Oregon Department of Transportation

Stage 1 Research Problem Statement

Number*: 26-07*

Proposed Title: "Visual Analytics System for Prioritizing Emergency Responses"

1. Concisely describe the **transportation issue** (including problems, improvements, or untested solutions) that Oregon needs to research.

Computer models adopted by DOTs nowadays include machine learning results. This computation paradigm is inherently complex and requires extensive verification after training on some input data. There has been much success observed from using software packages based on neural networks. Due to climate change, increasing numbers of natural disasters such as landslides, wildfires, flooding and coastal erosion are making factors such as tribal group needs and commodity transport even more challenging to support. Prioritization over emergency responses is needed and computer models for different situations should be combined for a comprehensive evaluation. A visual analytics system can help track the situations and provide computed ranking for needed responses.

2. Document how this **transportation issue** is important to Oregon and will meet the Oregon Research Advisory Committee Priorities

Many images and videos have been obtained for different ODOT projects from traffic control, wildlife tracking and groundwater system. Object classifications can be done using computer models based on machine learning and neural network techniques for these images and videos. It can be helpful to use some information on these objects to aid the planning of emergency responses.

Visual analytics systems include multiple windows for different types of information. These systems are developed to interpret computer models, visualize computed results and record user inputs. These systems can be designed to provide data information for urgent decision-making needs.

3. What **final product or information** needs to be produced to enable this research to be implemented?

The final product is a software tool that contains information on natural disasters, needs from communities and computer models used to track objects from related images and videos. The aim is to include the "demands" from nature and communities in one tool for ODOT researchers. Computer models enable analyses over large amounts of input data such images and videos; however, the accuracy still needs to be verified by researchers. The software tool will include visual interpretations of the key algorithms in the models and visualizations of the quantified measurements on the accuracies of the models.

To construct this tool, there will be five phases. The first phase is to enable software capabilities to allow user interactions. This interface will follow existing guidelines for well-used software tools at ODOT. Frequent meetings with ODOT will be conducted to ensure needed capabilities are included. The second phase is to collect computer models used for different images and videos to extract the objects investigated. For example, if coastal erosions are measured through tracking water levels or sizes of beaches, then the efficiency and the performance of these models will be visualized using existing tools. Moreover, the amount of erosion calculated will be visualized. The curated information will be stored in the tool for retrieval by the users. The third phase is to develop a priority score for the different disasters and needs. This involves determining the acceptable references for these demands, e.g., erosion level less than a certain threshold. Literature search from historical documents will be done so that the references established have validity. The next step is to determine how to calculate the deviation from these references based on the image and video data obtained in the recent years. The amount of deviation is the key factor in calculating the priority score, i.e., when the erosion found through using computer models on images and videos is beyond a certain threshold, then the priority is set to be high. Our calculations will be using a priority scale

such as 1-10 rather than just low, medium and high. The fourth phase is to incorporate the priority scale into the software developed at the first phase. For the different disasters and community needs, the priority scales will be shown. Users can see the results from the computer models for the chosen scales. In addition, the users can see the change over the years that we have data on. The last phase is to deploy the tool and make further improvements based on the feedback. Over the course of the project, demos and discussions will be arranged at regular intervals so that the work is verified at each stage. There will be version control applied so that future adaptations can be continuously made by ODOT after this project.

4. (Optional) Are there any individuals in Oregon who will be instrumental to the success of implementing any solution that is identified by this research? If so, please list them below.

Name	Title	Email	Phone
Kira M. Glover-Cutter	Research Analyst and Coordinator	kira.m.glover-cutter@odot.oregon.gov	971-701-0051

5. Other comments:

6. Corresponding Submitter's Contact Information:

Name:	Yué Zhang
Title:	Associate Professor
Affiliation:	Oregon State University
Telephone:	541 737 0478
Email:	zhangyue@oregonstate.edu

This form is not a grant application or contract document.