Shamima Yasmin, PhD

Associate Professor, Computer Science and Electrical Engineering Department
Eastern Washington University
Office: Catalyst 333
601 E. Riverside Avenue, Spokane, WA 99201
Email: syasmin@ewu.edu

APPOINTMENTS

- Associate Professor, Eastern Washington University, September, 2021- present.
- Assistant Professor, Eastern Washington University, September, 2015- August, 2021.
- Postdoctoral Research Scholar, Arizona State University, December, 2013- September, 2015.
- Postdoctoral Research Scholar, The University of Texas at San Antonio, November, 2012- November, 2013.
- Research Associate, Nanyang Technological University, Singapore, February, 2010- November, 2012.

EDUCATION

- PhD, Universiti Sains Malaysia, Malaysia (March, 2010). Thesis entitled "3D Morphing and Shape Transformation Using Slices".
- MSc, Computer Science, University of New South Wales, Australia (2004).
- BSc, Civil Engineering, Bangladesh University of Engineering and Technology (1995).

SCHOLARSHIP/ AWARDS

- Commonwealth Scholarship (full) awarded by Malaysia government for PhD program at Universiti Sains Malaysia, Malaysia.
- AusAID Scholarship (full) awarded by Australia government for Master's program in Computer Science, University of New South Wales, Australia.

TEACHING EXPERIENCE

- **General Courses**
  - C and Unix Programming (CSCD 240)
  - C++ Programming (CSCD 305)

- **Specialized Courses**
  - Introductory Computer Graphics (CSCD377)
  - 3D Computer Graphics Principles (CSCD 470/570)
  - Advanced Computer Graphics (CSCD 471)
  - Virtual Reality and Data Visualization (CSCD477/577)

RESEARCH INTERESTS

- 3D geometric modeling, data visualization, haptics-based applications. See **Research projects** on page 7 for detail.

STUDENT SUPERVISION AND RESEARCH

1. Erik Almaguer, an undergraduate Computer Science (CS) student and a McNair scholar worked on data visualization using WebGL and haptic virtual environments. This research resulted in a joint publication, presentations at international and local conferences and NCUR.

2. Robert Moreno, an undergraduate CS student built a software tool for the deaf and hard-of-hearing to learn how to speak. This research resulted in a joint publication and presentations at international and local conferences.

3. Rihanna Quick, an undergraduate CS student built a haptic-enhanced software tool on molecular docking. This research resulted in a joint publication and a presentation.

4. Richard Lefebvre, a graduate CS student worked on presenting multivariate data in a multimodal environment by incorporating multiples senses, i.e., audio, vision, and touch.

5. Zane Chalich, an undergraduate CS student conducted research on physics-based simulation. Submission for NCUR 2021 is under review.

6. Angel Bermudez, an undergraduate CS student conducted research on ray tracing and music-enhanced data presentations. Submission for NCUR 2021 is under review.

7. Sarah Reavis, an undergraduate CS student conducted research on ray tracing and multimodal ray tracing in exposure therapy applications.

8. Joa Robak, an undergraduate CS student conducted research on incorporating instancing in data visualization and developed an application called “The Dancing Data Table”.

9. Dillon Dalton, an undergraduate CS student conducted research on the feasibility of game-based learning in secondary education.

10. Graduate Committee Member for Toshiaki Ueno, Master’s student, Eastern Washington University (thesis title “Character extraction from ancient Chinese stele using discrete cosine transform”; thesis successfully defended in winter 2016).

11. Graduate Committee Member for Marco Karier, Master’s student, Eastern Washington University (thesis title “Using Gaussian blur, Sobel edge detection and Hu moments to match Kanji calligraphy”, thesis successfully defended in fall 2018).

PUBLICATIONS AND PRESENTATIONS

A. Journal Publications

1. S. Yasmin, “**Virtual Reality and Assistive Technologies: A Survey**”, *International Journal of Virtual Reality*, Volume 18 (02), pp. 30-57, 2018.

