

AI applications for Children



Team 11

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Outline

- AI in Education
- Example: Storytelling by a kindergarten social assistive robot: A tool for constructive learning in preschool education
- Relative algorithms
- AI in autism detection: Interactive Technologies for Autistic Children
- AI toys, potential risks and ethical issues
- Grand challenge in the future



AI in Education

The educational applications of AI are a combination of use-inspired basic and pure applied research

AI in Education(AIED)

- This figure shows how we can create AIED systems by drawing upon existing AI theories, tools and techniques.
- The demands of systems may drive researchers to make advances in fundamental AI.
- AIED research has a similar relationship to models of human cognition, affect, motivation and so on.

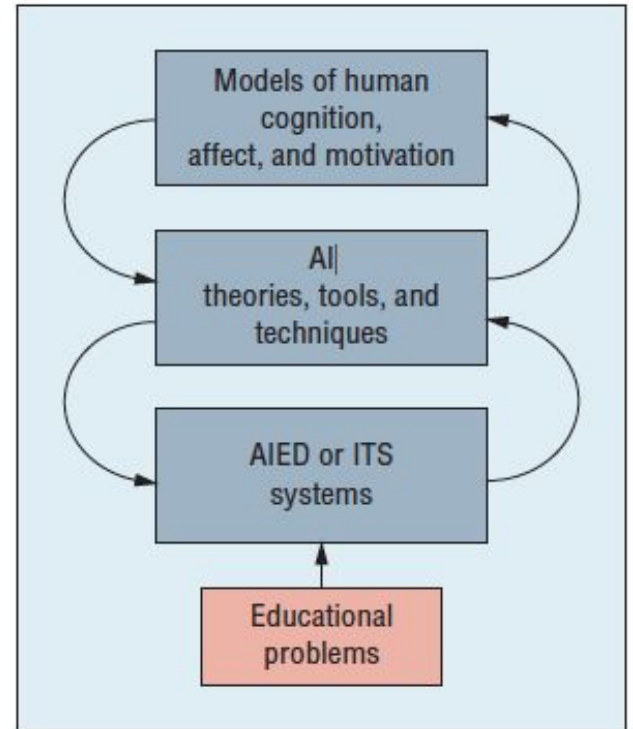


Figure 1. Problem-driven AI research. Educational needs drive AIED research, which both draws on and contributes to AI theories, tools, and techniques. A similar synergistic two-way relationship holds between AIED and research in human cognition with AI.



- Earlier work focus on the solitary learner
- Recent work takes account of the broader learning.
- Not all AIED systems have all the elements in the figure, not even all the italicized ones.

