Waseem Hassan
Postdoc

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Employment

- Post-doctoral researcher at Human Centered Computing, University of Copenhagen — 2023.02.01 – Current
- Research Professor at Computer Science and Engineering Department, Kyung Hee University, South Korea — 2022.11.01 – 2023.02.28
- Post-doctoral researcher at Haptics and Virtual Reality Lab, Kyung Hee University, South Korea — 2022.03.01 – 2022.10.31

Education

- Kyung Hee University, Yongin-si, South Korea — 2016.09.01 – 2022.02.16
  Ph.D. in Computer Engineering
  Title: Towards Haptic Texture Content Library: Texture Synthesis Through Automatic Model Assignment and Texture Authoring in Haptic Attribute Space
  Advisor: Professor Seokhee Jeon
- Kyung Hee University, Yongin-si, South Korea — 2014.09.01 – 2016.08.17
  M.S. in Computer Engineering
  Title: Towards Universal Haptic Library–Library-Based Haptic Texture Assignment Using Image Texture
  Advisor: Professor Seokhee Jeon
- National University of Science and Technology, Pakistan — 2008.09.01 – 2012.08.31
  B.S. in Electrical (Telecomm) Engineering

Research Interests

Haptic texture perception and psychophysics
Machine learning for haptic content automation
Wearable and modular haptic interfaces (Hardware and Software)
Soft pneumatics for wearable haptics

Teaching

- CSE20800 Technical English 1
- CSE30900 Technical English 3

Honors and Awards

- Best student innovation challenge award, World Haptics Conference (WHC) 2019
- Outstanding paper award, Ubiquitous Robotics and Ambient Intelligence (URAI) 2019
- Outstanding paper award, Korean Computer Congress (KCC) 2016
- Doctoral research scholarship, 2016 – 2022
- Masters research scholarship, 2014 – 2016
- Graduate student scholarship, Kyung Hee University, 2014 – 2022

- President Telecomm Society at MCS, National University of Science and Technology 2011 – 2012
- Sports prefect at MCS, National University of Science and Technology 2011 – 2012
- Undergraduate merit scholarship, National University of Science and Technology, 2008 – 2009

Projects

1. Haptic Modeling and Rendering Technology for Mirror World, Global Frontier, NRF Korea (2014 - 2022)
2. Perceptual Performance Enhancement of Ultrasonic Haptic Display, ETRI Korea (2016 - 2017)
3. HD Haptic Technology for Hyper Reality Contents, MSIP, IITP (2017 - 2019)
4. Drone-Based Haptic Interface with Unlimited Workspace, Basic Research, NRF Korea (2017 - 2019)
5. Development of Virtual Objects Interaction Techniques in Life-Safety Situations, Ministry of the Interior and Safety (2019 - current)
6. Haptic simulation technology for moving interface, Hyundai Korea (2022.03 - current)

Research Highlights

Image Texture and Perception Based Automatic Haptic Model Assignment

Lack of haptic contents is one of the major bottlenecks in current haptics technology. This research aims at developing a framework for efficient haptic model building based on data from image features of textures and their perceptual haptic attributes. In this work, we associate data-driven haptic models, for stiffness, friction, and surface texture, with their image features and construct "The Haptic Texture Contents Library." Then, we seek for new perception and image-based techniques to automatically assign the acquired models into 3D mesh models.

Establishing Haptic Texture Attribute Space and Predicting Haptic Texture Attributes

This project strives to provide a haptic attribute space where texture surfaces are located based on their haptic attributes. The main aim of the haptic attribute space is to come up with a standardized model for representing and identifying haptic textures analogous to the RGB model for colors. To this end, a four dimensional haptic attribute space is established by conducting a psychophysical experiment where human participants rate 100 real-life texture surfaces according to their haptic attributes. The generalization and scalability of the haptic attribute space is achieved by training a 1D-CNN model for predicting attributes of haptic textures. The 1D-CNN is trained using the attribute data from psychophysical experiments and image features collected from the images of real textures.

