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Abacus: Immersive data science education

Activity 2: Abacus Interactive Technologies

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I. Introduction

The Abacus project is centered around the development of an interactive, self-paced data literacy platform aimed at educating adults on data science and complex algorithms. Leveraging augmented reality (AR) and serious games, the platform seeks to make data science accessible to individuals of all backgrounds, irrespective of ethnicity, socio-economic status, geographical location, religion, abilities, or gender.

Interactive Technologies in Education

Interactive technologies refer to digital tools and platforms that allow users to actively engage with content, manipulate elements, and participate in the learning process. These technologies provide interactive and immersive experiences that go beyond passive consumption of information, fostering active learning, collaboration, and critical thinking.

In education, interactive technologies have become increasingly prevalent and impactful. They offer several benefits in enhancing the learning experience and improving educational outcomes. Here are some key concepts related to the use of interactive technologies in education:

1. Engagement: Interactive technologies capture learners' attention and increase their motivation by providing dynamic and interactive experiences. Through gamification, simulations, virtual reality, augmented reality, and other interactive elements, learners are more likely to remain engaged and enthusiastic about the learning content.

2. Active Learning: Interactive technologies promote active learning, enabling learners to actively participate in the learning process rather than passively receiving information. They encourage exploration, experimentation, problem-solving, and decision-making, empowering learners to construct knowledge and develop critical thinking skills.

3. Personalization and Differentiation: Interactive technologies allow for personalized and differentiated instruction. They can adapt to learners' individual needs, preferences, and learning styles, providing tailored experiences and content. This personalization promotes self-paced learning, allowing learners to progress at their own speed and focus on areas where they require more support.

4. Immediate Feedback: Interactive technologies offer immediate feedback, providing learners with instant information on their progress, performance, and understanding of the content. This feedback helps learners identify strengths and areas for improvement, reinforcing learning and guiding their future efforts.

5. Accessibility and Flexibility: Interactive technologies have the potential to make education more accessible and flexible. They can be accessed anytime and anywhere, allowing learners to engage in learning activities at their convenience. Interactive technologies can also cater to diverse learning needs and accommodate learners with different abilities, ensuring inclusivity in education.

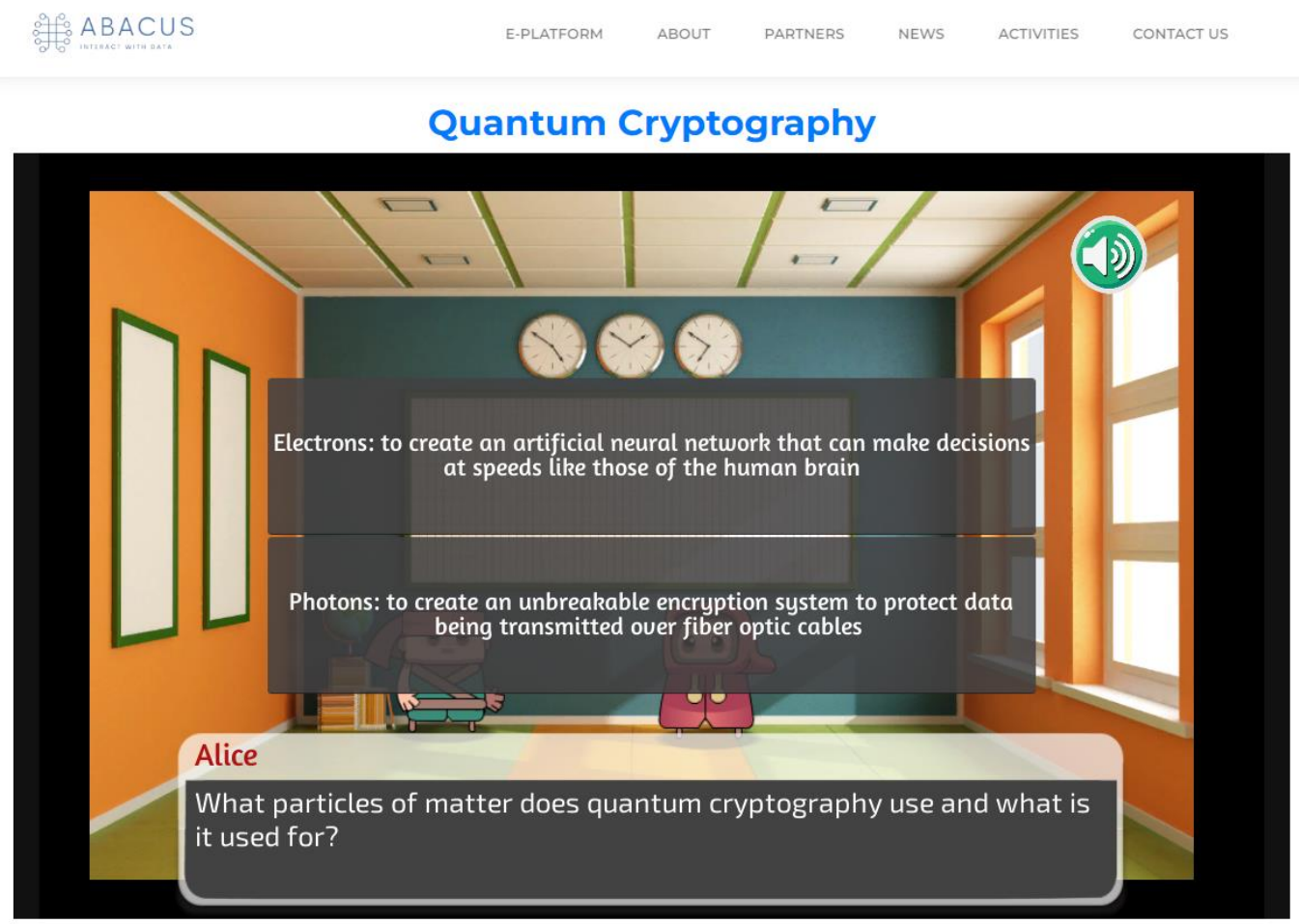
6. Data Collection and Analysis: Interactive technologies generate data on learners' interactions, progress, and performance. This data can be collected and analyzed to gain insights into learners' strengths, weaknesses, and learning patterns. Educators can utilize this information to personalize instruction, identify areas for improvement, and make data-informed decisions.

