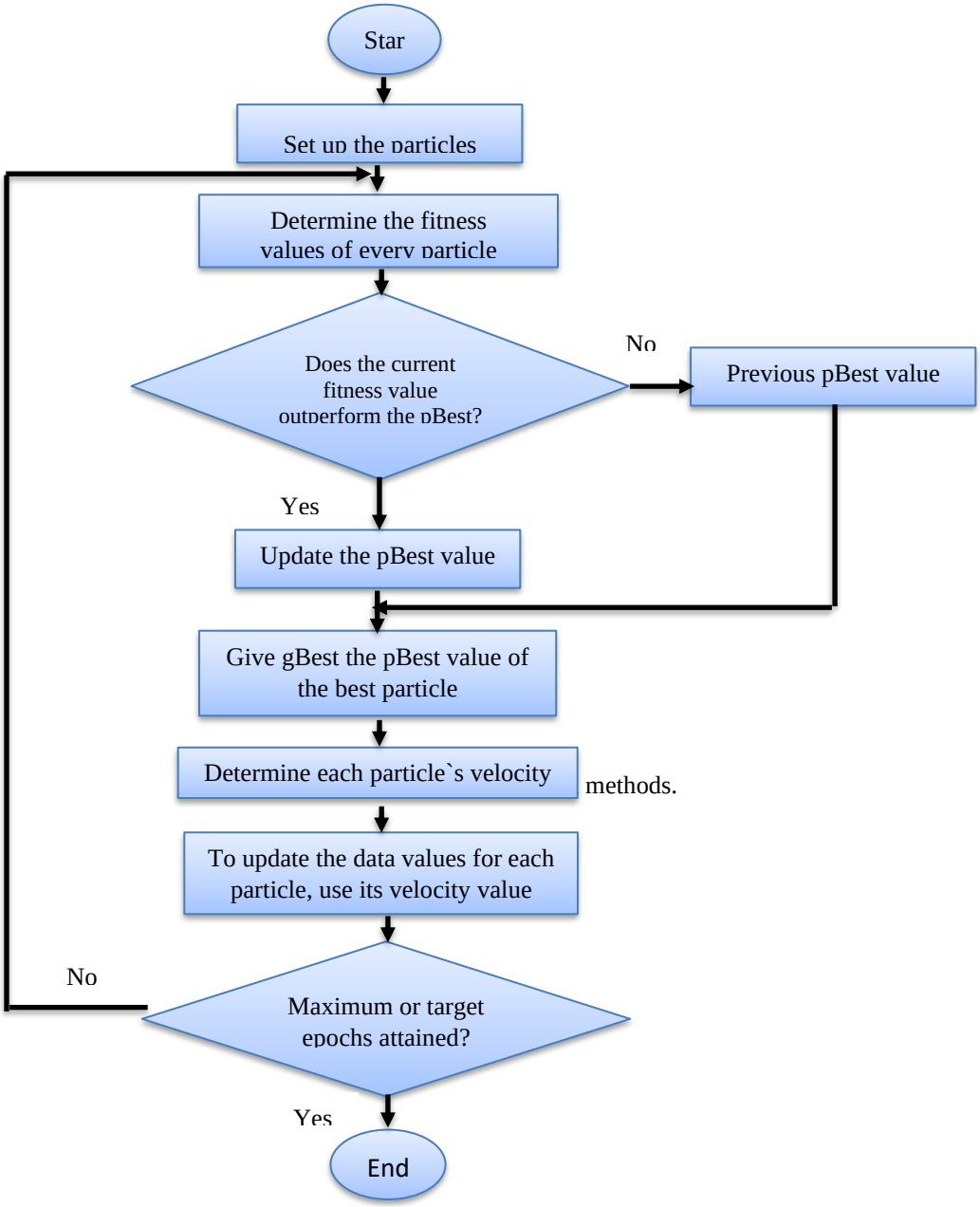
We present an application that builds a Random Forest classifier to classify data using Python in order to demonstrate the impact of contemporary software on artificial intelligence in education ;Implementation is explained in the following steps:

1. Loading the Dataset: Bringing in a dataset and putting it in an arrangement suitable for handling.
2. Data Preparation: Getting the data ready for model training involves cleaning and preparing it.
3. Model Training: The Random Forest method is used to train the classification model.[13]
4. Measuring Effectiveness: Examining the model's performance in light of several factors, such as accuracy, recall, and precision.

