Pen-based interaction has enormous potential in educational software. In this work, we investigate methods that can augment pen-based interaction to yield better intelligent tutoring systems (ITS). Our proposed techniques enable an ITS to understand the scenario and requirements posed by a given problem statement and to couple this knowledge with a computational model of the student's handwritten solution. These pieces of information can be used to construct meaningful animations and feedback mechanisms that can highlight errors in the solution. Our prototype ITS can recognize mathematics and diagrams in a handwritten solution and infer implicit relationships among diagram elements, mathematics and annotations such as arrows and dotted lines. We use Natural Language Processing to identify the domain of a given problem, and use this information to select one or more of four domain-specific physics simulators to animate the user's sketched diagram. We enable students to use their answers to guide animation behavior and also describe a novel algorithm for checking recognized student solutions. We provide examples of scenarios that can be modeled using our prototype system and discuss the strengths and weaknesses of our current prototype.

Major: Computer Science

Educational Career:
Bachelor's of Computer Science, BS, 2005, Lahore University of Management Sciences
Master's of Computer Science, MS, 2012, University of Central Florida

Committee in Charge:
Joseph J. LaViola Jr, Chair, EECS
Charles E. Hughes, Department of EECS, University of Central Florida
Gita Sukthankar, Department of EECS, University of Central Florida
Tracy Anne Hammond, Texas A & M University

Approved for distribution by Joseph J. LaViola Jr, Committee Chair, on October 7, 2014.

The public is welcome to attend.