Problem Statement and Goals
PyERT

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Table 1: Revision History

Date	Developer(s)	Change
Sept 23	Jasper Leung	Modified Problem Statement, Goals, and Stretch Goals
Sept 23	Zabrain Ali	Modified Goals, Stretch Goals, Team Number, and Group Name
Sept 23	Hongzhao Tan	Modified Goals, Stretch Goals, Stakeholders, and Environment
Sept 23	Mengtong Shi	Modified Problem, Inputs and Outputs, Stakeholders, and Environment
Sept 23	Mike Li	Modified Problem Statement, Input, Output, Hardware, and Goals
Sept 23	Linqi Jiang	Modified Outputs Problems Statement and Goals
April 3	Mengtong Shi	Modified Environment
April 5	Jasper Leung	Modified Document to match Revision 1

1 Problem Statement

1.1 Problem

GIS-based Episode Reconstruction Toolkit (GERT) is a set of tools for working with GPS data and is used to identify stop and travel episodes and match

them to a network. The toolbox currently uses an external software ArcGIS Pro, which requires a license to be accessed. This makes GERT less accessible for most potential users and very expensive to maintain. In theory, ~~the re-implemented toolbox~~ a program which recreates the main functions of the toolbox should be fully open-source and independent so that it can accomplish the same tasks without needing to license ArcPro.

1.2 Inputs and Outputs

1.2.1 Input

- Geographic data
- Mobility data
- GPS stamps

1.2.2 Output

- Analysis of geographic data
- Network and traffic analysis
- Map matching
- Possible research results according to user requirement

1.3 Stakeholders

- School of Earth Environment and Society of McMaster University
- Supervisor of the project Dr. Antonio Paez and the potential users of the toolbox
- Professor of the 4G06 capstone course Dr. Spencer Smith
- Developers of this project Zabrain Ali, Linqi Jiang, Jasper Leung, Mike Li, Mengtong Shi, Hongzhao Tan

1.4 Environment

1.4.1 Software

The software should be compatible with Python~~, R~~ and any required libraries.

1.4.2 Hardware

The hardware that would be utilized includes personal computers for development, and computers from the General Science Building computer lab to access ArcGIS.

2 Goals

- ~~Re-implement the features in GERT that use ArcGIS Pro packages with open-source packages and libraries and remove any use of ArcGIS in the project.~~ Re-create the main functions of GERT with a separate program that uses open-source packages and libraries that don't use ArcGIS.
  - Using open-source packages and libraries instead of ArcGIS will make the ~~GERT tools~~ new program that recreates the functions of GERT free to use.
- Document the changes made to ~~GERT when replacing ArcGIS~~ the new program and how it differs from GERT.
  - Having detailed documentation for the ~~modified GERT~~ new program will ensure that existing users of GERT will be able to transition from using ~~the ArcGIS version easily~~ GERT and understand the changes made. It will also be helpful for new users.
- Modify existing project structure to be more organized and readable.
  - Most of the code for the current project is stored in a single file, making it hard to read. Organizing the code and potentially splitting up the code of the new program into separate modules would be helpful for any users trying to use the code.

3 Stretch Goals

- Implement GUI for the ~~re-implemented tool~~ the new program.
  - The current GERT is run using the command line. Implementing a GUI for the new program will make it more intuitive, and may motivate new users to use it.
- Implement new features or improve existing features in GERT.
  - If the existing features of GERT are all ~~converted to Python~~ present in the new program and there is still time, we can spend the ~~remainder~~ remaining time improving these features, or add new features based on Dr.Paez's feedback, such as visualization.
- Create tutorials for how to use ~~modified GERT~~ the new program.
  - ~~There is the documentation for GERT within the code, but no videos/manuals on how to use it.~~ Adding videos/manuals for how to use the new program would make the tool more accessible.
- Improve run time by implementing more efficient sorting and searching algorithms.

– After successfully ~~reverse engineering the toolbox~~ re-implementing the main features of GERT in the new program, we would like to improve the speed of the software by implementing new ~~potential~~ algorithms to efficiently handle large geographic data sets.