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Visual Analysis of Telemetry Data

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Abstract

Patient data is oftentimes measured in a static environment, for example, in a hospital or laboratory, a situation that does not guarantee a real-world scenario. In this paper we describe a visual analysis approach that allows patients to freely walk around in a natural environment at remote places, and doctors to visually analyze this data on an interactive dashboard.

CCS Concepts

• ***Human-centered computing*** → ***Visual analytics;*** • ***Applied computing*** → ***Health care information systems;***

1. Contribution

Telemetry is a concept that allows the communication of recorded data to remote places, for example, to a doctor's laboratory while people are freely walking around in a natural environment [NA12]. The challenge in this research is the analysis of the data, with algorithms but also visually.

In this paper we focus on providing a doctor with real-time patient data while also allowing to monitor patients by means of interactive linked visualization techniques with the advantage of their easy-to-understand aspects. Moreover, hypotheses about the patients can be built, refined, confirmed, or rejected by the doctor, as in other visual analytics platforms [KKEM10].

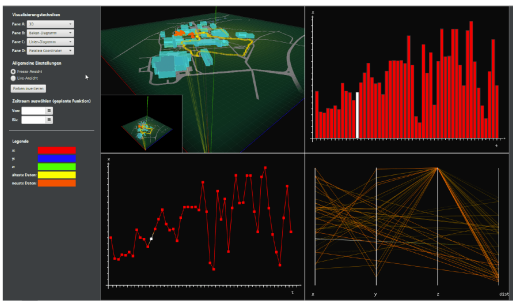

Figure 1: *The graphical user interface provides four different perspectives on the recorded data.*

1.1. Tracking Device and Visualization

We equipped a patient with a prototypical device that provides movement data while the patient freely walks around at our university campus. The doctor has access to the recorded data via a global area network (GAN).

Figure 1 shows an example snapshot of the visualizations in action. A 3D point cloud indicates the longitude and latitude parameters and can give an additional hint about the density of the data. A bar chart containing the mean value, a line diagram showing a trend function, as well as a parallel coordinates plot are implemented. We support a dimensionality reduction projecting the multivariate data to 2D or 3D. Additionally, color coding can be applied to indicate the inherent temporal information in the data, i.e., yellow reflects older time points while orange to red show newer time points.

1.2. Conclusions

In this work we introduced a visual analysis tool for telemetry data that is based on a prototypical device for recording patient data in real time and in a free walking task. This more naturalistic study setting allows a doctor to give clear instructions to a patient while at the same time analyzing the transmitted temporal data visually, in a laboratory. To this end we support several standard visualization techniques. For future work we plan to extend the work by more data science concepts in order to find better results for the data analysis, for example, to automatically detect temporal patterns. Moreover, we might also use more precise measurement devices while also recording even more data sources like EEG data, galvanic skin response, pupil dilation, or eye movement behavior.

References

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