TETAM Lab 5
Cognitive Science and Vision Laboratory

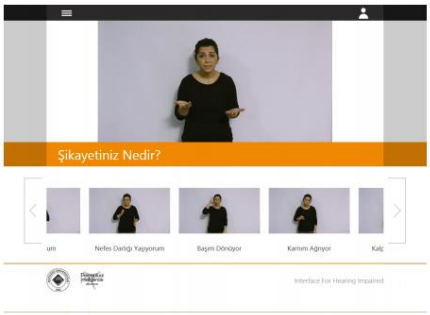
Areas of Research: Cognitive Science, Computer Vision, Machine Learning

Principal Investigators: Lale Akarun, Albert Ali Salah

Current Research Projects:

SANTEZ Project: Sign-based Interface for Health and Banking Applications:

Sign language is the natural medium of communication for the Deaf community. In this project we have developed an interactive communication interface, based on Vision-based sign language recognition. We work on recognizing sign language gestures using signer independence enhancing domain adaptation and subunit based recognition methods. In order to perform recognition in health and finance domains, we collected the BosphorusSign Turkish Sign Language corpus, which consists of 859 signs and phrases from the health, finance and everyday life domains.



The corpus is collected using the state-of-the-art Microsoft Kinect v2 depth sensor, and is the first to appear in this sign language research field. The annotations will be rendered by linguists so that the corpus will appeal both to the linguistic and sign language recognition research communities.

Modeling annotator behaviors for crowd labeling:

Machine learning applications can benefit greatly from vast amounts of data, provided that reliable labels are available. Mobilizing crowds to annotate the unlabeled data is a common solution. Although the labels provided by the crowd are subjective and noisy, the wisdom of crowds can be captured by a variety of techniques. In this project, we focus on crowd consensus estimation of continuous labels, which is also adaptable to ordinal or binary labels. Our approach is designed to work on situations where there is no gold standard; it is only dependent on the annotations and not on the feature vectors of the instances, and does not require a training phase. For achieving a better consensus, we investigate different annotator behaviors and incorporate them into Bayesian models. By examining annotator quality, we aim to detect good annotators to enhance consensus quality and reduce crowd labeling costs.

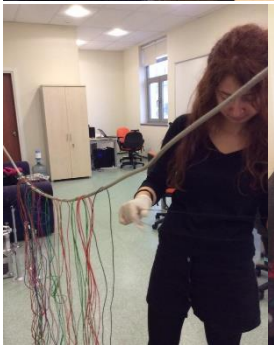
8 Channel Bipolar EEG recording and analysis program:

EEG is a device that brain waves in terms of measures electrical activity. It is a cheap method of visualization of brain functions, and is one of the most widely used equipment in brain research. EEG offers the highest temporal resolution with a rate of up to 2000 samples per second and is more advantageous than other methods in that regard. Compared to methods in which personal

information is collected based on a questionnaire, EEG offers much less subjective results. It is also used in experiments with computer-human interfaces. Multiple disciplines including Psychology, Computer Engineering and Cognitive Science make use of EEG systems in their research.

EEG system is designed to work in the lab experiments and a special cabin was established for experimentation. The following images from the device give an idea on the experimental setup of the device.






Past Research Projects:

TUBITAK Project: Sign Tutor 2004-2007

In this project, we have conducted research on the analysis of Turkish Sign Language and developed educational tools for teaching Turkish Sign Language, with the support of the Scientific and Technological Research Council of Turkey. Turkish Sign Language is a visual language, used by the deaf-and-mute, which consists of hand gestures and facial expressions. The study of sign language is a currently interesting research field both by computer vision researchers and linguists. Beyond the research interest, the development of educational tools for teaching sign language has benefits to the general community. The aim of this project is the development of educational tools for sign language while doing research on sign analysis and recognition from videos. With this purpose, we have worked in five different areas: 1. Development of Turkish Sign language databases for research and education; 2. One of the databases collected has been used for a website and stand-alone application program for a TID sign dictionary; 3. Research on analysis of sign language from videos and the development of a prototype of an interactive sign tutor; 4. The deveopment of Signiary, a Sign Dictionary which uses the Turkish Radio Television's news for the hearing impaired; 5. Research on distributed sign language recognition in a multi-agent environment. The output of the project is in the form of theses, reports, journal papers and conference papers. In addition, we have produced databases and demonstrator programs.

TUBITAK - RFBR Joint Bilateral Project: Information Kiosk for the Handicapped 2009-2011:

The aim of this project is to develop input-output interfaces relying on natural modes such as speech and hand signs for the use of handicapped and normal users, and to implement these interfaces in an

information terminal. For this purpose, research on sign language recognition, sign language synthesis, and speech recognition has been carried out. This project has been carried out in cooperation with our Russian project partner, St. Petersburg Institute SIIRAS. Therefore, sign languageand speech recognition has been carried out in Turkish and Russian, and the information terminal applications accept input and presents output in mutiple modes and multiple languages. Two different applications have been developed: The first application presents an interface for the communication of normal people and people having different handicaps using diffferent languages and different modes. In the second application, normal or handicapped people can use sign or speech to access an information terminal. The outputs of the project include theses, research reports, papers in journals and conferences, as well asthe databases and the developed application programs.

TUBITAK - BMBF Joint Bilateral Project: Gesture Based Interaction in Emergency Management Systems (GEMS), 2010-2012:

Emergency Management relies on timely and sufficient information: During an emergency, the efficient display of large amounts of information in a central command room is a vital requirement The purpose of this project was to develop human-computer interaction methods for such environments. We have concentrated on three subjects in detail: Face analysis, body analysis and hand gesture analysis. For face analysis, we have worked on both face recognition and facial expression analysis. For body gesture analysis, one needs to track and analyse body movements. For hand gesture recognition, we have used color and depth sensors to track human bodies in general environments. Hand gestures consist of two main components: the hand shape and its trajectory. Therefore, the signal is inherently a multimodal time series signal and techniques used to represent time series are suited for this application. We have worked on shape classification and time series analysis for gesture classification. We have used probabilistic methods to a fit a 3D skeletal model of the body and hand. We have generated systems to recognize gestures in real time.

Inventory:

- 3D Scanner
- Camera Equipment (Projectors, Stands)
- 6 Pointgray Cameras
- 4 Personal Computers
- Enhanced Reality googles
- 32 channel Brainvision EEG+EMG System
- Hemosoft FNIRS System
- Vuzix AR Virtual and Augmented Reality Glass
- EPrime 2.0 software
- Cortical Metrics CM4 tactile stimulator system

Personel:

- Lale AKARUN
- Albert Ali SALAH
- Yunus Emre KARA
- Ahmet Alp KINDIROĞLU
- Elif Canseza KAPLAN

- Ece YALLAK
- Doğa GÜLHAN
- Kübra EREN
- Furkan GÜRPINAR
- Murat Can MUTLU
- Bihter AKYOL