Abacus Interactive Technologies

As part of the Abacus project, various interactive technologies have been developed to enhance the learning experience. These technologies include:

1. Interactive Augmented Reality (AR) Game on Binary Search Algorithm: By leveraging AR technology, users can engage with a dynamic and immersive game that explores the concepts and applications of the binary search algorithm. This interactive experience allows learners to visualize and interact with the algorithm in a unique and engaging way.

2. Interactive Serious Games on Artificial Intelligence, Cryptography, and Protocols: The Abacus project has also developed a series of serious games focused on key topics in data science. These games encompass different genres and formats, such as quizzes, visual novels, narrative games, and text-based adventure games. By offering diverse gameplay experiences, the serious games cater to a wide range of learning preferences and engage users in an interactive and enjoyable manner.



Development Process of Abacus Narrative Games

This section of the report delves into the development process of the Abacus narrative games, exemplifying the meticulous approach taken to create high-quality educational experiences.

1. Conceptualization and Design: The development process begins with the conceptualization and design phase, where the educational objectives and storyline for each game are established. The Abacus team collaborates to define the learning outcomes, narrative structure, characters, and overall game mechanics.

2. Content Creation: The development team then proceeds to create the content for the games. This involves creating engaging narratives, informative dialogues, interactive challenges, and relevant visual assets. Care is taken to ensure the accuracy of the information presented, while maintaining an engaging and immersive experience for the learners.

3. Iterative Development: The games undergo iterative development cycles, incorporating user feedback, playtesting, and continuous improvement. This iterative process allows the team to refine the gameplay mechanics, adjust difficulty levels, and optimize the learning experience based on user insights.

