CIS II Plan proposal

1. Stated topic and goal

Topic: Annotation Framework for Recurring Appointments in Medical Applications using Augmented Reality

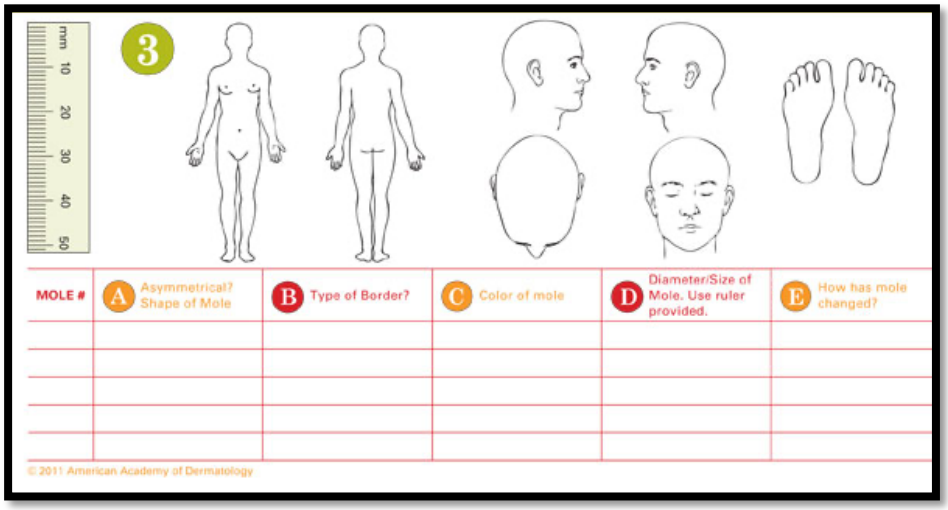
Goal: Design an AR application to annotate anatomical landmarks in medical scenarios that require their identification during recurring appointments.

2. Team members and mentor

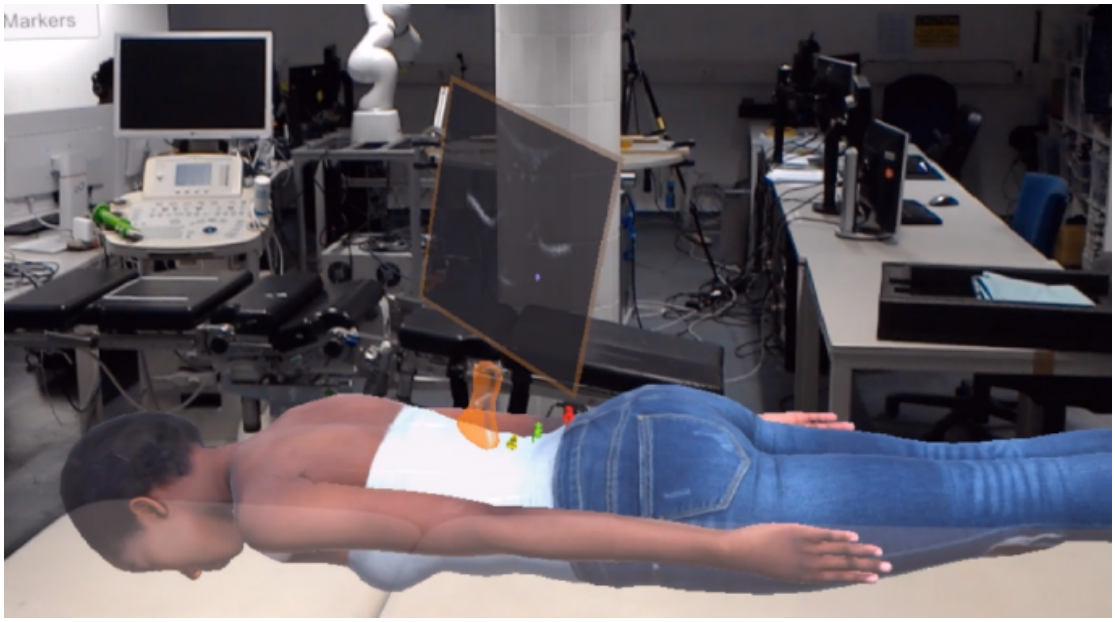
Team members: Guanyu Song, gsong8@jhu.edu
Mentor: Alejandro Martin Gomez, alejandro.martin@jhu.edu

3. Short statement of relevance/importance

Background: Diverse medical setups, such as dermatological applications, require the identification of anatomical landmarks, such a skin lesions or mols, in the human body to evaluate their evolution over time. This scenario can also be observed during medical treatments that require ultrasound imaging.



