

## **Visit Report**

Visit start date: 2<sup>nd</sup> June 2013  
Visit end date: 14<sup>th</sup> June 2013

### **Challenges:**

Adapt the pre-processing stage of the previously developed AI-based gesture recognition system made for 5DT 5 data-glove, to allow the PNN, as the core of the gesture classification system, to work with input vectors of higher dimensionality without significant deterioration of its performance in VR environments.

### **Work description:**

1. Preparation of data acquisition program to allow collection of gesture data from various data-glove users and store them in data files named after the gesture designation (G01-G12) (Fig.1).
2. Acquisition of gesture data for the twelve different gestures from the gesture dictionary. In this experiment, two female and three male subjects took part. The acquisition process entailed following steps:
  - Subject is first familiarized with the gestures and gets to try each of them before real experiment;
  - Calibration is performed with a fully open hand (palm) and fully closed hand (fist), after which the system is ready for operation;
  - Subject is allowed 30 seconds to perform each of the gestures, during which time the system records the gestures as 10-member vectors – which correspond to 10 sensor signals (2 per each finger) (Fig.2).
3. Application of Principal Component Analysis (PCA) to reduce data dimensionality and allow the probabilistic Neural Network (PNN) to perform gesture recognition on the data sets with reduced number of vector members.

### **Results:**

As the result of the first stage of this investigation, during the gesture acquisition process, each of the five subjects produced 12 data files, in total – 60 files which need to be processed.

Principal component analysis performed in the subsequent step of the processing, generated the PCA scores (sample is shown in Fig.3) and it was possible to see that, for all of the subjects, all gestures could be efficiently reduced to vectors consisting of just several members which represent the components which account for more than 90% of the variance (example diagrams shown in Fig.4)

### **Future work**

The next immediate step in this investigation shall include:

- Training the PNN using the reduced-dimensionality data set
- Testing the PNN for accuracy of gesture recognition
- Analysis of results

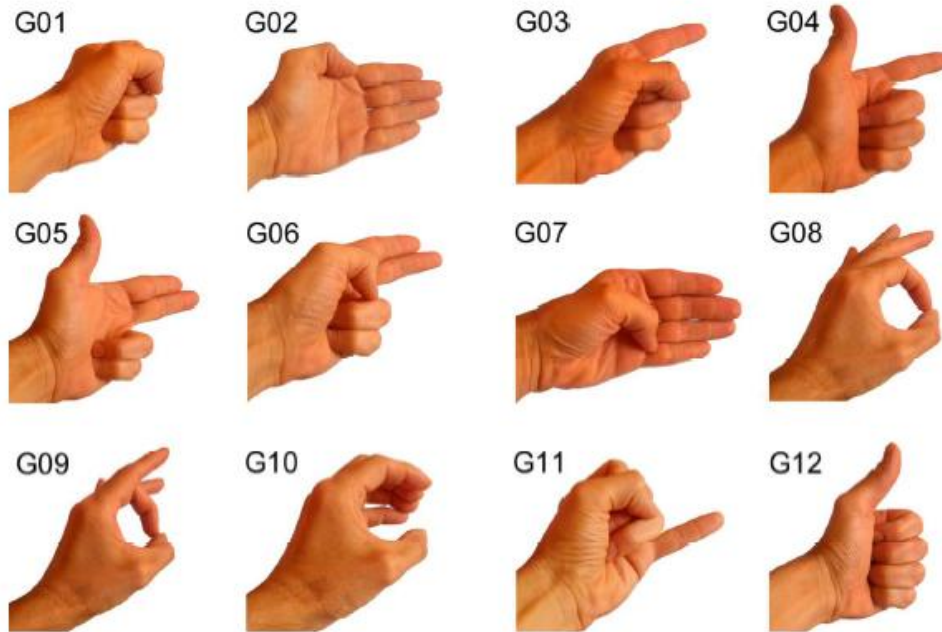


Fig. 1 Twelve gestures of the gesture dictionary used in the experiment

Thumb Near	Thumb Far	Index Near	Index Far	Middle Near	Middle Far	Ring Near	Ring Far	Little Near	Little Far
2306	2833	2898	3444	2494	3104	2361	3204	2706	2862
2306	2832	2898	3444	2499	3104	2360	3203	2706	2859
2306	2832	2895	3443	2498	3105	2361	3205	2707	2860
2304	2831	2896	3443	2496	3104	2360	3205	2707	2862
2306	2832	2895	3443	2495	3104	2361	3205	2707	2860
2304	2831	2898	3444	2499	3106	2361	3204	2706	2860
2305	2831	2897	3444	2496	3105	2361	3205	2708	2862

