The First

Visual Enabled Computing Open House Showcase

EC4218 Student Projects

Wednesday, December 17, 13:00h—14:30h

JeonCom Building C (C3), 1st Floor, Lounge

Sponsored by

The Visual Enabled Computing (VEC) Lab.

Director

Brian J. d'Auriol, Ph.D., Assoc. Prof. GIST, Korea

Animated Visualization of Sensor-Acquired Biceps and Triceps Muscular Movements

Gaeul Park, Ho Jun Kong, Min Kyung Kim and Seon Jae Yu

The goal of this project is to understand how muscle fatigue develops during elbow flexion and extension performed at different tempos. Although electromyography (EMG) signals can indicate muscle activation, fatigue-related changes are difficult to interpret from raw data alone. To address this, we simultaneously measure biceps and triceps EMG signals during slow and fast tempo movements, extract time-dependent features and map these values onto a 3D arm model as a dynamic heatmap. This prototype visualization enables intuitive observation of activation balance, co-activation patterns, and the onset of fatigue over time. The significance of this work lies in providing an interpretable, spatial-temporal representation of muscle fatigue, which may inform exercise pacing, rehabilitation strategies, and future wearable or EMG-controlled assistive systems.

Visualizing Topological Artifacts in Deepfake Images

Brandon Salas and Temirlan Abishev

An analytic visualization tool is designed in this project for deepfake artifact detection and its visualization. A custom python algorithm analyzes mesh curvatures in given 3D models that represent deepfake features to identify geometrical structural inconsistencies in the model's topology. This method specifically targets complex regions where generative models frequently struggle to maintain coherence, for example, the eyes and nose in facial deepfakes. The resulting data is visualized by a density heatmap to pinpoint error clusters. Additionally, exponentially scaled vector spikes quantify the severity of the distortion. By translating topological variance into a clear visual interface, this tool offers a robust method for verifying biometric authenticity without AI or any data other than the original model.

Prototype Visualizations of High Dimensional Water Environmental Parameters

Aigerim Bolatbekkyzy, Sumaiia Altynbekkyzy, Kyung min Lee, Sehee Park, Jaeryong Shin Tsoggerel Tsogbadrakh and Nuradil Zholmukhan

This project prototypes various visualization techniques for use in a 3D, scene-based visualization model for water quality parameters. Traditional visualizations of water quality parameters rely on multiple scatter plots and layered geographic heat maps. However, these types of visualizations may cognitively burden analysts and moreover are generally ill-suited for large numbers of correlated parameters with diverse relationships. This prototype provides visual space information navigation using compound glyphs geolocated over 3D terrain relief. It is suitable for visualizing multiple correlations of parameters at a single measurement location, spatial distributions of correlated parameters across multiple locations and parameter relationships with shoreline land use and topography. Navigation enables the viewing of information in typical scatter plot and heat map formats if desired.

Human Cognitive Object Identification in LiDAR-based 3D Point Clouds

Mikhail Tsoy

Advantages of LiDAR-measured 3D point clouds provide measured length, width and height coordinates in a 3D scene model that represents a measured real-world environment. However, such point clouds do not have natural coloring nor texturing and may have sparse regions. These factors hinder human visual identification of objects in the 3D model. This project investigates a sequence of methods including SLAM-based LiDAR measurements and LiDAR-based Yolo-based object recognition to construct a 3D model with semantic information associated with each point in the point cloud. The resulting glyph-based point cloud visualizations are rendered in Paraview.

Towards Generalized 3D Scene modeling Generated by 2D LiDAR-based Point Clouds

Alisher Omirzak

Advantages of 2D LiDARs as compared with 3D LiDARs include smaller size, lighter weight and less power consumption requirements making it ideal for light-payload mobile platforms such as small-sized UAVs (drones). However, the sampling density is also much lower resulting in sparse, low-density point clouds. Visual features are often not recognizable by humans in such point clouds. This project concerns mathematical methods aimed at addressing human visual feature recognition. There are two interconnected parts: the determination of a rough 3D scene model based on detection of horizontally oriented dominate planes using Manhattan and San Francisco Worlds geometric modeling, followed by the surface reconstruction of the LiDAR data based on triangulation projections onto the 3D scene model. The resulting procedure is intended to be applied in aerial UAV-based terrain mapping applications.