2. S. Yasmin, N. Du, J. Chen and Y. Feng, “**A Haptic-enabled Novel Approach to Cardiovascular Visualization**”, *Computer Animation and Virtual Worlds*, Volume 25, 3-4, pp. 255-269, 2014.

3. S. Yasmin and A. Sourin, "**Image-based Virtual Palpation**", *Transactions on Computational Science XVIII Lecture Notes in Computer Science*, Volume 7848, pp. 61-80, 2013.

B. Conference Publications

1. Shamima Yasmin, "**Haptic Selfies: Bold and Beautiful Living for the Blind and Visually Impaired**". *In 26th ACM Symposium on Virtual Reality Software and Technology (VRST'20)*. Association for Computing Machinery, New York, NY, USA, Article 54, 1–3. DOI: https://doi.org/10.1145/3385956.3422129

2. Shamima Yasmin and Rhianna Quick, "**Molecular Binding in a Visuohaptic Environment: An Enhanced Approach in STEM Learning**". *In workshop on Molecular Graphics and Visual Analysis of Molecular Data (MolVA2020).* The Eurographics Association, 1-5. DOI: https://doi.org/10.2312/molva.20201095

3. S. Yasmin, "**Data Presentation with Haptic Glyphs: A Pilot Study**", in *Proceedings of VRCAI '19: The 17th International Conference on Virtual-Reality Continuum and its Applications in Industry*, November 14-16, 2019, Brisbane, Australia. https://doi.org/10.1145/3359997.3365711

4. S. Yasmin, "**A Glyph-based Multimodal Presentation of Multivariate Data**", in *Proceedings of 25th ACM Symposium on Virtual Reality Software and Technology (VRST'19)*, November 12-15, 2019, Sydney, Australia. https://doi.org/10.1145/3359996.3364735

5. S. Yasmin, "**A Haptic-enhanced New Approach to Laryngoscopy**", in *Proceedings of 25th ACM Symposium on Virtual Reality Software and Technology (VRST'19)*, November 12-15, 2019, Sydney, Australia. https://doi.org/10.1145/3359996.3364736

6. E. Almaguer and S. Yasmin, "**A Haptic Virtual Kitchen for the Cognitive Empowerment of Children with Autism Spectrum Disorder**". In: *Stephanidis C., Antona M. (eds) HCI International 2019 – Late Breaking Posters. HCII 2019. Communications in Computer and Information Science, vol 1088. Springer, Cham*, July 26-31, 2019, Orlando, Florida. https://doi.org/10.1007/978-3-030-30712-7_18

7. R. Moreno and S. Yasmin, "**A Software Tool for the Deaf and Hard-of-Hearing to Learn How to Speak**" In: *Stephanidis C., Antona M. (eds) HCI International 2019 – Late Breaking Posters. HCII 2019. Communications in Computer and Information Science, vol 1088. Springer, Cham*, July 26-31, 2019, Orlando, Florida. https://doi.org/10.1007/978-3-030-30712-7_22

8. S. Yasmin, "**Data Visualization versus Data Perception**", in *Proceedings of VRST '17 Proceedings of the 23rd ACM Symposium on Virtual Reality Software and Technology (VRST 2017)*, November 8-10, 2017, Gothenburg, Sweden.

9. S. Yasmin and S. Panchanathan, "**Haptic Mirror: A Platform for Active Exploration of Facial Expressions by Individuals who are Blind**", in *Proceedings of the 15th ACM SIGGRAPH International Conference on Virtual-Reality Continuum and its Applications in Industry (VRCAI 2016)*, pp. 319-329, December 3-4, 2016, Zhuhai, China.

10. S. Yasmin, T. McDaniel and S. Panchanathan, "**A Haptic-based Application for Active Exploration of Facial Expressions by the Visually Impaired**", in *Proceedings of 10th International Symposium on Visual Computing (ISVC)*, pp. 357-366, 2014, Las Vegas.