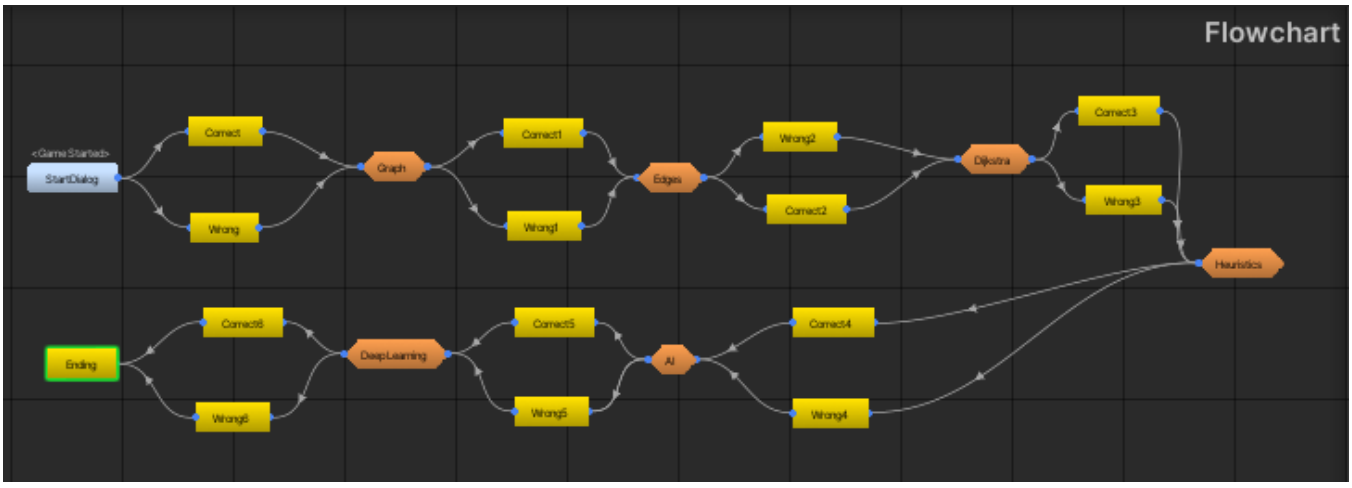
4. Integration into Abacus e-Platform: The outputs of the development process are seamlessly integrated into the Abacus e-platform. Learners can access the games through the platform's user-friendly interface, making it convenient to engage with the educational content.

Example of an Abacus Game

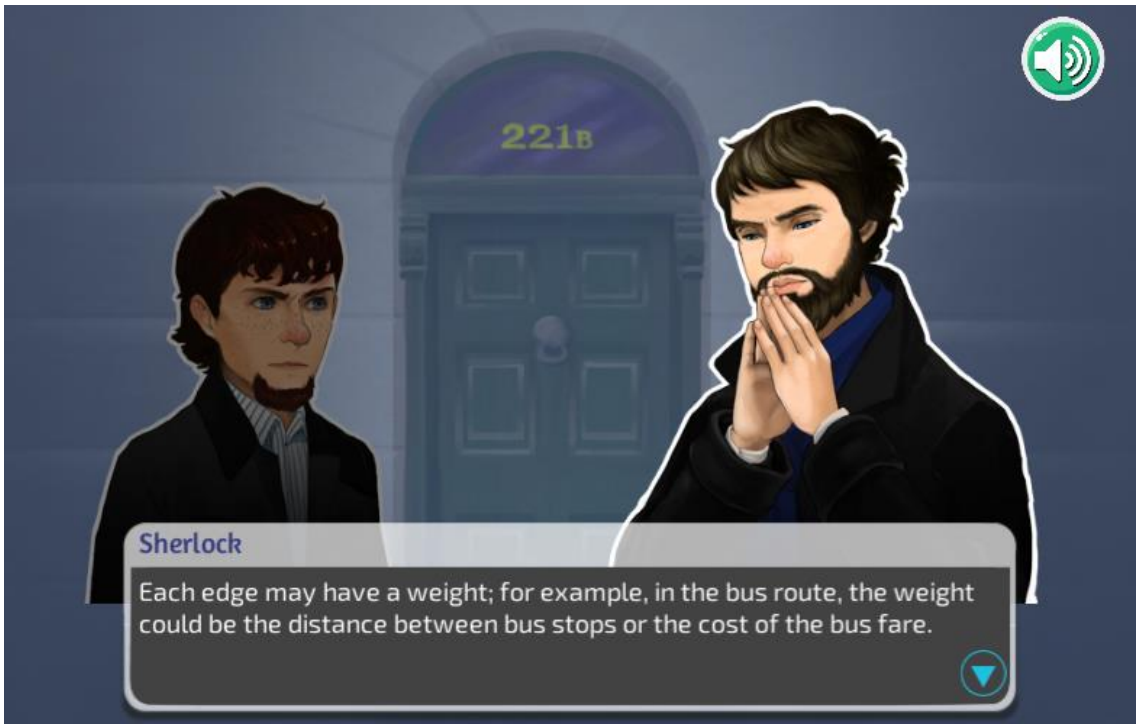
To provide a glimpse into the Abacus narrative games, one game from the collection will be highlighted as an example in the following sections. This game showcases the captivating storytelling, interactive challenges, and educational content found throughout the Abacus platform. Specific details and gameplay elements of the example game can be explored by accessing the Abacus website at https://abacus-games.eu/platform.html.