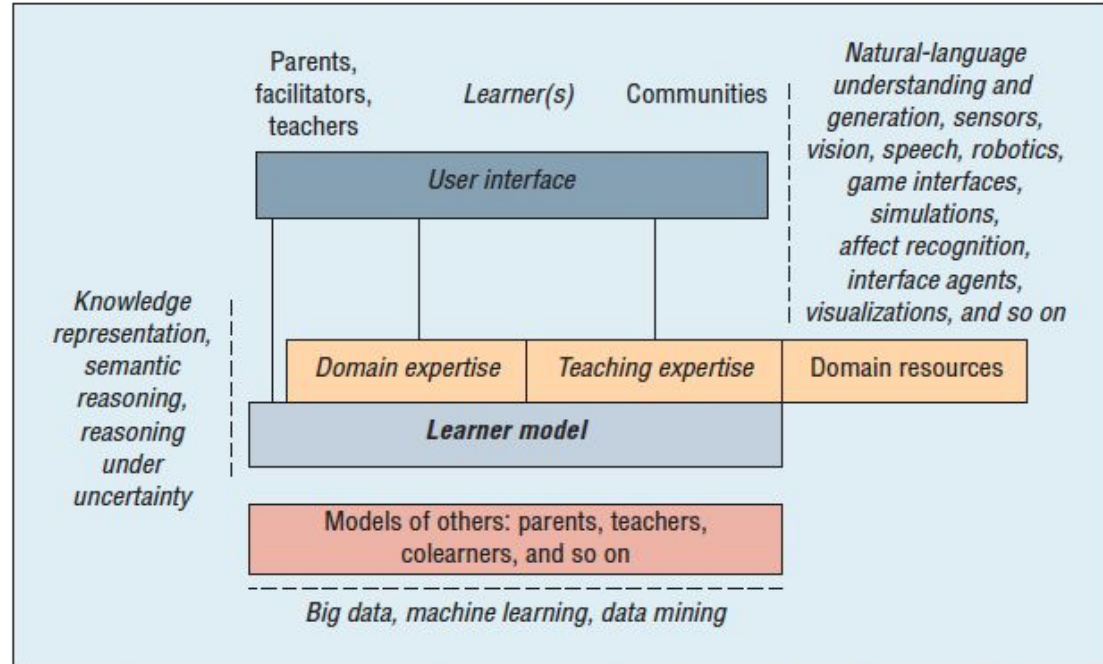


Figure 2. Key elements of AI in Education systems. From its foundation, AIED research has had four core elements: a model of the learner, domain expertise, teaching expertise, and interfaces. Recent research takes a broader view, recognizing the importance of other people and rich collections of digital learning resources.



- Learner model: the most common element which need to represent those aspects of the learner that will drive the whole system, including interpretation of the learner's actions and the system's generation of its own action
- The other two elements: domain expertise and teaching expertise are also important.
- In practice, AIED systems need to have a tight coupling across these elements: all three need to operate together for effective teaching.

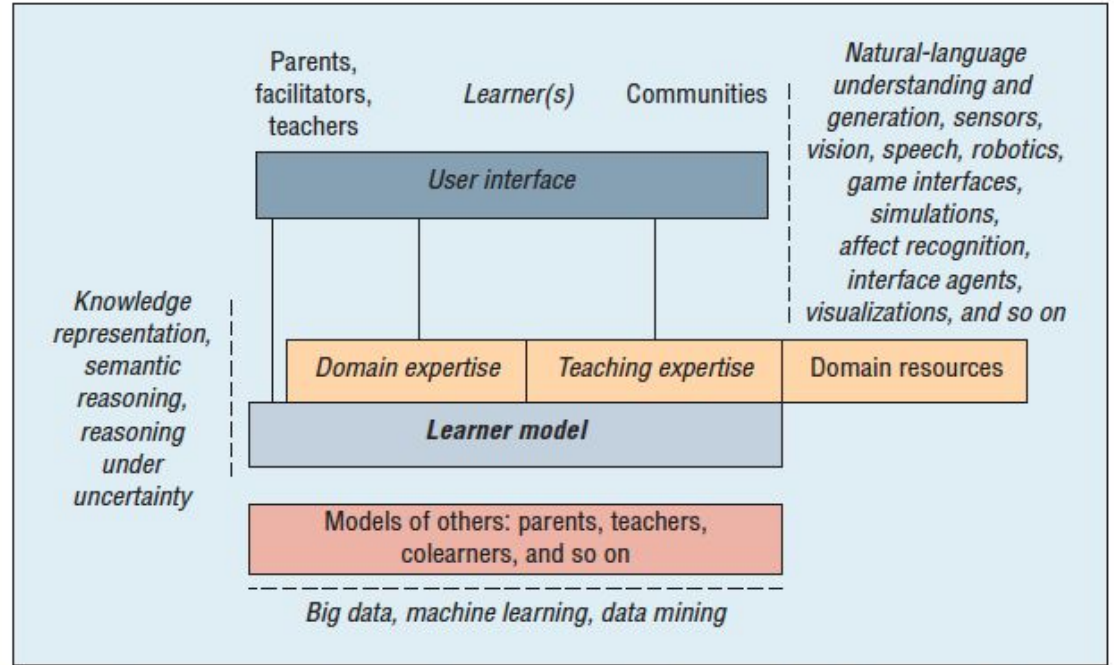


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The left side of the figure characterizes aspects of AI that are important for all three elements.

