H.T. CHANG, C.H. HWANG, C.C. HSIEH, C.H. LEE, C. PEI, T.L. SUN. Visual exploration with PCA dimension reduction to support fall-risk assessment of community-dwelling elderly. Gerontechnology 2018;17(Suppl):92s; https://doi.org/10.4017/gt.2018.17.s.090.00 **Purpose** Identifying community dwelling elderly with high fall risk and sending them to hospitals for further evaluation is important to keep and maintain older adults' quality of life. Comprehensive fall risk assessment is costly in terms of human labor and equipment. An alternative and more feasible approach is to conduct preliminary fall risk assessment through community services to identify elderly with elevated fall risk and ask them to go to hospital for further evaluation. This paper proposes a visual exploration approach together with principle-component analysis (PCA) based dimension reduction to help medical professionals evaluate fall risk based on multi-dimensional data collected from preliminary fall risk evaluation tools. **Method** A total of 392 community-dwelling elderly from central Taiwan were evaluated from April 2014 to May 2015. After excluding participants aged <65 years or with incomplete data, 356 elderly people were included in this analysis and their fall risk assessment data were collated. Balance ability and gait functionality were evaluated using the Short-Form Berg balance scale (SFBBS)[1] and 3-meters timed up and go (3M TUG) test[2], respectively. Cognitive function was measured using a Chinese version of the short portable mental status questionnaire (SPMSQ), and their independence in activities of daily living was measured using the Barthel index (BI). The resulting data matrix thus contains 356 rows and 4 columns. Principle component analysis (PCA) were then performed on the data matrix to derive optimal linear combinations of the original data, i.e., BBS, 3M TUG, SPMSQ and BI, that best explain the original data's variances. **Results & Discussion** The first two PCA components explain 72.1% of the original data's variance. Figure 1 shows the distribution of 356 community-dwelling elderly in a scatter plot using the first two principle components as the X and Y axes. Three clusters can be easily discovered in this figure. From top to down, they are drawn in blue (317 subjects), orange (25), and red (14). Since the blue cluster contains the majority of the subjects, this cluster should correspond to the non-fall group. The orange and red clusters are more likely to be the fall group. After checking the subjects' fall history, we found that 11 out of the 317 subjects in the blue cluster reported fall history in the past one year, 1 out of the 25 subjects in the orange cluster reported fall history, and all 14 subjects in the red cluster reported fall history. Therefore, the red cluster corresponds to high-risk elderly with 100% accuracy! Subjects in the blue and orange clusters, on the other hand, should belong to the low-risk category. The 11+1=12 subjects in the blue and red clusters who reported fall history need further examination by medical experts. Since factors contributing to fall were complicated, these subjects may report fall history due to other reasons, e.g., wrong memory, taking medication, environment issues, etc. Detailed discussion can be found in Huang 2018[3]. Although PCA analysis seems promising, the domain meaning of the linear combination of these four clinical fall risk evaluation scales requires further investigation.

References

1. Karthikeyan G, Shamim GS and Purushotham C. Test-retest reliability of Short Form of Berg Balance Scale in elderly people. Global Advanced Research Journal of Medicine and Medical Sciences 2012;1:6
2. Shumway-Cook A, Brauer S, Woollacott M. Predicting the probability for falls in community-dwelling older adults using the Timed Up & Go test. Physical Therapy 2000;80:896–903
3. Huang CH. The fall prevention of the elderly: Effects of visual stimulation and visual analysis of the fall risk, Ph.D. Dissertation, Yuan-Ze University, 2018

Keywords: fall assessment, visual exploration, PCA
Address: Yuan-Ze University, Taiwan;
E: tsun@saturn.yzu.edu.tw

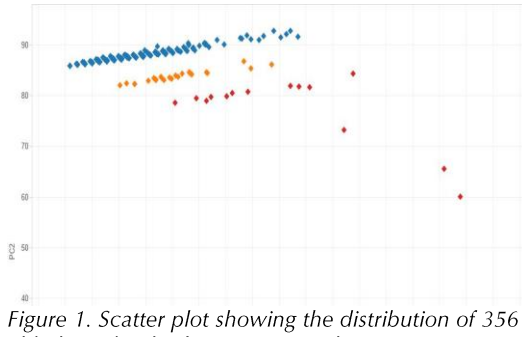

Figure 1. Scatter plot showing the distribution of 356 elderly under the first two principle components derived from 4 clinical scales, i.e., BBS, 3M TUG, SPMSQ and BI