CSCI 7000 - Szafir - Human-Robot Interaction

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Three Laws of Robotics

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Three Laws of Robotics
by [Bo Cao](#) - Sunday, January 29, 2017, 10:13 PM

Presentation:

[Three Laws of Robotics](#)

- **What is your research question?**

How can Isaac Asimov's "Three Laws of Robotics" be implemented for Human-Robot Interaction, which are

1. A robot may not injure a human being or, through inaction, allow a human being to come to harm.
2. A robot must obey the orders given it by human beings except where such orders would conflict with the First Law.
3. A robot must protect its own existence as long as such protection does not conflict with the First or Second Laws?

reference: http://www.auburn.edu/~vestmon/robotics.html

Add my personal forth law:

    4. A robot must protect other robot's existence as long as such protection does not conflict with the former three Laws

- **How does this relate to human-robot interaction?**

There are numerous kinds of interactions between human and robot. Simply put it this way, we can divide all these interactions into two categories -- either with physical touch or without it. In terms of the former one, it raises the question of Safety for both human and robot's perspectives. If the robot, or the interaction between robot and human does not take Safety for each side into consideration, a potential injure could happen to each side. This question is critical due to the fact that safety is the ensurance of the existence for both human and robots, which should be placed in a high priority in HRI.

- **Why do you think this would be interesting?**

How to teach robots the concept of "Safe" or "Harmful"?

How can robots know what kinds of actions are safe or harmful to humans?

How can robots know what kinds of activities can harm itself?

What kinds of actions should robots do to protect themselve if it is aware that it is in a dangerous situation, while not conflicting with the First or Second Laws.

This three laws covers most of the questions about safety for both human beings and robots for Human-Robot Interaction. However, in my opinion, one important part that was missing (and an interesting quesion) is that, what should a robot do if he/she is aware that some activities may pose a threat on their existences? Though Law 3 mentioned that "A robot must pro

Some level of implementing these laws: (the number of level is greater, the more abstract of the concept of not injuring a human being it would be, thus making the implementation more complex)

Law 1:

Level 1: Able to avoid physical interaction with human being.

Level 2 :Able to recognize the safe distance between robot and a human.

Level 3: Aware of its components that could potentially injure a human.

Level 4: Aware of its actions that could potentially injure a human.

Level 5: Able to recognize the activities that could potentially injure a human.

Level 6: Able to predict humans' activities that could potentially injure humans before the injury happened.

Level 7: Able to stop humans' activities that could potentially injure humans before the injury happened.

Law 2:

Level 8: Able to recognize the order that could potentially injure a human.

Level 9: Able to disobey the order that could potentially injure a human.

Law 3:

Level 10: Able to recognize the objects that could potentially injure themselves.

Level 11: Able to recognize the actions that could potentially injure themselves.

Level 12: Able to predict the actions that could potentially injure themselves.

Level 13: Able to stop the actions that could potentially injure themselves.

Level 14: Able to recognize the order that could potentially injure a robot.

Level 15: Able to disobey the order that could potentially injure a robot.

- **Things you think you know how to do**

Research:

Methodologies from HCI:

Sketching, A/B Prototypes, Contextual Interview, Heuristic Evaluation, Usability Testing and so forth.

Wizard of oz.

Techniques:

Use Computer Vision techniques for robots to avoid people like OpenCV.

Teleoperate Turtlebot, Drones and Humanoid Robots.

3D modelling and printing.

Robot Operating System (ROS)

Kinect V2 Sensors for recording video and gestures.

Leap Motion to record gestures.

Amazon Mechanical Turk.

- **Things you don't think you know how to do**

Teach the robot the concept of safety.

Teach the robot to recognize an activity that could potentially injure a human (mainly by visual cues).