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AI-assisted personalized education for a sustainable future

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Core concepts

• Personalized education refers to tailoring educational content to suit the student's needs
• Personalized learning path is the approach that involves the customization of the learning process based on personal requirements and characteristics of each learner [1]
• Artificial intelligence and machine learning can play a huge role in modeling personalized education by providing insightful feedback and tailored recommendations

Motivation

• Research shows that fewer than 6 in 10 students graduate in time in the USA [2]
• Since the number and variety (in terms of backgrounds, knowledge, and goals) of students is expanding rapidly, the same learning path is unlikely to best serve all students.
•There are not many models which can achieve state-of-the art performance in data fitting, (i.e., future performance prediction) as well as feedback generation (i.e., providing interpretable feedback to learners and instructors for downstream tasks such as personalization).

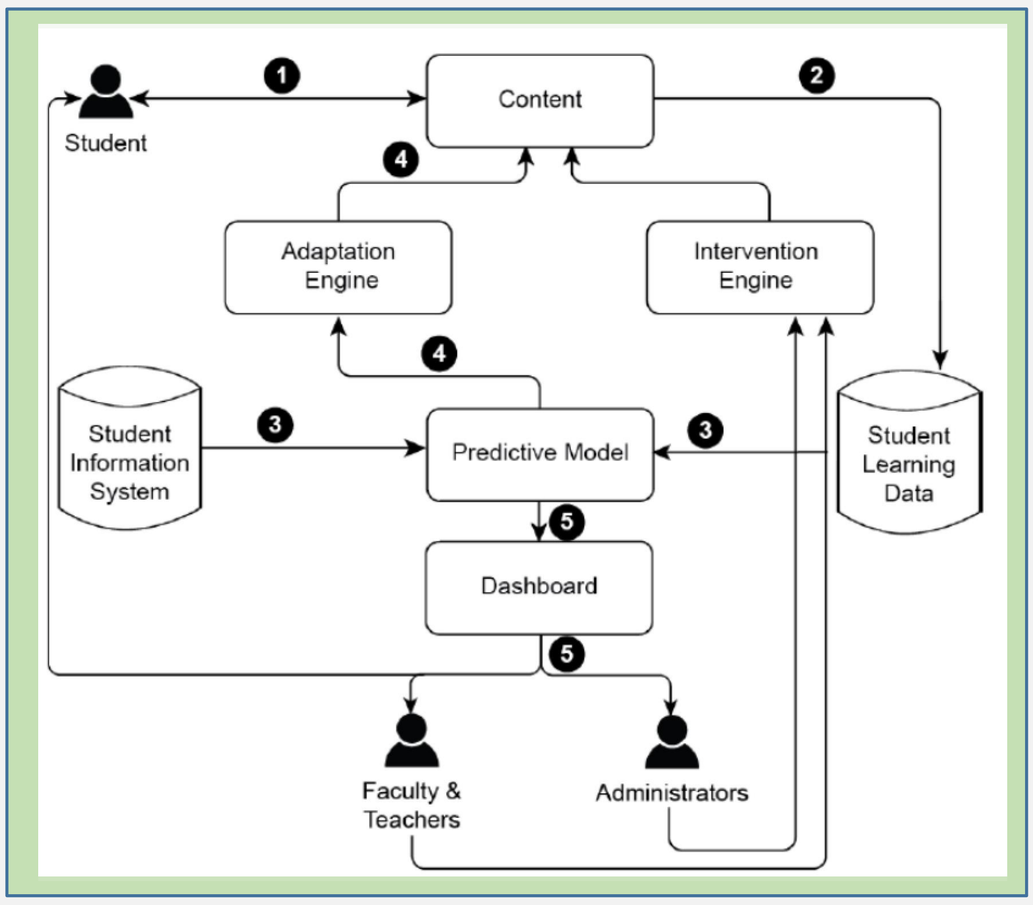

Fig 1. Personalized Learning [3]

Approaches

1. Smart AI powered chatbots
• provide an interactive educational process
• provide customized guidance for each learner dependent on their personal needs
• solution to the problem of the lack of communication as in the case of online learning system usage.