Haptic Texture Authoring

It would facilitate contents generation if we could freely edit the perceptual properties of real measurements, e.g., creating a new haptic texture having a slightly increased roughness from a real surface, a new texture where the roughness value is inherited from one and hardness from another, and a texture that can be perceived as lying exactly in the middle of two real textures. Efficiently creating such textures from real textures is the goal of present work, and we call this as haptic texture authoring. Texture authoring is achieved by establishing an association between physical attributes of data-driven texture models and their haptic perception. This association is represented in the form of a 2D space containing real textures as functions of their haptic attributes. Textures within this space having arbitrary perceptual attributes can be rendered on various haptic interfaces.

On Demand Haptics

The main aim of this study is to establish wireless wearable modular haptic interfaces designated for specific haptic feedback. These modules can be stacked together or used individually to provide a multitude of haptic feedback depending on the application. Currently, the system contains standalone modules for providing vibrations, pressure, impulse, and thermal feedback.

HapWheel

This project presents a novel steering design that contains ubiquitous haptic displays embedded into a steering wheel. The haptic displays are used to interact with the different in-car control functionalities. The main purpose of this design is to reduce sensory demand on the visual and cognitive senses and use haptic

communication for interacting with in-car controls. The steering wheel provides haptic feedback in the form of associative vibrotactile feedback as positive reinforcement. The designed steering wheel is readily deployable into all current automobiles without significant overload. The user testing has suggested that the design is easy to adapt for new users and significantly reduces manual, visual, and cognitive distractions in an automotive context.

Publications: Journal Articles

1. **Waseem Hassan**, Joolekha Bibi Joolee, and Seokhee Jeon, "Establishing Haptic Texture Attribute Space and Predicting Haptic Attributes From Image Features Using 1D-CNN", Scientific Reports 13, no. 1: 11684 (2023).
2. CheolWoo Lee, Seokhee Jeon, **Waseem Hassan**, HyeongYeop Kang, "VR unseen gaze: Inducing feeling of being stared at in virtual reality", Virtual Reality, (2023): 1-20
3. Talhan, Aishwari, Sanjeet Kumar, Hwangil Kim, **Waseem Hassan**, and Seokhee Jeon. "Multi-Mode Soft Haptic Thimble for Haptic Augmented Reality Based Application of Texture Overlaying." Displays 74 (2022): 102272.
4. **Waseem Hassan**, Ahsan Raza, Muhammad Abdullah, Hashem, Mohammad Shadman, Seokhee Jeon., "HapWheel: Bringing in-Car Controls to Driver's Fingertips by Embedding Ubiquitous Haptic Displays into a Steering Wheel." IEEE Transactions on Intelligent Transportation Systems, 2022.
5. Hashem, Mohammad Shadman, Joolekha Bibi Joolee, **Waseem Hassan**, and Seokhee Jeon. "Soft Pneumatic Fingertip Actuator Incorporating a Dual Air Chamber to Generate Multi-Mode Simultaneous Tactile Feedback." Applied Sciences 12, no. 1 (2022): 175.
6. **Waseem Hassan**, Hwangil Kim, Aishwari Talhan, and Seokhee Jeon. "A Pneumatically-Actuated Mouse for Delivering Multimodal Haptic Feedback." Applied Sciences 10, no. 16(2020): 5611
7. **Waseem Hassan**, Arsen Abdulali, and Seokhee Jeon. "Authoring new haptic textures based on interpolation of real textures in affective space." IEEE Transactions on Industrial Electronics 67, no. 1 (2019): 667-676.
8. Raza, Ahsan, **Waseem Hassan**, Tatyana Ogay, Inwook Hwang, and Seokhee Jeon. "Perceptually correct haptic rendering in mid-air using ultrasound phased array." IEEE Transactions on Industrial Electronics 67, no. 1 (2019): 736-745.
9. **Waseem Hassan**, Arsen Abdulali, Muhammad Abdullah, Sang Chul Ahn, and Seokhee Jeon. "Towards universal haptic library: Library-based haptic texture assignment using image texture and perceptual space." IEEE Transactions on Haptics 11, no. 2 (2017): 291-303.
10. Ali, Taqdir, Maqbool Hussain, Wajahat Ali Khan, Muhammad Afzal, Jamil Hussain, Rahman Ali, **Waseem Hassan**, Arif Jamshed, Byeong Ho Kang, and Sungyoung Lee. "Multi-model-based interactive authoring environment for creating shareable medical knowledge." Computer methods and programs in biomedicine 150 (2017): 41-72.
11. Abdulali, Arsen, **Waseem Hassan**, and Seokhee Jeon. "Stimuli-magnitude-adaptive sample selection for data-driven haptic modeling." Entropy 18, no. 6 (2016): 222.
12. Idris, Muhammad, Shujaat Hussain, Muhammad Hameed Siddiqi, **Waseem Hassan**, Hafiz Syed Muhammad Bilal, and Sungyoung Lee. "MRPack: Multi-algorithm execution using compute-intensive approach in map reduce." Plos One 10, no. 8 (2015): e0136259.