- **The fourth element of the classic AIED systems view is the user interface. Many AIED researchers strive to create interfaces that enhance learning effectiveness by making the interaction natural and compelling.**

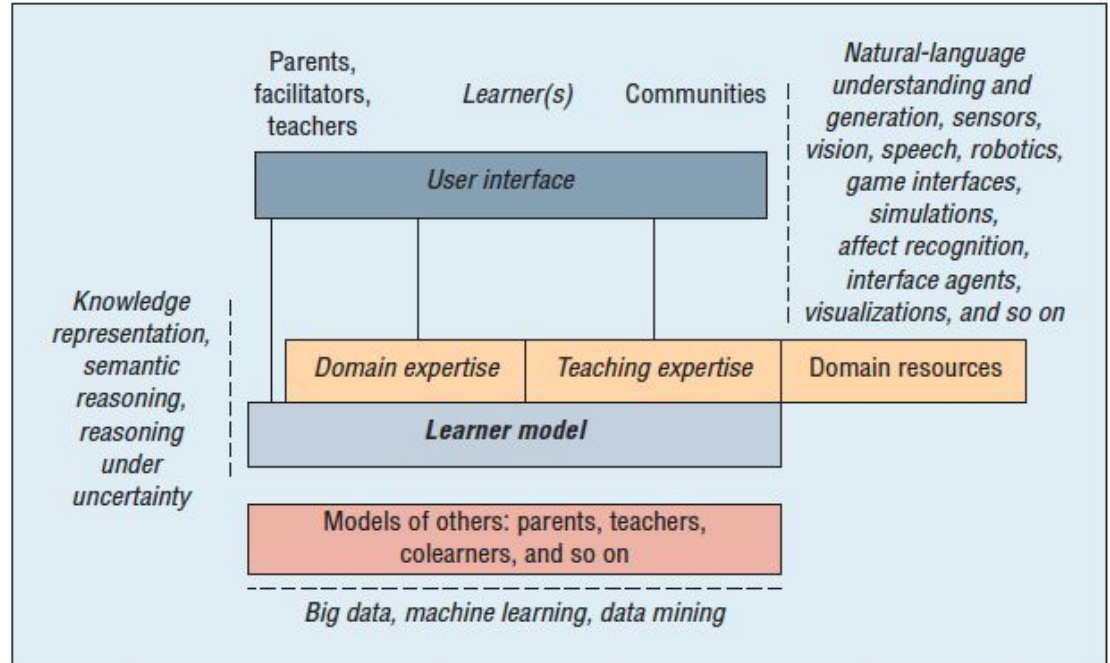


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Kindergarten Social Assistive Robotics

- Novel technology that offers kindergarten staff an innovative tool for achieving educational aims through social interaction.
- Monitors children's process and concurrently provides both the children and educational staff with detailed feedbacks on task performances.
- The robot, using appropriate vocabulary, thus introduces novel concepts to the children in terms based on children's previous knowledge.
- Constructive learning also encourages learners to experience the content in different ways, using different senses
- The robot displays images on a screen, tells a story and discusses it with the children, and incorporates singing and motor activities in the process.

Kindergarten Social Assistive Robotics



- The educational process can take place in any natural environment for children, such as the schoolyard or a playground, and hence allows for children's mobility.
- KinderSAR can overcome the limitation by providing, at relatively low cost, social interactions for educational purposes and promoting children's cognitive development over time.
- The kindergarten teams develop a broad range of cognitive, emotional and social skills in preschool children.



Technology - Affective Computing

Also called the emotion AI, the study and development of systems and devices that can recognize, interpret, process, and simulate human affects. It is an interdisciplinary field spanning computer science, psychology, and cognitive science.

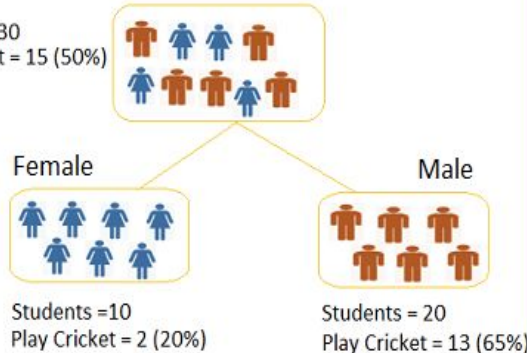
Algorithm - The process of speech/text affect detection requires the creation of a reliable database, knowledge base, or vector space model,[19] broad enough to fit every need for its application, as well as the selection of a successful classifier which will allow for quick and accurate emotion identification.

