**Curriculum vitae**

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**【Introduction】**

I am originally from India. After earning a bachelor’s degree in engineering, I wanted to deepen my knowledge in the field of Human Computer Interaction, so I participated in the training of an Indian research institute called Central Electronics Engineering Research Institute （CEERI） under the Council of Scientific and Industrial Research (CSIR), India. As a result, I became interested in technology that helps people in need (physical or cognitive). Then, I entered the Biological Systems Engineering Laboratory of Hiroshima University and researched about soft-type robotic actuation through the MEXT-sponsored "Taoyaka Program". I chose Japan because Japanese technology is commendably advancing, especially in the fields of automation and robots. In Japan, I was especially able to learn the Japanese language and committed research culture. I would like to continue living in Japan, improve my skills, and grow as a researcher.

**【Expertise】**

* Soft Robotics: Pneumatic Gel Muscles (PGMs), Human Sensing, Exercise Assistance, Force Feedback, Exergames
* Data processing & analysis: Feature extraction, Classification through Machine Learning (ML), Algorithm development
* Development of interactive Virtual Reality (VR) environments using sensing modules (VR Head Mount Display (HMD): Vive VR, Leap Motion Sensor, Vive Trackers, stretch sensors, Intel RealSense)

**【Project information】**

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| **Period** | **Research Content** | **Working environment** | **Position** |
| October 2020  ~ October 2021  (12 months)              October 2020  ~ July 2021  (10 months) | **■ Estimating Signal-Dependent Noise (SDN)-based motion variations to enhance gesture recognition (Advanced Robotics)**  - Variations are inevitably generated when human gestures are repeatedly performed. Such variations reduce the accuracy of gesture recognition. This issue can be addressed by increasing the amount of training data. However, this increases the load on the human subjects and the experimenters.  - To address this issue, we proposed an algorithm that predicts changes in gesture movement by superimposing SDN (signal-dependent noise) on muscle activity data generated from a single measured gesture trajectory.  - The predicted data were used to improve the gesture recognition accuracy by 26% when compared to conventional methods. Gestures considered were chop, punch, star, circle (clockwise and anti-clockwise) and slap.  **■ Feature selection and validation of an ML-based lower limb risk assessment tool (MDPI Sensors)**  - Research goal is self-identification of locomotive degradation. ML-based classifiers are used to identify the risk level.  - We use 9 squat and 4 one-leg standing exercise features (obtained through skeletal data) as input parameters to the ML classifiers.  - The output layer of the classifiers is based on Short Test Battery Locomotive Syndrome (STBLS) test used to detect Locomotive Syndrome (LS) approved by the Japanese Orthopedic Association (JOA).  - Best accuracies obtained for test scores of stand-up, 2-stride, and GLFS-25 through Random Forest Regressor were 0.86, 0.79, and 0.73, respectively. | MATLAB  Python  Python | Assistant Professor  Hiroshima University  Assistant Professor  Hiroshima University |
| April 2021  ~ October 2021  (7 months)  April 2018  ~ October 2020  (30 months)            April 2017  -April 2018  (12 months)        July 2014  -May 2015  (10 months)            July 2012  -May 2013  (10 months) | **■ Squat exergame design (HCII 2021)**  - We used VR to design an exergame that combines squat exercise and ski environment with PGM-based force feedback.  - Collectible spheres were placed on the pathway of the user so that optimum squat height is achieved with low risk of injury.  - We monitored different physiological parameters such as Galvanic Skin Response (GSR), body temperature and heartrate during the squat exercises.  - Since GSR indicates the stress level in participants, we observed that providing timed force-feedback during squat tends to reduce stress levels and thus raise the motivation levels to complete the exercise.  .  **■ Soft and wearable upper limb assist and force feedback (IEEE TMRB, AHs 2020, SII 2020, GSIP 2019)**  - In this research, we developed a wearable force feedback and assist suit using artificial muscles called PGMs (specially designed low-pressure artificial muscles).  - During this project, I conducted several experiments (both technical and human-interface) to identify the effects of applying PGM-based actuation on human body during different scenarios.  - I used the prototype in 4 main applications: VR (Virtual Reality) Force Feedback, Navigation Assistance, Rehabilitation Training of elderly, Motor Learning.    **■ Design and development of wrist assist device using pneumatic artificial muscle (PAM) and stretch sensor (ICRA, IEEE RAL)**  - In this research, we developed a wrist assist device that uses a stretch sensor to detect the intent of the user and based on this detection, the corresponding set of PAMs is actuated to support the remainder of the wrist motion.  - In training and evaluation sessions, the majority of subjects showed a statistically significant reduction in muscle actuation when they used the device.  **■ Robot control by Brain-Computer Interaction (BCI)**  - Quadriplegic patients can become partially independent if they can control devices through their functioning part – brain.  - In this research we used BCI technology to control a low-cost robot through facial expressions  - First, we extracted Discrete Wavelet Transform (DWT) coefficients from the Electroencephalography (EEG) data and applied PCA (principal component analysis). The processed data was sent to Artificial Neural Networks (ANNs) for meaningful classification.  - The ANN was integrated with a GUI (Graphical User Interface) for driving robots using the obtained EEG signals.  **■ Performance of hybrid MRC / SC diversity receiver in Rayleigh Fading Channel (CCUBE 2016)**  - Diversity combining techniques are quite significant in wireless communication engineering. We proposed a hybrid diversity scheme combining Maximal Ratio Combining (MRC) and Selection Combining (SC) for the Rayleigh fading channel.  - Performance is evaluated by calculating the outage probability and average bit error rate. | Python  C#  Unity  Pneumatic valves  Arduino  GSR sensors  Vive VR  MATLAB  C#  Python  Unity  LeapMotion  Pneumatic valves  Arduino  sEMG sensors (Delsys)  Stretch sensors  Pneumatic Artificial Muscles  MATLAB  Arduino  sEMG sensors (Oisaka pEMG)  MATLAB  Arduino  Emotiv EPOC  (EEG sensors)  Gyro sensors  Neural Networks  Signal Processing  Mathematica  MATLAB  R  Multisim | Assistant Professor  Hiroshima University  Student (Doctor)  Hiroshima University          Student (Master)  Hiroshima University        Student (Master)  Tezpur University (India)        Student (Bachelor) |