Fig. 2 Example of a file which stores recorded gestures as 10-member vectors

Comp.1	Comp.2	Comp.3	Comp.4	Comp.5	Comp.6	Comp.7	Comp.8	Comp.9	Comp.10
-3.5411	2.947947	0.983645	0.126521	-0.10945	0.029733	-0.00871	-0.0596	-0.02998	0.074711
-3.69046	3.455504	0.842925	-0.58222	-0.27654	-0.10359	-0.03191	-0.01078	-0.03926	0.008357
-3.61785	2.879599	0.936517	-0.62253	0.164884	-0.09549	0.016463	0.02361	-0.00736	0.034959
-3.18377	2.765654	-0.05418	-0.24688	0.337023	0.106371	-0.05397	-0.10835	-0.03694	0.016527
-3.43675	2.765956	1.035971	-0.1952	0.176841	0.018794	0.074269	0.042068	-0.01365	0.065161

Fig. 3 Example of the generated scores for a single subject for a particular gesture

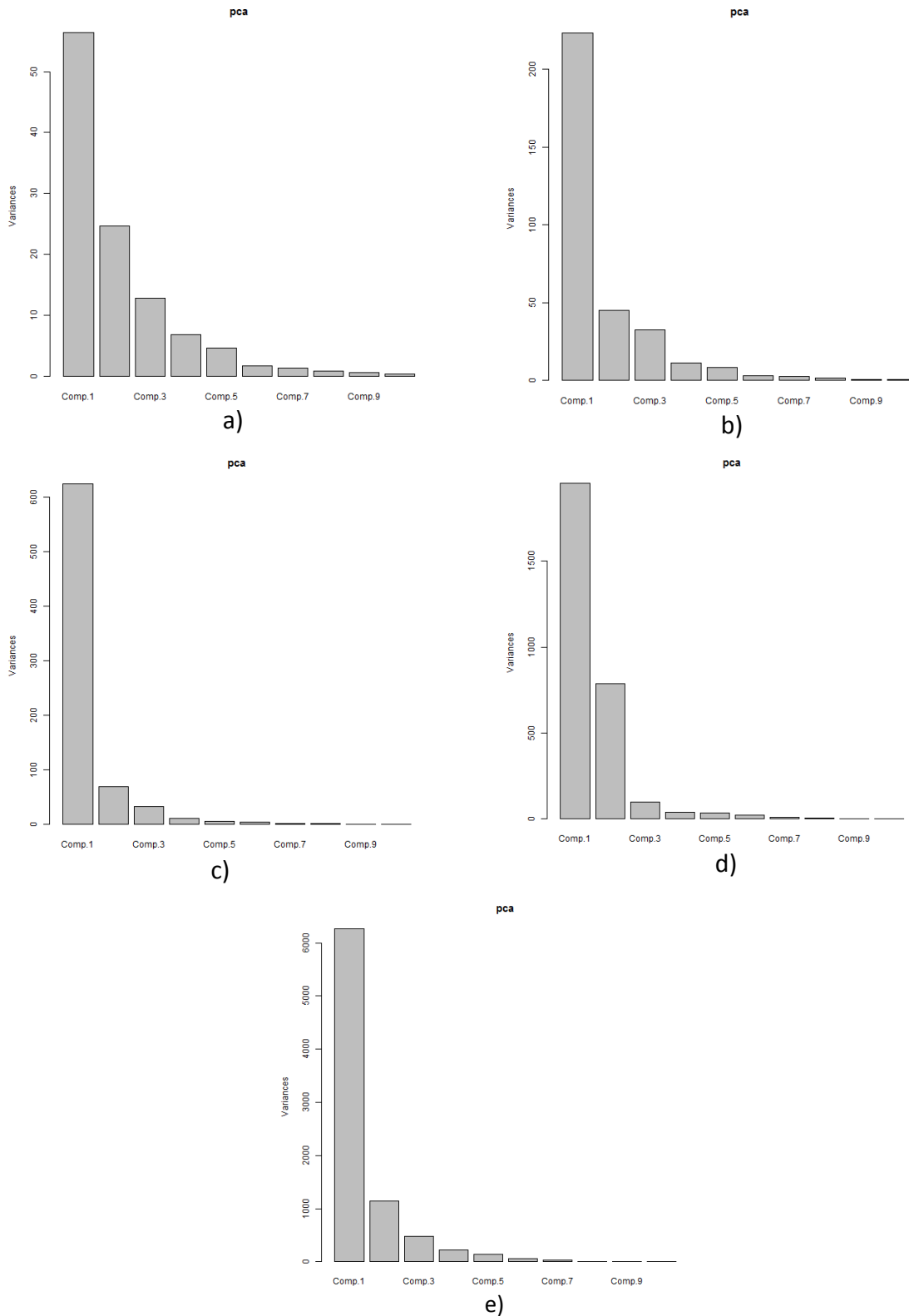


Fig.4 Diagrams showing relative contribution of PCA components to the variance for the five subjects (a-e) for gesture G05

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Proposer:

Assist. Prof. Ognjan Lužanin, PhD., University of Novi Sad, Serbia

Host institution:

Poznan University of Technology, Poland