Relevance: Traditional approaches use printed notes with anatomical atlas to indicate the position of these landmarks. This task can be time-consuming and imprecise



4. Short technical summary of approach

Use platform of Unity Vuforia Engine and C# for display and tracking. Use Microsoft Hololens for 3D display and user-interaction.

Technique relates to:

- Locate optical markers onto the patient's body to identify the patient's pose (alternative method including body tracking is also an option).

- Design and track an annotation tool to record and indicate the position of the interesting landmarks.

- Display the position and history of the anatomical landmarks on top of the patient's body.

5. List of "deliverables" (min, expected, max)

- **Minimum:** Visualization of the anatomical landmarks on one of the patient's arms.
- **Expected:** Visualization of the anatomical landmarks on one of the patient's arms, including images and history of the previous appointments/visits.
- **Maximum:** Full body tracking and visualization of the anatomical landmarks, including the landmarks' evolution.

6. Key dates & assigned responsibilities

By now, this project will be completed by Guanyu Song independently and will be supervised by mentor Alejandro Martin Gomez.

- **2-28**: Learn Unity Essential and Vuforia. Plan for the project.

- **3-7**: Use Unity and Vuforia to track the pose and position of an ultrasound probe model and save the image.

- **3-14**: Finish the function of position and pose tracking. Use a box to simulate the human body. Use different markers to recognize the ultrasound probe and box separately. Then use Unity and Vuforia for relative pose and position tracking. Programme with C# to save the pose and images.

- **4-1**: Use 3D scanner to make 3D anatomy samples on a human body phantom for recurring anatomy tracking. Then using the phantom to test previous work: save the position and pose of images with respect to ultrasound probe.

7. List of dependencies & plan for resolving

1. Microsoft Hololens and Hololens Clicker
   a) Mentor will assign a hololens device that already exists in the lab.

2. Camera for tracking
   a) Mentor assigns.

3. Human body phantom
   a) There is already one in the lab.

4. Anatomical information of human phantom
   a) Use 3D scanner for scanning and make 3D samples
   b) Use 3D model published on website (eg. embodi3d)

8. Management Plan

- Meet with project mentor Alejandro every Thursday at 11:30 a.m.
- Daily communication with mentor through skype
- Code: Upload on github
- Documentation: Google drive and CIS Wiki

Reading

INFOGRAPHIC: SKIN CANCER BODY MOLE MAP: https://www.aad.org/public/diseases/skin-cancer/find/at-risk/mole-map

CWRU takes the stage at Microsoft's Build conference to show how HoloLens can transform learning: https://case.edu/hololens/

Matthew G. Hanna, Ishtiaque Ahmed, Jeffrey Nine, Shyam Prajapati, Liron Pantanowitz; Augmented Reality Technology Using Microsoft HoloLens in Anatomic Pathology. *Arch Pathol Lab Med* 1 May 2018; 142 (5): 638–644. doi: https://doi.org/10.5858/arpa.2017-0189-OA

Farahani, N., Post, R., Duboy, J., Ahmed, I., Kolowitz, B. J., Krinchai, T., Monaco, S. E., Fine, J. L., Hartman, D. J., & Pantanowitz, L. (2016). Exploring virtual reality technology and the Oculus Rift for the examination of digital pathology slides. Journal of pathology informatics, 7, 22. https://doi.org/10.4103/2153-3539.181766

M. Krichenbauer, G. Yamamoto, T. Taketom, C. Sandor and H. Kato, "Augmented Reality versus Virtual Reality for 3D Object Manipulation," in *IEEE Transactions on Visualization and Computer Graphics*, vol. 24, no. 2, pp. 1038-1048, 1 Feb. 2018, doi: 10.1109/TVCG.2017.2658570.

Zhu E, Hadadgar A, Masiello I, Zary N. 2014. Augmented reality in healthcare education: an integrative review. PeerJ 2:e469 https://doi.org/10.7717/peerj.469