II. Abacus Narrative Games

A narrative game follows a script where the player can make decisions that affect the development of the story. Below is an example flowchart from one of the Abacus narrative games, teaching the player about Deep Learning and complex algorithms. The flowchart shows the sequence of the different events/dialogues/player choices in the game.



Below is a screenshot from the actual game, which is based on a Sherlock theme where Sherlock and John are having a conversation about deep learning and complex algorithms, and the player can answer relevant questions and participate in the story.



Multiple scripts and games were developed as part of Abacus. Here is the actual script of the game presented above:

#SAY.Flowchart.523.Sherlock

I feel like exploring the idea of graphs today. I'm really curious how the GPS path finding works.

#SAY.Flowchart.11.John

Are graphs like queues?

#MENU.Flowchart.586

Yes

#MENU.Flowchart.587

No

#SAY.Flowchart.579.Sherlock

A graph is a non-linear data structure consisting of nodes and edges.

#SAY.Flowchart.581.John

Ok I see. But how does direction work?

#SAY.Flowchart.602.Sherlock

If the edges have a direction from one node to the other it is a directed graph.

#SAY.Flowchart.847.Sherlock

For example, let's consider bus routes. The nodes are bus stops and the edges connect two stops next to each other.

#SAY.Flowchart.604.John

I've heard that not all edges have the same weight. Is that true?

#MENU.Flowchart.588

Yes

#MENU.Flowchart.595

No

#SAY.Flowchart.598.Sherlock

Each edge may have a weight; for example, in the bus route, the weight could be the distance between bus stops or the cost of the bus fare.

#SAY.Flowchart.634.John

It makes sense... But still, I don't get how path finding happens.

#SAY.Flowchart.848.Sherlock

Now that we are clear on what a graph is, we should investigate the two most common path finding algorithms used in AI.

#SAY.Flowchart.607.

Finding the shortest path between two points on a graph is an important part of AI.

#MENU.Flowchart.608

Yes

#MENU.Flowchart.610

No

#SAY.Flowchart.700.John

Hearistic? Never heard of it.

#SAY.Flowchart.698.Sherlock

Heuristic is simply an "intelligent guess" on how far we have to go to reach the destination most efficiently.

#SAY.Flowchart.849.John

Alright - also you mentioned AI earlier. How is AI related to ML and DL? These terms really confuse me.

#MENU.Flowchart.689

Deep learning is a subset of machine learning, which is itself a subset of AI.

#MENU.Flowchart.690

They all mean exactly the same thing.

#SAY.Flowchart.729.Sherlock

In DL, the system is able to think like a human using these neural networks, and its performance improves with more data.