11. S. Yasmin and A. Sourin, "**A New Approach to Virtual Palpation**", in *Proceedings of International Conference on Virtual Reality Continuum and Its Applications in Industry (VRCAI)*, pp. 203-211, 2012, Singapore.
12. S. Yasmin and A.Sourin, "**Virtual Palpation for Medical Training in Cyberworlds**", in *Proceedings of International Conference on Cyberworlds*, pp. 207-214, 2012, Darmstadt, Germany.

13. A. Sourin and S. Yasmin, "**Haptic Editing of MRI Brain Data**", in *Proceedings of Medicine Meets Virtual Reality (MMVR-19)*, pp. 490-496, February 9 - 11, 2012, Newport Beach, California.

14. S. Yasmin and A. Sourin, "**Towards Virtual Haptic Palpation**", in *Proceedings of International Conference on Computer Animation and Social Agents (CASA)*, pp. 21- 24, 2012, Singapore.

15. S. Yasmin and A. Z. Talib, "**Parallel Shape Transformation Using Slices**", in *SEPADS'11 Proceedings of the 10th World Scientific and Engineering Academy and Society (WSEAS) International Conference on Software engineering, parallel and distributed systems*, February 20 -22, 2011, Cambridge, UK.

16. A. Sourin, S. Yasmin and V. Zagorodnov, "**Segmentation of MRI Brain Data using a Haptic Device**", in *Proceedings of 10th IEEE International Conference on Information Technology and Applications in Biomedicine*, November 3 -5, 2010, Corfu, Greece.

17. S. Yasmin and A. Z. Talib, "**A New Approach for Surface Reconstruction Using Slices**", in *Proceedings of International Conference on Computational Science 2009 (G. Allen et. al., ed.), vol. 5545 of Lecture Notes Computer Science, (Berlin-Heidelberg)*, pp. 790-800, Springer-Verlag, 2009, Baton Rouge, Louisiana, US.

18. S. Yasmin and A. Z. Talib, "**Shape Transformation of Multiple Objects Using Slices**", in *Communication Papers Proceedings of the 17th International Conference on Computer Graphics, Visualization and Computer Vision (WSCG)*, pp. 25-32, 2009, Prague, Czech Republic.

19. S. Yasmin and A. Z. Talib, "**A Method for 3D Morphing Using Slices**", in *Proceedings of International Conference on Computer Graphics, Theory and Applications (GRAPP)*, pp. 292-301, 2009, Lisboa, Portugal.

C. Poster Presentations

1. S. Yasmin, "**Haptic Selfies: Bold and Beautiful Living for the Blind and Visually Impaired**", work-in-progress poster presented virtually via discord at 26th ACM Symposium on Virtual Reality Software and Technology (VRST 2020), November 2-4, Virtual Events, Canada.

2. S. Yasmin, "**Can Haptic Selfies Help the Blind and Visually Impaired Live Boldly and Beautifully?**", work-in-progress poster presented (virtually via zoom) at Eurohaptics 2020, September 6-9, 2020, Leiden, Netherlands.

3. S. Yasmin and R. Quick, "**Molecular Binding in a Visuohaptic Environment: An Enhanced Approach in STEM Learning**". The research article was published in a workshop proceeding on Molecular Graphics and Visual Analysis of Molecular Data (MolVA2020) and is available at https://doi.org/10.2312/molva.20201095. A power point presentation was made via zoom on May 25th, 2020. Email correspondence is available under **Professional and Scholarly Activity/Presentation**.

2. S. Yasmin, "**A Haptic-based Novel Approach to Laryngoscopy**", work-in-progress poster presented at EuroHaptics 2018, Pisa, Italy, 2018.

3. S. Yasmin, "**Data Visulaization versus Data Perception**", work-in-progress poster presented at IEEE World Haptics, 2017, Frustenfeldbruck, Munich, Germany, 2017.

4. S. Yasmin, "**iHap: An Interactive Haptic-based Application for Active Exploration of Facial Expressions by Individuals Who are Blind**", work-in-progress poster presented at EuroHaptics 2016, Imperial College London, UK, 2016.

