Reality Augmentation for Medical Procedures (RAMP)
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We demonstrate a system that realizes “in-situ” visualization of medical data from variety of modalities such as MR, CT, and Ultrasound. The system takes advantage of stereoscopic video see-through head mounted displays (HMDs), where not only the 3D perception is provided but also complete visualization control and an objective registration goal is achieved. An infrared head mounted camera keeps track of the user’s head position, with respect to a stationary frame of retro-reflective markers, and provides jitter free and stable graphics overlays onto the user’s displays. Advantages of head mounted tracker camera include: 1) easing the line of sight restriction, 2) providing excellent registration accuracy, and 3) optimizing the use of the tracker camera field of view. The system is also capable of tracking a hand-held instrument (e.g., needle) with the attached cluster of retro-reflective markers.

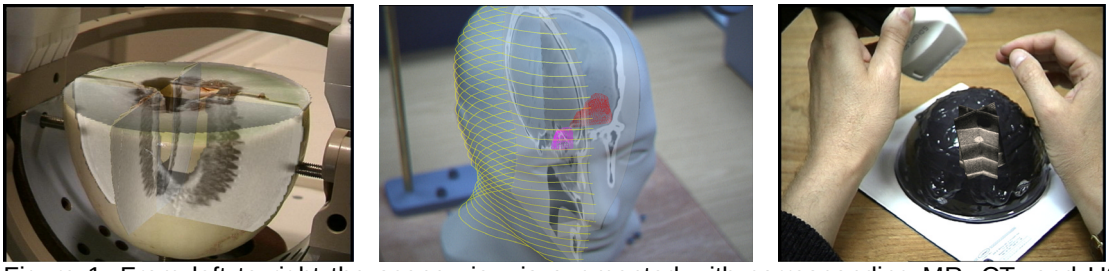
Figure 1: From left to right the scene view is augmented with corresponding MR, CT, and US images.

An Example Application: In a needle biopsy scenario, visualization of the augmented needle and its extension (trajectory), which can interact with the overlaid medical data, provides the physician with abundant information and intuitive guidance in order to perform an accurate biopsy.

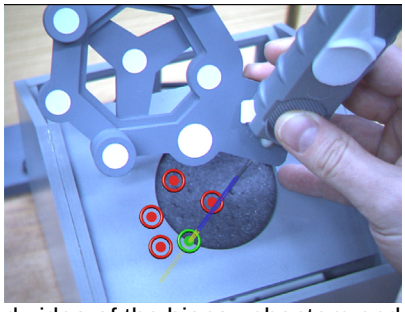
Figure 2: Augmented video of the biopsy phantom and the tracked needle.

Hardware Specifications: The system is implemented on a single personal computer and includes two optical cameras, one infrared camera, and a high-resolution head mounted display. The system operates in real-time (i.e., 30 frame/sec). The graphics overlay and the live videos (for left and right eye) are synchronized, therefore the user does not perceive any time lag between them. The overall latency of the system is about 0.1 second.

Summary: We demonstrate a PC based system for *in-situ* visualization of medical data via stereo video-see-through HMD. Our system facilitates understanding of imaged 3D structures and also provides an intuitive guidance for interventional procedures (e.g., needle biopsy). At this stage, we pursue applications, where AR can be of critical value, together with clinical partners.