Decision Tree Algorithms

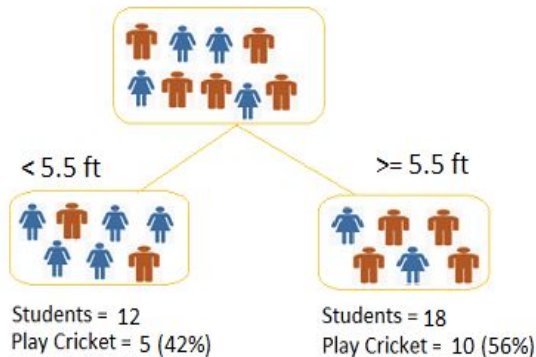
Decision tree learning uses a decision tree (as a predictive model) to go from observations about an item (represented in the branches) to conclusions about the item's target value (represented in the leaves).

Split on Gender

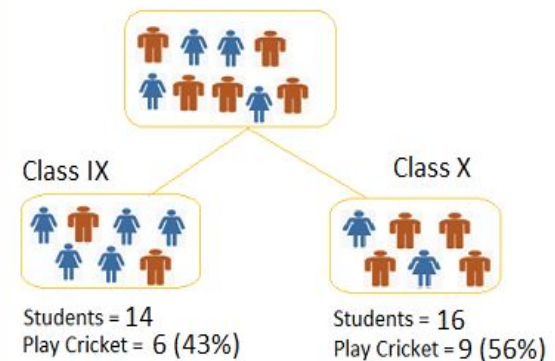
Students = 30
Play Cricket = 15 (50%)