5. S. Yasmin, "**Haptics in Social Interaction and STEM Education**", poster presentation at S.M.A3.R.T. (Successful: Mentoring, Administration, Advising, Arts, Research and Teaching) faculty and staff poster session, 19th Annual Research & Creative Works Symposium, May 16-18, 2016, EWU.

6. S. Yasmin, and S. Panchanathan, "**iHap: towards a Vision Substitution System for Active Analysis of Facial Expressions**", in Proceedings of ACM SIGGRAPH Symposium on Interactive 3D Graphics and Games (I3D), p. 131, San Francisco, 2015.

7. S. Yasmin, T. McDaniel, and S. Panchanathan, "**Haptic Mirror for Active Exploration of Facial Expressions by Individuals Who are Blind**", in *Proceedings of ACM Symposium on Applied Perception (SAP)*, p.133, Vancouver, Canada, 2014.

GRANT ACTIVITIES

1. **(PI) Can Haptic Selfies Help the Blind and Visually Impaired Live Boldly and Beautifully?** EWU Faculty Grants for Research and Creative Works (FGRCW), $9,978.36, submitted on October, 2020, (**funded**).

2. **(PI) Enhanced Accessibility for Learning via Inclusive and Diverse Multimodal Approaches**, NSF Program Solicitation No. 19-508, EHR Core Research (ECR), STEM Learning and Learning Environments, Broadening Participation, and Workforce Development, submitted on September 2020, requested amount $399,786 (**not funded**).

3. (**PI**), "**Learning in a Multimodal Environment: An Approach toward STEM Education for the Blind and Visually Impaired**", EWU Faculty Grants for Research and Creative Works (FGRCW), $9,935, submitted on October, 2018, (**funded**).

4. (**PI**) "**Haptic Mirror: A Platform for Active Exploration of Facial Expressions and Social Interaction**", NSF solicitation no. 16-581, organization Unit –IIS- Cyber Human Systems (CHS), submitted on November 2016, requested amount $ 459,040 (not funded).

PROFESSIONAL SERVICE

A. Conference Organizer

1. Co-chair of the parallel session entitled **"Haptics for Assistive, Rehabilitative and Healthcare Technologies"** at the 9th International Conference on Universal Access in Human-Computer Interaction in the context of HCI International 2015, Los Angeles, California.

B. Reviewer

1. Grant Proposals

i. Served as a panelist at National Science Foundation's (NSF) core research programs. (July, 2018)
ii. Worked as a reviewer for research proposals for National Science Foundation's (NSF) core research programs. (July, 2018)
iii. Worked as a reviewer for proposals for the University of Texas at San Antonio (UTSA) Limited Submissions DoD HBCU/MI. (August, 2017)

2. Journals

i. Transactions on Accessible Computing (TACCESS). (2020)
ii. International Journal of Human-Computer Interaction (IJHCI). (2019)
iii. International Journal of Virtual Reality (IJVR). (2018)
iv. IET Computer Vision and EURASIP. (2013)

3. Conference Articles

i. ACM CHI Conference on Human Factors in Computing Systems (https://sigchi.org/conferences/upcoming-conferences/). (2020)

ii. IEEE Virtual Reality (http://www.ieeevr.org/). (2017)

iii. WSCG conference on Computer Graphics, Visualization and Computer Vision (http://www.wscg.cz). (2015)

C. Memberships

1. Member, The American Chemical Society (ACS), since 2020.
2. Member, ACM SIGACCESS, since 2019.
3. Member, IEEE, since 2017.
4. Professional member, Association of Computing Machinery ACM), since 2016.
5. Member, ACM SIGGRAPH, since 2014.