Publications: Conference Papers (Peer Reviewed)

1. Mudassir Ibrahim Awan*, **Waseem Hassan***, Seokhee Jeon. "Predicting Perceptual Haptic Attributes of Textured Surface from Tactile Data Based on Deep CNN-LSTM Network", Proceedings of the 29th ACM Symposium on Virtual Reality Software and Technology.
2. Mudassir Ibrahim Awan*, Tatyana Ogay*, **Waseem Hassan***, Dongbeom Ko, Sungjoo Kang, Seokhee Jeon. "Model-Mediated Teleoperation for Remote Haptic Texture Sharing: Initial Study of Online Texture Modeling and Rendering." IEEE International Conference on Robotics and Automation (ICRA) 2023
3. Hashem, Mohammad Shadman, Joolekha Bibi Joolee, **Waseem Hassan**, and Seokhee Jeon." A Silicone Based Finger-Tip Pneumatic Actuator to Render Multi-Mode Haptic Feedback." 18th International Conference on Ubiquitous Robots (UR), 2021
4. Seo, Sang-Woo, SeungJoon Kwon, **Waseem Hassan**, Aishwari Talhan, and Seokhee Jeon. "Interactive virtual-reality fire extinguisher with haptic feedback." In 25th ACM Symposium on Virtual Reality Software and Technology, pp. 1-2. 2019.

5. **Waseem Hassan**, Arsen Abdulali, and Seokhee Jeon. "Haptic Texture Authoring: A Demonstration." In International AsiaHaptics conference, pp. 18-20. Springer, Singapore, 2018.
6. Abdulali, Arsen, **Waseem Hassan**, Baek Seung Jin, and Seokhee Jeon. "Hands-On Demonstration of Heterogeneous Haptic Texturing of Mesh Models Based on Image Textures." In International AsiaHaptics conference, pp. 61-65. Springer, Singapore, 2018.
7. Raza, Ahsan, Muhammad Abdullah, **Waseem Hassan**, Arsen Abdulali, Aishwari Talhan, and Seokhee Jeon. "Painting Skill Transfer Through Haptic Channel." In International AsiaHaptics conference, pp. 66-68. Springer, Singapore, 2018.
8. Rakhmatov, Ruslan, Arsen Abdulali, **Waseem Hassan**, Minji Kim, and Seokhee Jeon. "Virtual reality bicycle with data-driven vibrotactile responses from road surface textures." In 2018 IEEE Games, Entertainment, Media Conference (GEM), pp. 1-9. IEEE, 2018.
9. Abdullah, Muhammad, **Waseem Hassan**, Ahsan Raza, and Seokhee Jeon. "Haptic Logos: Insight into the feasibility of digital haptic branding." In International conference on human haptic sensing and touch enabled computer applications, pp. 696-708. Springer, Cham, 2018.
10. Abdullah, Muhammad, Minji Kim, **Waseem Hassan**, Yoshihiro Kuroda, and Seokhee Jeon. "HapticDrone: An encountered-type kinesthetic haptic interface with controllable force feedback: Example of stiffness and weight rendering." In 2018 IEEE Haptics Symposium (HAPTICS), pp. 334-339. IEEE, 2018.
11. Abdullah, Muhammad, Minji Kim, **Waseem Hassan**, Yoshihiro Kuroda, and Seokhee Jeon. "HapticDrone: An encountered-type kinesthetic haptic interface with controllable force feedback: Initial example for 1d haptic feedback." In Adjunct Publication of the 30th Annual ACM Symposium on User Interface Software and Technology, pp. 115-117. 2017.
12. **Waseem Hassan**, Arsen Abdulali, and Seokhee Jeon. "Perceptual thresholds for haptic texture discrimination." In 2017 14th International Conference on Ubiquitous Robots and Ambient Intelligence (URAI), pp. 293-298. IEEE, 2017. **[Outstanding paper award]**
13. Abdulali, Arsen, **Waseem Hassan**, and Seokhee Jeon. "Sample selection of multi-trial data for data-driven haptic texture modeling." In 2017 IEEE World Haptics Conference (WHC), pp. 66-71. IEEE, 2017.
14. **Waseem Hassan**, and Seokhee Jeon. "Evaluating differences between bare-handed and tool-based interaction in perceptual space." In 2016 IEEE Haptics Symposium (HAPTICS), pp. 185-191. IEEE, 2016.
15. **Waseem Hassan**, and Seokhee Jeon. "Building haptic texture perceptual space from real-life textured surfaces using multidimensional scaling." Korean Computer Congress (2016): 1390-1392. **[Outstanding paper award]**