Split on Height



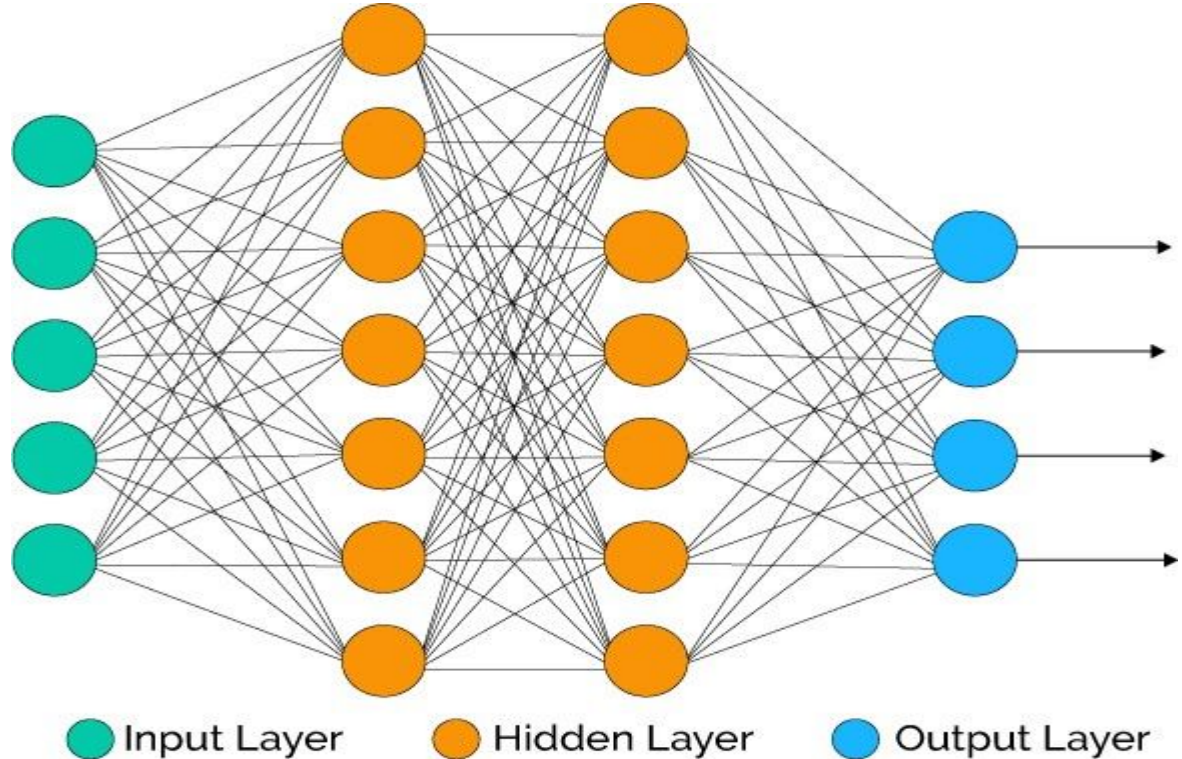
Split on Class





Artificial Neural Networks

Artificial neural networks (ANNs), a form of **connection**, are computing systems inspired by the biological neural networks that constitute animal brains





Other Algorithms

Besides decision tree algorithm and artificial neural networks, there are many other classifiers, including linear discriminant classifiers (LDC), k-nearest neighbor (k-NN), Gaussian mixture model (GMM), support vector machines (SVM), and hidden Markov models (HMMs). Various studies showed that choosing the appropriate classifier can significantly enhance the overall performance of the system.

- LDC – Classification happens based on the value obtained from the linear combination of the feature values, which are usually provided in the form of vector features.
- k-NN – Classification happens by locating the object in the feature space, and comparing it with the k nearest neighbors (training examples). The majority vote decides on the classification.

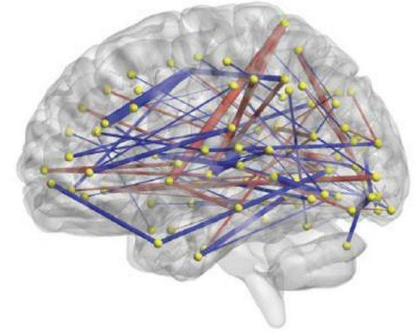


AI Uses for Autistic Children

- Autism spectrum disorder(ASD) is a neurological and developmental disorder that begins early in childhood and lasts throughout a person's life. It affects how a person acts, interacts, communicates and learns with others.
- In typically developing children, the ability to correctly identify interpret and produce social behaviors is a key aspect for communication and is the basis of social cognition.
- That's why It is important that AI uses to help children with autism.

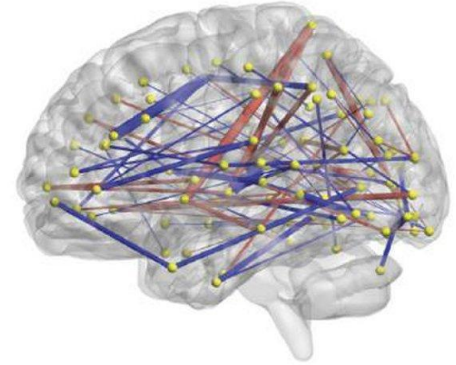


AI Predicts Autism of Infant



- The study examined 59 infants who had an older sibling with autism because these infants have high risks of developing autism.
- The artificial intelligence predicted with 100 percent accuracy that 48 infants would not develop autism. For 11 infants who developed the disorder at the age of 2, the system correctly predicted nine of the cases.
- The results of the new research could identify autism before symptoms occur, giving opportunity to intervene early.

AI Predicts Autism of Infant



Collect Data:

- Scan the image of infants' brains and record the the c between brain region in order to predict which infant develop autism.
- When children at the age of 2, they come back in for behavior assessment.
- The researchers looked at the children's social interactions and communication to determined whether each child had autism.
- the program was learning to spot differences between the functional connections imaged in the MRI data collected at 6 months old that correlate with cognition, memory and behavior and the details from the behavioral assessments collected at 24 months.