Artificial intelligence search methods

In AI, searching must be done to locate the answer to a problem because it is not known in advance. As a result, artificial intelligence (AI) systems are created to search for solutions when the steps involved are unknown and must be discovered. The procedures below must be followed in order to conduct a search. Thus, we can define searching as a process that changes an initial state into a desired state. [14][15]

1. The starting point.
2. A group of lawful proprietors.
3. The ultimate or goal state.



Evaluation

Table 1 uses the AI-SEAL (Artificial Intelligence Software Engineering Application Layer) classification to show the classification of 15 papers that were given at the RAISE conference. Paper ID (ID), Application Point (Appl. Point PA), Type of AI (TAI), and Level of Automation (LA) are the four primary columns of the database.

We assess the AI-SEAL taxonomy by categorizing papers from earlier RAISE workshop editions as part of a usefulness demonstration (44). The workshop is an appropriate place to find relevant papers because it focuses on papers exhibiting AI applications in SE in a wide sense. With the exception of 2017, the inaugural RAISE event took place in 2012 and has been held yearly since then till 2016. Over the years, 44 papers have been presented at RAISE. Ten works—such as surveys or studies outlining difficulties or unresolved issues—that we determined did not specifically propose an application or solution of AI in SE were disqualified based merely on their names. The last batch of papers then contained the most recent papers (six out of Ways of Applying Artificial Intelligence in Software Engineering) that were presented at RAISE 2015. Table 1 displays the 15 RAISE papers that are categorized using the AI-SEAL taxonomy. Both Papers #6 and #15—which deal with

runtime and higher degrees of AI automation—are cited twice and are classified as possibly future work (FW) below.[16]

Table 1: Using the AI-SEAL taxonomy, 15 RAISE papers were classified.

ID	Appl. Point (PA)	Type of AI (TAI)	Level of Auto (LA)
1	Process	Analogizer	2
2	Process	Analogizer	2-3
32	Process	Connectionist	9
34	Process	Symbolist	7
36	Process	Analogizer	2
37	Process	Symbolist	2-3
38	Process	Symbolist	2
39	Process	Evolutionary	2
41	Process	Analogizer	2-3
44	Process	Analogizer	2-3
15	Process	Analogizer	2
35	Process	Analogizer	2-3
6	Product	Symbolist	8
35	Product	Analogizer	9
35	Product	Symbolist	9
6	(Runtime)FW	Symbolist	(8)FW
15	(Runtime)FW	Analogizer	7

Results

The application of AI technologies in education has demonstrated significant potential and benefits, including:

1. **Improved Learning Efficiency:**
    - AI systems like expert systems and neural networks help personalize learning experiences, making them more efficient by providing tailored guidance and support to students based on their individual needs and performance.
2. **Enhanced Educational Resources:**
    - Robotics and other AI tools enrich educational resources by offering new, interactive ways of learning that go beyond traditional methods. This leads to a more engaging and practical learning environment.

3. Modern Education System:

- Integrating AI into education helps to modernize educational systems, making them more scalable, more efficient and able to meet the demands of the future. AI's ability to analyze big data and provide insights helps develop more effective instructional strategies and programs.

4. Alternative teaching methods:

- The use of AI in education encourages the development of innovative teaching methods that foster students' creativity and critical thinking. They are created through interactive learning experiences provided by educational robotics and other AI technologies.