Publications: Non-refereed Conference Papers/Poster/Demo/Abstract

1. **Waseem Hassan**, Raza, A., Abdullah, M., Jeon, S., "Friction Wheel: Bringing in-Car Controls to Driver's Fingertips by Embedding Dual Ubiquitous Haptic Friction Displays into a Steering Wheel." Student innovation challenge, World Haptics conference 2019. **[Best Student Innovation Challenge Award]**
2. **Waseem Hassan**, and Seokhee Jeon, "Heterogeneous Haptic Texture Assignment to Mesh Models Based on Image." Demonstration, SIGGRAPH 2019
3. **Waseem Hassan**, Aishwari Talhan, Tatyana Ogay, Hwangil Kim, and Seokhee Jeon, "Tactile and Kinesthetic Feedback for Safety Experience/Training Simulators: A Case Study of Fire Extinguisher.", Demonstration, SIGGRAPH 2019
4. **Waseem Hassan**, Arsen Abdulali, and Seokhee Jeon, "Authoring New Haptic Textures Based on Interpolation of Real Textures in Affective Space: A Demo", Demonstration, Haptics Symposium 2018
5. **Waseem Hassan**, and Seokhee Jeon, "Towards Universal Haptic Library Library-Based Haptic Texture Selection Using Image Texture", WIP, Eurohaptics. 2016
6. **Waseem Hassan**, Arsen Abdulali, and Seokhee Jeon, 'Towards Universal Haptic Library: Library-Based Haptic Texture Selection Using Image Texture", Demonstration, Eurohaptics. 2016

Patents

1. **Waseem Hassan**, Raza, A., Abdullah, M., Jeon, S., "Apparatus for controlling electronic function module in the vehicle using steering wheel with dual ubiquitous haptic sensor." South Korean patent 1022757610000, registered July 5, 2021

2. **Waseem Hassan**, Jeon, S. “Haptic Cigarette: Creating perception of smoking using vibrotactile haptic feedback”. South Korean Patent **(Application Pending)**
3. **Waseem Hassan**, Joolee, J.B., and, Jeon, S. “Establishing Haptic Texture Attribute Space and Predicting Haptic Attributes from Image Features Using 1D-CNN” South Korean Patent **(Application Pending)**

Professional Reviews

1. IEEE Transactions on Haptics (2016 - current)
2. IEEE Transactions on Industrial Electronics (2018 – special issue on Haptics)
3. IEEE Robotics and Automation Letters (2019 - current)
4. IEEE Haptics Symposium (2016 - current)
5. IEEE World Haptics Conference (2016 - current)
6. EuroHaptics Conference (2018 - current)
7. AsiaHaptics Conference (2016 - current)
8. The International Conference on Robotics and Automation (2022 - current)
9. IEEE Virtual Reality Conference (2018 - current)
10. ACM Augmented Humans Conference (2021)
11. IEEE Transactions on Vehicular Technology (2022)

Professional References

1. Dr. Seokhee Jeon
   Designation: Associate Professor
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2. Dr. Seungkyu Lee
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3. Dr. Noman Akbar
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   Relation: Senior Graduate lab mate and undergraduate classmate
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