**【Language qualifications】**

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| **Acquisition month** | **Qualification** |
| July 2020 | TOEIC – 945 |
| October 2015 | GRE - 305 |
| August 2021 | JLPT N3 - 120 |

**【Skill list】**

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|  | **Usage experience** |
| 「OS」 Windows | Can install from scratch (10 years) |
| 「OS」 iOS | Can understand and use basic functions, install new apps, and troubleshoot (3 years) |
| MATLAB, Python, Unity | Can write the optimum code according to the situation and give guidance (5 years) |
| C++, C, C#,  Simulink | Can program after reading/ revision (2 years) |
| Sketch, Figma | Beginner, but can easily understand the logic (6 months) |
| Mathematica, Multisim, R | Beginner, but can easily understand the logic (1 year) |

**【PR】**

My greatest strength is being able to work as a team irrespective of the cultural differences. Understanding team members is very important in teamwork. Especially when there is a deadline, I have to think about problem solving with optimal work allocation in a short span, and I am good at that. I have the ability to do futuristic thinking to solve problems with available resources within a given deadline. During college, I mainly participated in the following team projects. (1) Cassie Lowell (Harvard University student) internship project. I was pleased to be a member of the student team at the host institution, participating in her project and helping to achieve technical results in 6 months. (2) Muscleblazer project (presented in Delft, The Netherlands). In this project, it was a big challenge to prepare the hardware (force feedback suit, control circuit) that can operate without failure in the field while fighting with the deadline. I especially prepared the materials to prevent failure in field demonstrations and helped members to solve possible problems immediately. (3) Taoyaka Onsite Team Project (part of the Multicultural Doctoral Program). This was a one-year project, with field experiments. The hardest part of this project was that each team member had different goals (technical, social and cultural). However, by supporting each other, we were able to achieve these goals. Other team members helped me collect technical data, and at the same time I helped the others in doing field research in my data collection site. In this project, I was able to learn how to act and make the best use of a multicultural project.