Machine Learning, Artificial Intelligence and Robotics

Artificial Intelligence (AI) and robotics is a relatively new and very interesting area which can be used to solve a variety of problems. Nowadays, robots and intelligent systems are becoming a real companion in our daily life. They can be used in different applications to facilitate human lives. Therefore, Cybercom is willing to collaborate with students to make them more familiar with AI and provide them some facilities to learn more together.

Bioloid Premium Kit is a do-it-yourself educational robotic kit with all necessary components to build an advanced robot such as humanoid, hexapod, snake, etc. The kit has different sensors including gyro, infrared, and distance measurement sensor. Besides the mechanical and electronic parts, it is an open-source platform to enhance the programming skills of students. It can be used in many advanced applications, due to its customizable and advanced structure. So, Cybercom aims to do lots of interesting projects using this kit. Following we list some of the alternatives we have in mind, a reasonable scope for a thesis/practice should include 1 or 2 points from the list below, depending on your own preference.

- Balance control of the Bioloid humanoid robot in single or double support mode and while the robot is walking or going up the stairs (using gyro or sonar sensors or the status of the servo motors or by the machine vision algorithms)
- Mimicking the observed humans' motions by the Bioloid humanoid robot
- Controlling the motion and the stability of the Bioloid Hexapod robot while walking or going up steeps or stairs using CPG algorithms or Dynamical Systems, we might need to add new sensors to the system like GPS or force-sensitive resistors to adapt the walking behavior in different environments
- Designing and implementing a manipulator arm with similar degrees of freedom (DOF) to human's hands and then control it via the Kinect sensor to manipulate the objects (remote control)
- Controlling the motion behavior of the Snake robot using behavior-based control architecture to the avoid obstacles and find a desirable object in the environment
- Designing and implementing a robot that can draw pictures using Bioloid kit or the mBot robot platform. The robot should be connected to a mobile app sending what to draw
- Bioloid humanoid robot which can recognize the observed human motions (gesture recognition) while interacting with humans. The robot should then do an appropriate action in response to the observed actions
- Designing and implementing a hand rehabilitation robot which is connected to a computer game and encourages patients to do therapeutic exercises.
- Swarm robotics with applications of cleaning up the area or carrying a heavy object while individual robots collaborate with each other or for search and rescue task. The project can be done in simulation using different software such as Webots or V-REP, or it can be implemented using mBot robotic platform
- Object Detection and Classification using deep learning algorithms.
- Video Categorization or reading the human's handwriting using deep learning algorithms. There are different open-source libraries for deep learning such as DeepLearning4j, Keras, Microsoft CNTK, OpenNN, etc. which can be used in this project
- Investigate different available and open-source speech synthesis system, known as text to speech systems such as eSpeak, Gnuspeech, etc. and then selecting one of them to be used by Bioloid humanoid robot, enabling it to communicate with its partners more naturally
- Investigate different available and open-source Speech recognition software's, known as speech to text like Sphinx, Kaldi, etc. The system can be used by Bioloid humanoid robot to make it more user-friendly and interactive during interactions with people. However, the system can be used in many other applications like helping people with disabilities or making assistant systems more efficient and interactive by providing a facility to speak with them

Social robots that can reason while imitating and interacting with humans. High-level imitation learning algorithms will be used to teach different concepts to robots by imitation and the robot should be able to reason and select the best possible action among its actions based on the current environmental context.

Are Machine Learning, AI and/or robotics among your passions? Let us know about that!

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The collection of ideas that we present to you intend to reflect that diversity, we at Cybercom hope that you can find them inspiring. May your idea for thesis not be among our proposals? Let us hear about it, we will always welcome your own ideas and proactivity.

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