# Understanding Patient-Physician communication and turn-taking patterns with directional microphone arrays

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**Background:** EMR systems can influence the nature of the patient-physician relationship by impacting how they interact and communicate. In order to better inform the design of future EMR interfaces, we must understand the complex nature of current physician-patient-EMR interactions across modalities. Often such insight is gained through costly and time-consuming manual coding of patient-physician encounters. Therefore, along with our infrastructure for capturing video, eye-tracking, body-motion and EMR activity, we developed methods for utilizing directional microphone arrays during real-world clinical encounters to accelerate segmentation and coding of patient-physician communication patterns.

**Methods:** We collected data from 17 physicians across 116 outpatient visits at the VA San Diego and UCSD from a multitude of sensors deployed unobtrusively into the clinical environment. In particular for this analysis we looked at the Microsoft Kinect sensor and the Dev-Audio Microcone directional microphone. Audio from these visits was manually coded through a two-pass method to segment who was talking (physician, patient, patient companion), and later compared with the automatic sensor-based segmentation.

**Results:** Preliminary results show promise that technology can aid in the acceleration of segmentation of physician-patient communication patterns. While Kinect audio range is limited to a 100° arc in front of the device, it provided roughly 65% segmentation accuracy. The Microcone, a 360° microphone array, provided roughly 75% accuracy.

**Conclusion:** A mix of signal processing techniques for angle classification based on data from directional microphones shows great promise towards reducing the need to manually code audio/video files. Next we plan to explore sensor fusion of these two audio devices with additional sensors capturing other modalities (i.e. body positioning) in order to further improve segmentation accuracy. With these early findings we hope to encourage others in this space to consider the adoption of ever-improving sensing systems to accelerate research and data analysis.