2. Intelligent course recommendation system
• recommends course sequences
• identify gaps in student's knowledge and adapts the learning path to suit the needs

3. Content summarization and question generation
• Natural language processing (NLP)-based tools can be used for content production
• Text summarization can sort through long textbook sections and extract key features for remedial studies
• Automatic question generation can provide high quality factual assessment questions

4. Human-in-the loop content design
• AI can act as assistants to content designers
• On-demand feedback can help curating content

Challenges

1. Students vary tremendously in backgrounds, knowledge, and goals
2. Course sequence recommendation requires dealing with a large decision space that grows combinatorically with the number of courses.
3. Enforcing fairness in predictive algorithms is a challenging task.
4. In online mode, a loss of peer interactions and of the sense of community that is usually present in traditional classrooms

Challenge	Description
Content Production/Recommendation	Personalized and profession-oriented production, recommendation, and maintenance of contents
Evaluation and Assessment	Performance comparison in personalized education, testing without information loss, accreditation
Lifelong Learning	Continuous education and additional qualification for improvement and pivots in profession
Incentives	Internal and external motivation for learning, gamification, rewarding, inducing confidence
Networking and Interaction	Inducing learning networks, forming coalitions for efficient learning, imitating teacher feedback
Diversity and Fairness	Equal access to quality online education, avoiding biases in platform development

Fig 2. Some research directions for AI-based personal education [4]

Impact of COVID-19

1. The pandemic has boosted the usage of online learning tools for signal processing education, especially at the undergraduate levels
2. Policy makers can use ML methods on available data to classify students based on how they're exposed to the educational effects of the pandemic.

Conclusion

1. AI and ML have a great potential to enhance online education in different ways, e.g., through improving the quality of learning materials, enabling fairness and diversity, generating proper tests, and allowing to build knowledge networks
2. The intention here is to provide an AI-assisted learning experience and not an AI-led one.

References

[1] - Davies, J., Verovko, M., Verovko, O. and Solomakha, I., 2021. Personalization of E-Learning Process Using AI-Powered Chatbot Integration.
[2] - https://www.npr.org/2019/03/13/681621047/college-completion-rates-are-up-but-the-numbers-will-still-surprise-you
[3] - V S Magomadov 2020 J. Phys.: Conf. Ser. 1691 012169
[4] – Maghsudi S., Andrew L., et al. 2021. Personalized education in the AI Era: What to Expect Next?

AI-assisted personalized education for a sustainable future

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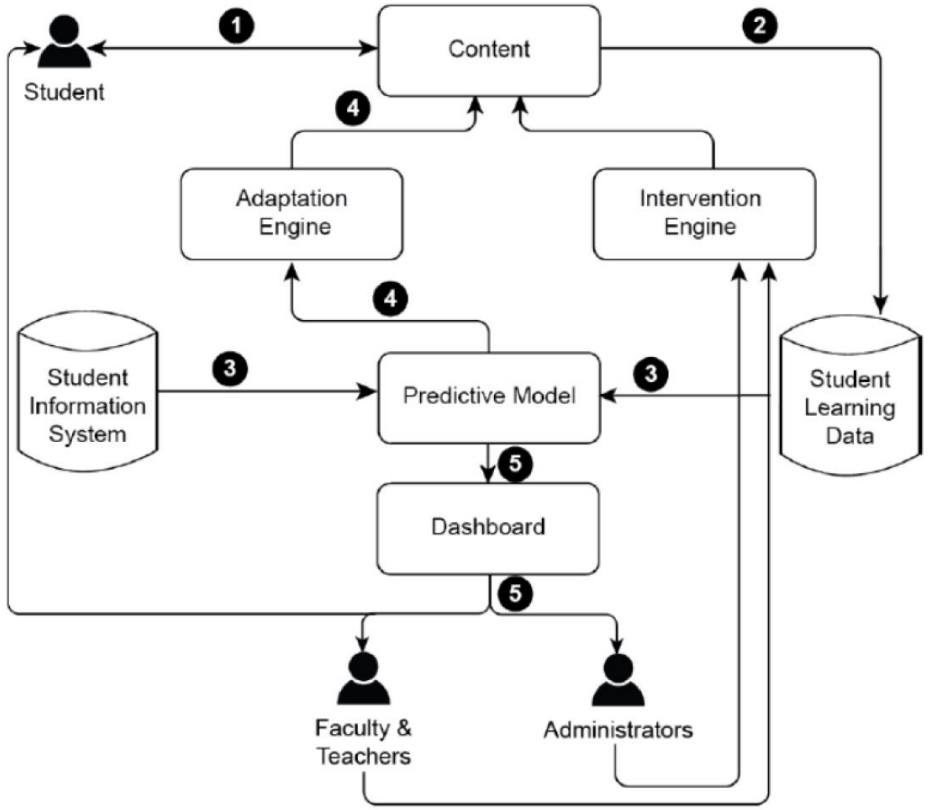
AGENDA

- What is Personalized Education?
- Motivation
- Approaches
  - Smart AI powered chatbots
  - Intelligent recommendation systems
  - Content summarization and question generation
  - Human-in-the-loop content design
- Challenges
- Impact of Covid-19
- Way Forward

WHAT IS PERSONALIZED EDUCATION?