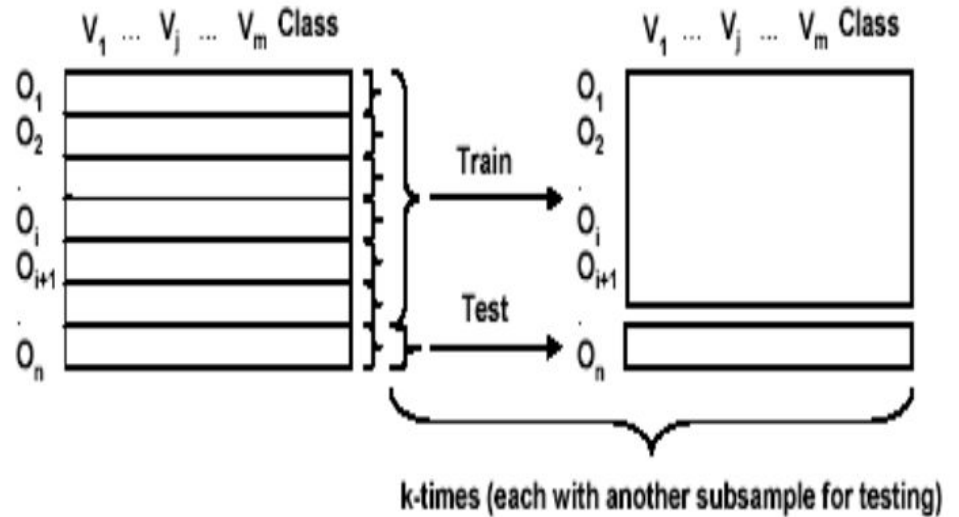


AI Predicts Autism of Infant

Using machine learning algorithm to predict if an infant might develop autism or not:

- Leave-one-out procedure to train and test the data
- 58 out of 59 infants are used to build the model at a time and 1 remaining children for testing the model.
- Repeat this process for 59 times

- The program was correct in 82% to predict the autism.





AI toys for Children

Popular talking toys:

“Hello Barbie”



“Talking Dinosaur”





AI toys for Children

Interactive robotics which provide interactions with children in multiple ways, like playing with children in body motions, not just talking, and waking up children in the morning:

<https://www.youtube.com/watch?v=DMvJq1R5LHA>



Potential Risks and Ethical Issues

Violation of private information

in ToyTalk's "Hello Barbie" privacy statement, ToyTalk outlines that it may:

“[...] use, store, process, convert, transcribe, analyze or review recordings in order to provide, maintain, analyze and improve the functioning of the services, to develop, test or improve speech recognition technology and artificial intelligence algorithms, or for other research and development and data analysis purposes.”



Potential Risks and Ethical Issues

Open “Equipment interference” for hackers and government agencies

The “Equipment interference” allows security and intelligence agencies to interfere with electronic equipment in order to obtain data, such as communications from a device. This would mean that government agencies could lawfully take over children’s toys and use them to monitor suspects.



Potential Risks and Ethical Issues

Children may rely on robotics too much and refuse to make human friends

Once a child has developed a friendship with the “Hello Barbie”, it might not be so easy to take her away.



The Future: Grand Challenge

The **Computing Research Association** identified just five Grand Research Challenges in Information Systems. **A Teacher for Every Learner** — is aimed to provide all learners with learning environments that “approach the effectiveness of a one-on-one human tutor.”

The **National Academy of Engineering** has identified 14 Grand Challenges for Engineering. **Advanced Personalized Learning** -- the challenge describes successful Web-based personalized learning systems, as well as recommender systems that help the learner find the right materials from the vast array available.



The Future: Grand Challenge

The **UK Computing Research Committee** identified nine Grand Challenges in Computing Research. The **Learning for Life**, calls for the creation of technology that lets each learner learn as he or she can and wants to do, and that connects the right teachers and learners.

Another UK Grand Challenge is **Memories for Life**, recognizing that we are defined by our memories. Augmented cognition is linked to a broad view of AIED, since our augmented memories are critical to lifelong and lifewide learning.



Thanks