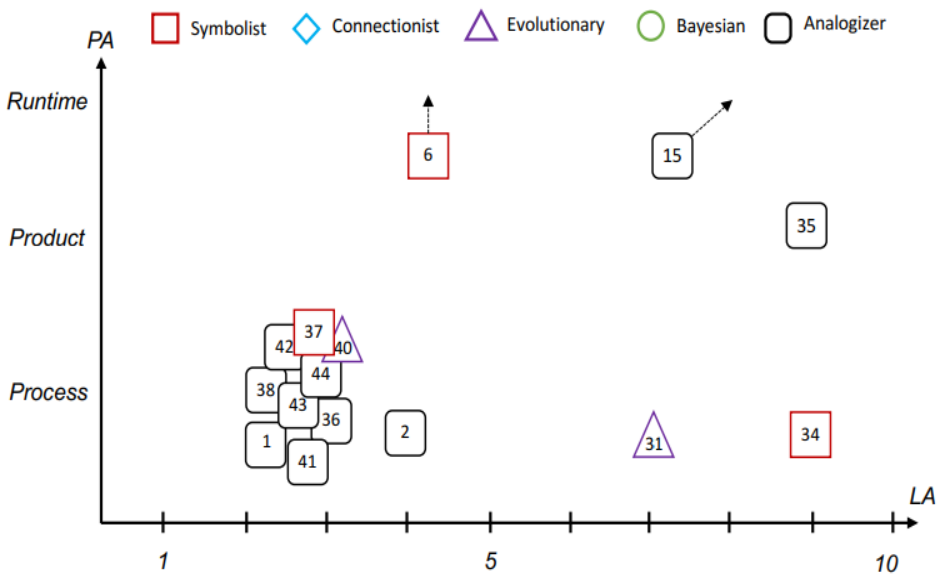


Figure 2: shows the AI-SEAL classification of papers from several RAISE editions [16].

Figure 2 presents the artificial intelligence (AI) classification by AI-SEAL (Artificial Intelligence Software Engineering Application Layer) at the RAISE conference. The PA and LA axes serve as the basis for the classification, and the various artificial intelligence model types are represented by the symbols.

- **Points of Application (PA):**
  1. AI applications are divided into "Process" and "Product" categories in the illustration.
  2. "Process" refers to AI applications that are incorporated into procedures to improve productivity, precision, or judgment.
  3. "Product" refers to AI applications that are integrated into goods to offer intelligent features.

- **Types of AI (TAI):**
  1. The picture divides artificial intelligence (AI) types into several groups, including evolutionary, connectionist, symbolic, and analogizer.
  2. Analogizer: AI that makes decisions by comparing instances and drawing conclusions from them.
  3. Connectionist: AI that models and interprets data using neural networks and deep learning.
  4. Symbolist: AI that solves issues through logic and symbolic thinking.
  5. Evolutionary: AI that optimizes solutions through the application of evolutionary algorithms.

Level of Automation (LA):

1. The automation level, which ranges from low (e.g.,level 2) to high (e.g., level 9), represents the degree of autonomy of the AI system.
2. Higher automation levels indicate more sophisticated AI capabilities that call for less human involvement.

Table Overview

• A thorough analysis of certain AI applications is given in the table that goes with Figure 3, together with citations to the relevant sources.

• Every entry has an ID that identifies it and contains information about the reference, application point, AI kind, and automation level.

• For example, entry #1 describes a level of automation, an analogizer kind of AI, and a process application point.

Application

A simple example of a Random Forest classifier-based Python program for data classification. This example covers the steps involved in importing a dataset, preparing the data, training the model, and assessing its performance. The example makes use of the Iris dataset, a well-liked dataset for classification issues.[17][18]

Step-by-Step Python Application for Random Forest Classifier

1. **Install Necessary Libraries:** Ensure you have scikit-learn and pandas installed. You can install them using pip if you haven't already.
   pip install pandas scikit-learn