- Personalized education refers to tailoring educational content to suit the student's needs
- Personalized learning path is the approach that involves the customization of the learning process based on personal requirements and characteristics of each learner



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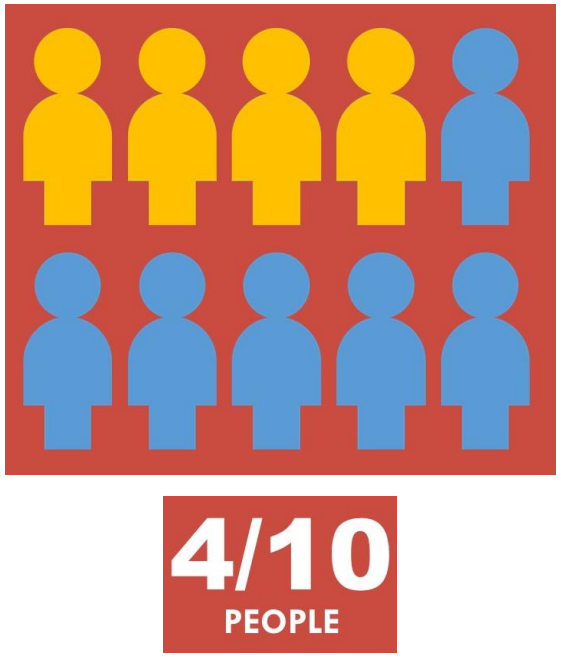
MOTIVATION



- Since the number and variety (in terms of backgrounds, knowledge, and goals) of students is expanding rapidly, the same learning path is unlikely to best serve all students.
- There are not many models which can achieve state-of-the art performance in generating personalized learning paths and constructive feedback mechanisms.

APPROACHES

- Smart Chatbots
- Course Recommendation System
- Content summarization & question generation
- Human-in-the loop content design

SMART AI POWERED CHATBOTS

- provide an interactive educational process
- provide customized guidance for each learner dependent on their personal needs
- provide a solution to the problem of the lack of communication due to e-learning

Image Credit: UserLike.com

Reference: Davies, J., Verovko, M., Verovko, O. and Solomakha, I., 2021. Personalization of E-Learning Process Using AI-Powered Chatbot Integration.

INTELLIGENT COURSE RECOMMENDATION SYSTEM

- recommends course sequences
- identify gaps in student's knowledge and adapts the learning path to suit the needs
- enhances the learning platform to become more responsive to the student’s needs

CONTENT SUMMARIZATION AND QUESTION GENERATION

- Natural language processing (NLP)-based tools can be used for content production
- Text summarization can sort through long textbook sections and extract key features for remedial studies
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HUMAN-IN-THE LOOP CONTENT DESIGN

- AI can act as assistants to content designers
- On-demand feedback can help curating content

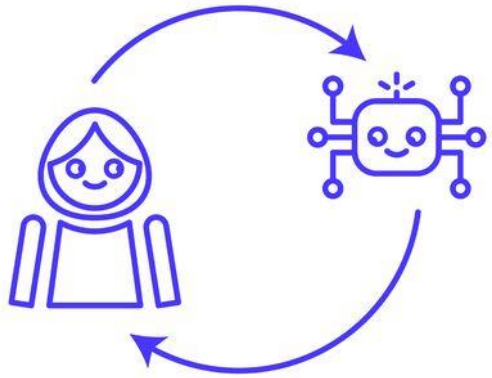

Image Credit: 123RF.com

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CHALLENGES

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RESEARCH DIRECTIONS

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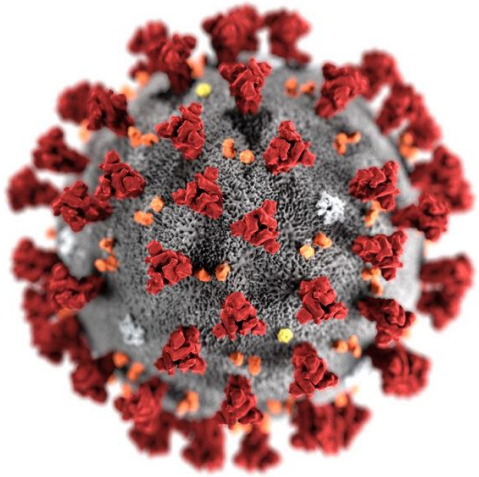

Image Credit: PakBrunei.com

WAY FORWARD

- AI and ML have a great potential to enhance online education in different ways through
  - improving the quality of learning materials
  - enabling fairness and diversity
  - generating proper tests
  - allowing to build knowledge networks
- The intention here is to provide an AI-assisted learning experience and not an AI-led one.

Thank You!

QUESTIONS?

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