Session Overview
Interfaces and Interaction

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The main focus on this section is "Interfaces and Interaction". Computer display is an interface showing the information to human visually. For providing with information from human to computer (or robots), there are many interface devices, such as force sensor, acceleration sensor, velocity sensor, position sensor, tactile sensor, vision and so forth. EMG and EEG signals are also utilized as an interface signal from handicapped people to robots. By utilizing these interfaces, interactive motion between human and robot can be achieved. Interaction with variety is extremely important for entertainment robots, amusement robots, and social robots. Since the capability of these robots strongly depends upon the reaction and the expression, both sensors and actuators are key components for advancing them. Three papers are presented in this section. The first is concerned with haptic based communication between human and robots. The second deals with the vestibular sensor that can detect head motion of human. The final paper deals with diagnosing autism through the interaction between human and robot. While these three papers are largely unrelated to each other in the purpose, the common key word is interaction between human and robot. Especially, in the first and the third paper, the interaction between human and robot is strongly intended.

In the paper "Haptic Communication between Humans and Robots," the authors present a detailed design of tactile sensor and utilization of haptic data for a robot to estimate human position and posture. They are eventually interested in obtaining a map describing the relationship between the tactile information and human positions/postures from the records of haptic interaction taken by tactile sensors and a motion capturing system composed of plural number of cameras installed in the environment. They first develop tactile sensors where each sensor element is film-type piezoelectric polymer sensors inserted between the thin and thick silicone rubber layers. The film-type sensor, consisting of polyvinylidene fluoride (PVDF) and sputtered silver, outputs a high voltage proportional to the pressure applied. The tactile sensor covers the entire robot body, so that any contact between human and robot can be detected. A couple of makers are attached to human body, so that the motion capturing system can take human positions/postures. At the same time, tactile information is captured so that the correlation map between tactile and visual information can be generated. Once the map is obtained, the robot can estimate the position and posture of human by using tactile information.

In the second paper "A Vestibular Interface for Natural Control of Steering in the Locomotion of Robotic Artifacts: Preliminary Experiments," the authors develop a novel interface capable of detecting human's motion intention obtained from anticipatory movements that naturally accompany more complex motor behaviors. To validate the idea, they develop a prototype vestibular interface that can detect head linear accelerations and angular velocities along three axes. In order to investigate the principle of a vestibular interface based on head anticipatory movements, head motions with the interface are compared with the actions on traditional input interface, during driving tasks. Preliminary experiments are executed to confirm whether the head anticipatory movements associated with steering is observed or not. An interesting observation is that head motion always is slightly in advance compared with steering command time when subjects are executing a driving game. The similar tendency is also observed in right-left steering in case of a mobile robot.

The paper "How Social Robots will Help Us to Diagnose, Treat, and Understand Autism" intends to diagnose and understand autism through the interaction between a candidate (or a patient) and social robots. The ESRA robot with the capability of three facial expressions is used with a playtest botton. The robot has no sensory capabilities and does not respond to anything that the child does. ESRA is programmed to perform a short script with both a set of actions and an accompanying audio file. The robot performs behaviors from this same repertoire with the initiation of these behaviors triggered by an experimenter. Even with the extremely limited capabilities of ESRA, the children seemed to thoroughly enjoy the session. An interesting observation is that while children are universally engaged with the robot and often spend the majority of the session touching the robot, vocalizing at the robot, and smiling at the robot, these positive proto-social behaviors are rarely seen for the children with autism. The authors point out that quantitative and objective evaluation for diagnosis can be accomplished through both passive observation of the child and active interactions with robots. Chasing gaze direction during a picture observing is a good example of passive sensing and observation during interaction with robot by using the playtest botton is a good example of the latter case.