#SAY.Flowchart.731.John

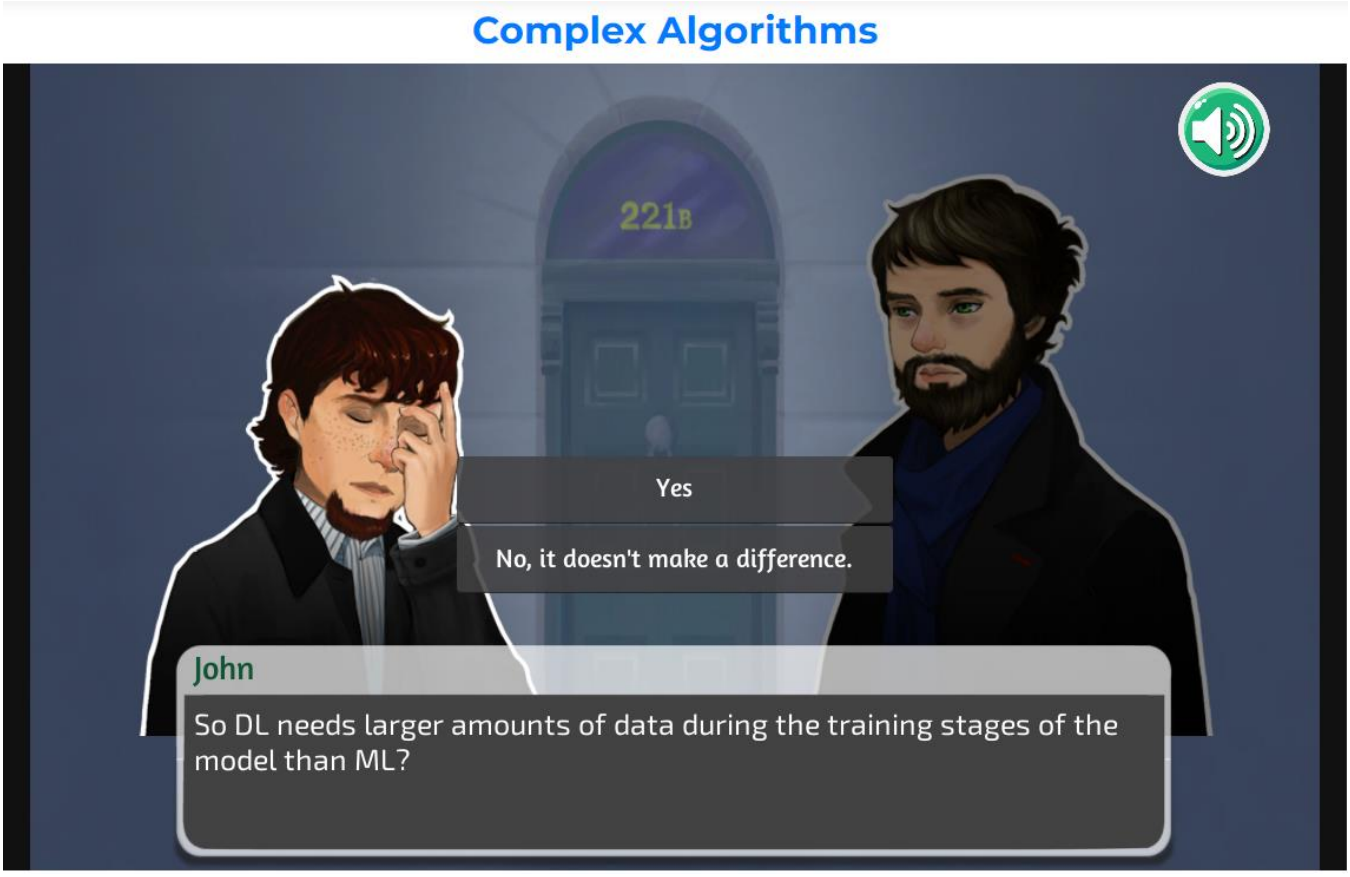
So DL needs larger amounts of data during the training stages of the model than ML?

#MENU.Flowchart.748

Yes

#MENU.Flowchart.749

No, it doesn't make a difference.



#SAY.Flowchart.677.Sherlock

The first one is Dijkstra's algorithm and the second one is A pathfinding algorithm.*

#MENU.Flowchart.671

Dijkstra's algorithm pays attention to direction; it can never take you far from destination.

#MENU.Flowchart.672

A is based on Dijkstra's but adds an extra heuristic value.*

#SAY.Flowchart.714.Sherlock

Intelligent machines that think and behave like humans - that's AI!

#SAY.Flowchart.850.Sherlock

Machine Learning is when systems learn without being programmed to learn.

#SAY.Flowchart.851.Sherlock

And Deep Learning is when machines think in a way similar to the human brain.

#SAY.Flowchart.735.John

Which one uses artificial neural networks then?

#MENU.Flowchart.718

AI

#MENU.Flowchart.719

ML

#MENU.Flowchart.852

DL

#SAY.Flowchart.760.Sherlock

I'm so excited to see what the future of AI holds. I'm sure that even the detection of crimes before they happen could be possible, only by looking at existing patterns...

#CHARACTER.Sherlock

Sherlock

#CHARACTER.John

John

III. Conclusion

Overall, interactive technologies provide innovative and engaging approaches to teaching and learning. They empower learners, foster active participation, and offer opportunities for personalized and meaningful experiences. By leveraging these technologies, educators can create dynamic and immersive learning environments that enhance comprehension, retention, and application of knowledge.

The Abacus project, with its focus on interactive technologies and serious games, aims to revolutionize data literacy education. By developing an accessible and engaging e-learning platform, Abacus empowers individuals from diverse backgrounds to explore data science and complex algorithms. The narrative games serve as effective tools for knowledge acquisition, fostering an enjoyable and immersive learning experience. Through the iterative development process and continuous improvement, the Abacus team ensures the highest quality educational content for its users.