RESEARCH PROJECTS

A. Current Projects

1. **Haptic Mirror: An Interactive Haptic-based Application for Active Exploration of Facial Expressions by Individuals Who are blind** (2014 - ongoing)

   This project aims towards the development of a fine-grained assistive tool called 'Haptic mirror', an interactive haptic-based application, which is basically an "Explore-learn-interaction" paradigm. A blind individual accesses his own facial expressions in a dynamic haptic environment which may be comparable to a visual mirror. Next, he masters movements of his own facial features for different expressions via exploration of his self-reflection in a virtual environment to become capable of interpreting others' facial expressions.

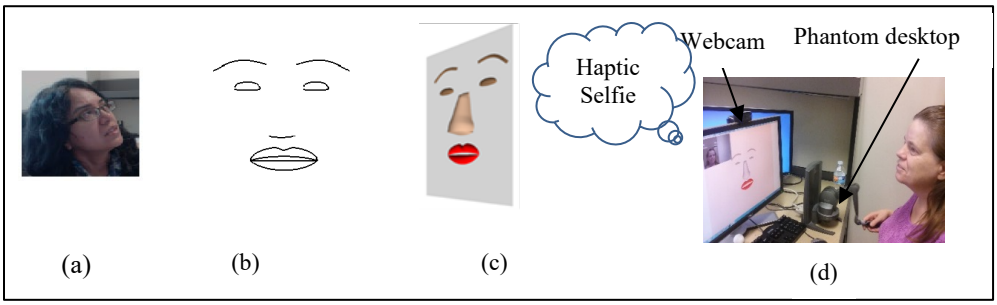

Figure 1. Workflow of the proposed approach:(a) webcam screenshot of a particular pose, (b) corresponding normalized facial features, (c) simplified 3D model of the normalized facial features, (d) pilot 'Haptic mirror' model developed from off-the-shelf equipment being used for exploring facial expressions by a blind participant.

2. **Data Visualization versus Data Perception** (2017 – ongoing)
   Semantic rendering of an object through haptic or touch-based integration can make a visual learning method accessible to the visually impaired (VI). A haptics-enhanced interactive environment can improve the accessibility of learning materials across STEM fields for the blind and VI students. Additionally, a virtual environment (VE) that involves multiple senses (visual, audio, and haptic) provides better immersion to the sighted population and can be an effective source of motivation and edutainment.

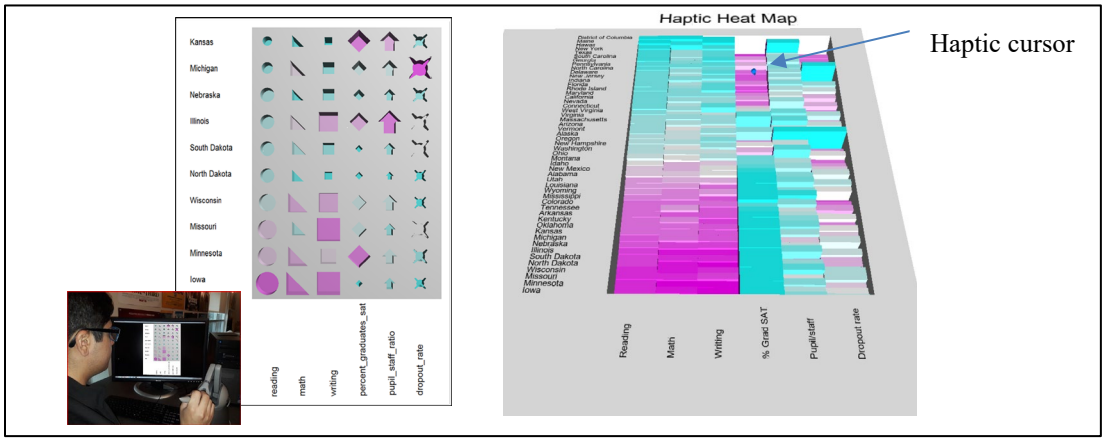

Figure 2. (Left) A multimodal presentation of multivariate data in use by a student; the multimodal environment incorporates three senses, i.e., audio, visual, and haptic; data is made tangible with a haptic device as demonstrated in the figure; (right) a haptic-enhanced presentation of a heat map.