2. **Import Libraries:**
   import panda as pd
   Import load_iris from sklearn.datasets
   Import train_test_split from sklearn.model_selection
   Import the RandomForestClassifier from sklearn.ensemble
   The accuracy_score, classification_report, and confusion_matrix are imported from sklearn.metrics
   iris_dataset = load_iris();
   attributes = iris_dataset.data
   label = iris_dataset . purpose
   data_frame = pd.DataFrame(objects, lines = iris_dataset.object_name);
   data_frame['value'] = characters
   X_train, X_test, y_train, y_test = train_test_split(attribute, label, test_size = 0.3, random_value = 42);
   random_forest_model = random_forest_model (n_estimators = 100, random_position = 42) .
   random_forest_model.fit(X_train, y_train) .
   prediction_labels = X_test = random_forest_sample.predicted() .
   accuracy_score (y_test , prediction_value) = model_truth
   Report results for distribution = distribution

3. **Load and Prepare the Dataset:**
   iris_dataset = load_iris();
   attributes = iris_dataset.data
   label = iris_dataset . purpose
   data_frame = pd.DataFrame(objects, lines = iris_dataset.object_name);
   data_frame['value'] = characters
   X_train, X_test, y_train, y_test = train_test_split(attribute, label, test_size = 0.3, random_value = 42);

4. **Train the Random Forest Classifier:**
   random_forest_model = RandomForestClassifier(n_estimators=100, random_state=42)
   random_forest_model.fit(X_train, y_train)

5. **Make Predictions and Evaluate the Model:**
   prediction_labels = model.predicted(X_test) .
   model_accuracy = accuracy_score(y_test, prediction_value);
   distribution_report_output = distribution_report(y_test, prediction_control);
   confusion_matrix_output = confusion_matrix (y_test, prediction_code) .
   print(f" {sample_absolute}")
   print(f":\n{distribution_report_output}")
   print(f":\n {confusion_matrix_output}");
   The Complete Law
   The whole of the law
   objects = iris_dataset.data labels = iris_dataset.target iris_dataset = load_iris() .
   data = pd.DataFrame(property, characters = iris_dataset.feature_dins);
   data['value'] = characters
   Train_test_split = X_train , X_test , y_train , y_test (label , test_size = 0.3 , random_value = 42),
   elements
   random forest partition (n_relatives = 100 , random_value = 42) = random_forest
   Random forests are appropriate for X and Y trains.
   Forecast is the same random forest.Forecast (X_test) .
   accuracy_score (y_test , prediction) = sample_truth
   report = distribution_report(prediction, y_test) .
   confusion_matrix (y_test , prediction) = matrix
   "Accuracy: {model_accuracy}" is printed.
   print(f"Configuration Report: Report}") print(f"Confusion Matrix: Matrix}");

Explanation:

1. Data Preparation and Loading: The iris dataset is loaded using the load iris() function.
    - The data is converted into a Data Frame to make manipulation easier.
    - To split the dataset into training and testing sets, use the train test split() method.
2. Model Training: o A Random Forest classifier is configured and trained using the training set of data.
3. Projecting and evaluating: o Predictions are based on the test set. The accuracy, classification report, and confusion matrix are in order to evaluate the model`s performance.

Conclusion:

In order to assist practitioners and researchers in categorizing various AI applications in software engineering including the field of education, we provide the AI-SEAL taxonomy in this study. This taxonomy uses runtime, product, and process as well as degree of automation factors. The type of AI technology is based on the Five Clans of Domingos initially, and the point of application is based on automation levels influenced by Sheridan-Verplanck`s Ten Levels of Automation. AI_SEAL gives consumers an understanding of the world of AI application in software engineering and gives software developers-including engineers in education – a foundation for considering the dangers involved in utilizing AI technology. This taxonomy, for instance, assists educators in weighing the final deliverables. Furthermore, because the classification is not restricted to particular applications within a sector, it encompasses all types of knowledge particular applications within a sector, it encompasses all types of knowledge pertaining to software engineering in the field of education and elsewhere. To demonstrate how this taxonomy is applied, we use it to categorize fifteen papers from past RAISE workshops. We find that most of the papers concentrate on assisting education stakeholders throughout the development process rather than altering source code or the behavior of the system while it is in use. Diverse AI methodologies have also been implemented in a varied manner; notably, Bayesian and, somewhat shockingly, neural network methodologies are not employed. There will be a compilation of further publications.

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