3. **Haptic Virtual Environment for Cognitive Empowerment** (2018- ongoing)

A haptic virtual environment is created with a unity game engine, 3D Systems' OpenHaptics software, touch haptic devices, and a Head-mounted display (HMD). A haptic virtual kitchen is being developed for a better immersive effect and cognitive empowerment of autistic children.

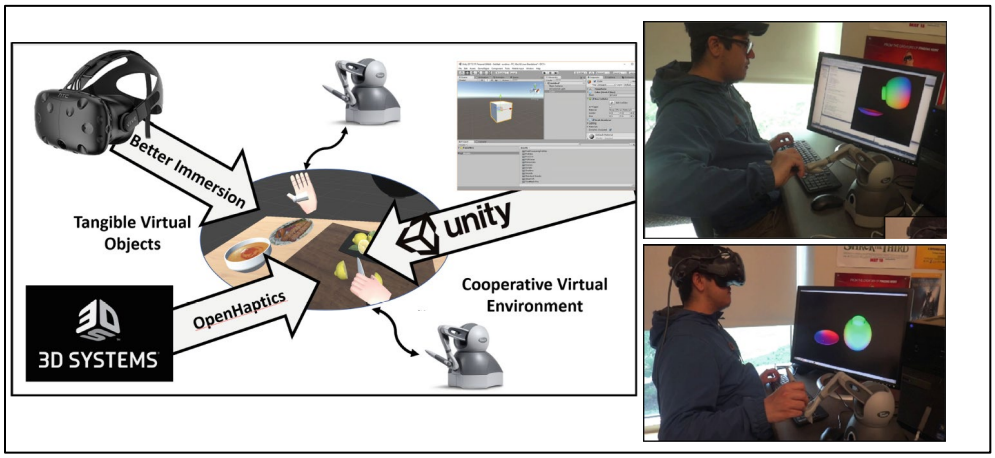

Figure 3: (Left) Different components of a haptic virtual environment: a unity game engine, 3D Systems' OpenHaptics software, touch haptic devices, and a HMD device; (right) a normal (non-autistic) user is interacting with the pilot haptic virtual kitchen (right-top) without a HMD and (right-bottom) with a HMD.

4. **A Haptic-enhanced New Approach to Laryngoscopy** (2018 – ongoing)

Laryngoscopy or endotracheal intubation is a common medical procedure where a tube is passed into the lungs of patients for providing oxygen or other anesthetic gas. After some feasibility study, a preliminary application for a haptics-based laryngoscopy has been outlined, which can be better understood from the picture below.

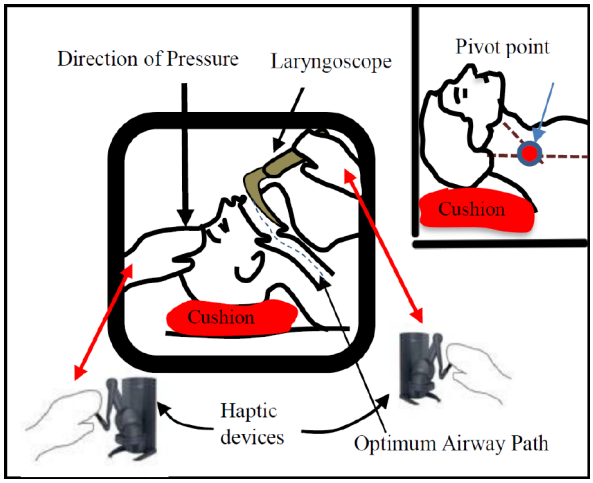

Figure 4: (Left) The proposed haptic virtual laryngoscopy setup; two haptic devices are used. The left haptic device is used for exerting vertical pressure to balance the patient's body and the right one demonstrates the intubation step where the stylus of the haptic device replicated a laryngoscope.

5. A Molecular Docking Application using a Haptic VE (2019 – ongoing)

A haptic molecular docking application has been developed using OpenHaptics' HL API with HD call back functions. As the user enters into 'Docking' mode, the haptic cursor (representing itself as a molecule moving around the environment) gets attracted to the center of another molecule if it is within a certain radius of it. The two molecules are then combined into one complex molecule. In 'Docking' mode, the user feels the force feedback as one molecule joins the other. Below are some outputs of this molecular docking application that demonstrate how single molecules are combined to form complex molecules.

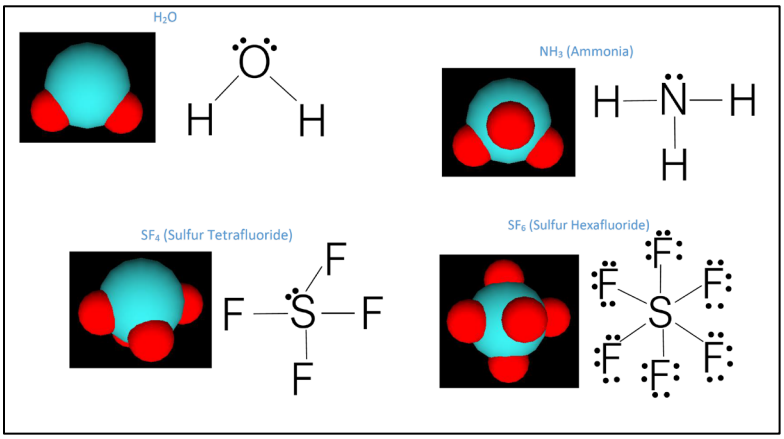

Figure 5: Some generated outputs from the haptic molecular docking application.

B. Previous projects:

1. 3D Reconstruction of Coronary Artery from IVUS Images

This application identifies plaque deposit as well as stenosis (narrowing) of a normal artery in a tangible 3D environment. A catheter probe haptically detects and differentiates stiffness between the plaque and non-plaque portions of the artery.

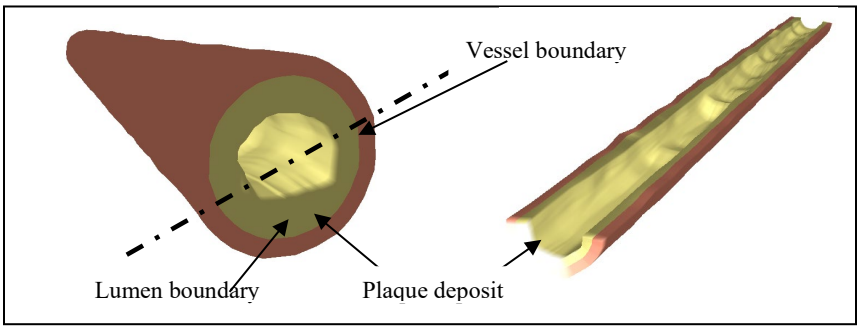

Figure 6: 3D reconstruction of coronary artery model from IVUS images and differentiation of plaque deposit in the artery tunnel.

2. Virtual Palpation for Medical Training

A user can feel the impression of real-life palpation in a virtual environment. Along with palpation, simultaneous breathe-in and breathe-out of the virtual patient have also been

observed. The virtual patient has been modeled with 2D images with underlying organs defined as implicit functions.

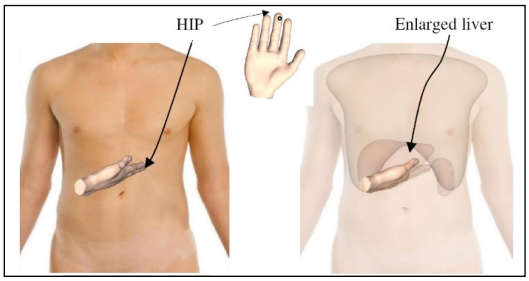

Figure 7: A haptic palm represented as haptic interaction point (HIP) palpating an inflamed liver in a virtual body.

3. Haptic Editing of MRI Brain Data

This application deals with the haptic-enhanced editing of MRI brain data. Visual impression is combined with tactile awareness while locating and editing erroneous portions of the surface.

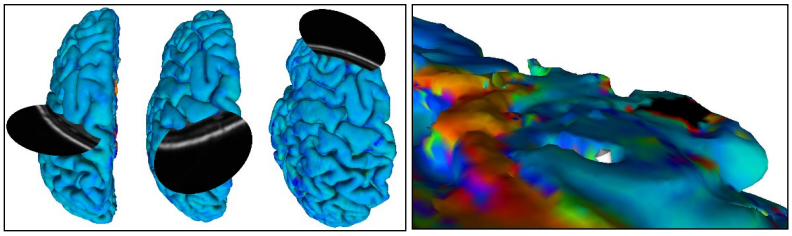

Figure 8: (Left) Representation of MRI brain data with a haptic cursor shown as a disk set at different angles at different positions and (right) a groove is being cut with a haptic cursor displayed as a white cone.

4. 3D Morphing and Shape Transformation using Slices

i. Developed a new 3D shape transformation algorithm from slices. Some outputs of the project are mentioned below.

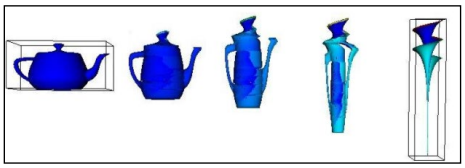

Figure 9: Gradual morphing sequence between two objects.

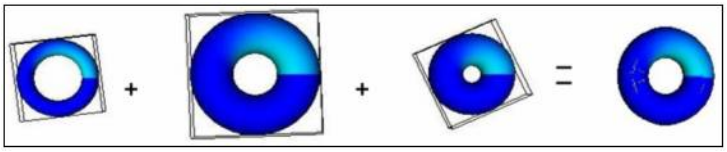

Figure 10: Shape transformation involving three objects.

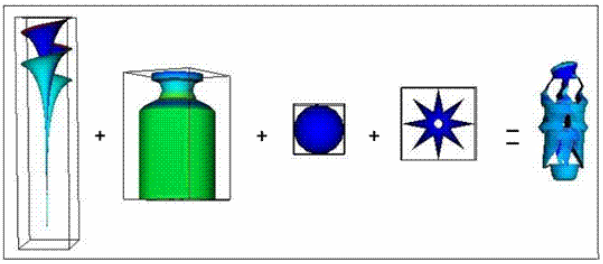

Figure 11: Shape transformation involving four objects.

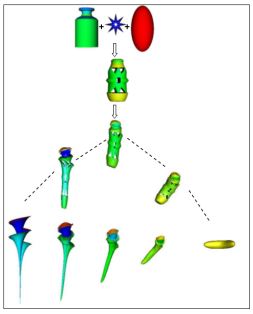

Figure 12: Use of three multiple influence shapes in morphing.

ii. Developed a new algorithm for 3D reconstruction of surface from slices.

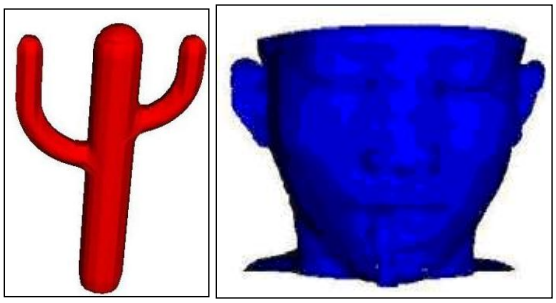

Figure 13: 3D reconstruction of (left) a cactus and (right) a human head.

5. Information Visualization

A data visualization application for multivariate data involving twelve attributes has been developed with Visualization Tool Kit (VTK) for graphical representation of **"Institutions and Good Governance in Asia and Oceania."**

6. Parallel Computing

Development of parallel versions of a popular pattern matching algorithm (**"Not So Naive")** and a 3D morphing algorithm using MPI protocol.