

Identification of Flood Depth using Analysis of Gait Data

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Abstract—Floods are natural disasters common to places located near shores or which receive heavy rainfall. Floods are the most common natural disasters faced in the United States of America. They affect several aspects of society indiscriminately. During floods, transportation becomes risky, difficult, slow and cause a lot of inconveniences. They can lead to a major loss of life and property. Due to incomplete and partial spread of information from unreliable sources, people, important resources get stranded in heavily waterlogged areas. These can be avoided or at the least minimized by careful planning and avoiding areas with higher amounts of water. This paper presents one aspect of planning a safe route for transportation during times of floods, which can also be used as a very good source of information for various rescue teams so that they consider the most affected areas initially. One can use sensors present in smartphones of people for . This data can be used to plan a safe route to travel. In order to accomplish this, data from Accelerometer, Gyroscope, Proximity Sensor, Gravitational and various other sensors;review.ç is recorded; a supervised learning based multi class classifier is used for classification of the approximate depth in which the user is travelling.

Index Terms—gait, data analysis, machine learning, floods

I. INTRODUCTION

In developing countries with high and unequal population density, natural disasters tend to be chaotic. In case of floods, one area might be heavily flooded while another might be only lightly affected. During the time of response, this information as to which area is and is not heavily flooded is not known. This causes commercial transportation issues, difficulty in sending help to affected areas and often makes it risky to travel for public. Being the home of more than 1.3 Billion people, India is one of the fastest growing countries in the world. But loopholes can be spotted in very basic aspects like city planning, which has to lead to a very common problem of drainage. Lack of proper drainage is a major factor contributing to floods in unplanned and chaotic areas. Transit from one place to another during the times of excess waterlogging and floods becomes excessively difficult. Even moderate amount of rains can create chaos in unplanned environments. It is difficult to predict in advance, the level of waterlogging in such areas. In India, this problem is variable in accordance with the region in question. This along with current measures taken by management to deal with floods is discussed in detail in the work of Mohapatra and Singh,2003.[1] Monitoring flood event

is essential to analyze causes, methods for prevention and selecting the best path for transportation during emergencies and to help to respond efforts. This leads to floods causing heavy economic damage. A paper that discusses economic damage by floods in detail is discussed in the work of Merz et al., 2010.[2]

Recently, devastating floods took place in Kerala. If at the time of Kerala floods, more such techniques as discussed in this paper were available, a lot of damage that was inflicted upon life and property, could perhaps be avoided. To develop and inspire such a technique that could help authorities deal with floods effectively proved to be a major motivation for the paper.

“Finding a reasonable method of detecting the depth/amount of water in the affected areas”. A practical problem faced today by many people living in places with a high amount of precipitation or places which get flooded easily is the problem of waterlogging. Situations such as these often cause inconvenience; delay and problems in transportation is a major concern to the government, law enforcement, medical institutions, and business corporations and even consumers. If a flood lasts for more than a few days, it can disrupt transportation of food, drinkable water and other necessary resources. This can affect people residing in that place in a severe way. Effects of flood on transportation has been discussed in detail in the work of Suarez et al., 2005.[3]

The problem statement of this paper was hence to craft a simple, efficient, accurate and economical method to detect the depth of the water in flooded areas, which can be used as a guide to affected areas using only devices that are readily available to humans to all locations where floods could occur (smart-phones). This information can be used by transport services to plan the route of transportation by road. There were only a scarce amount of readily available and useful techniques at the time of writing of this paper which could give such insights. The technique described in this paper can be used to aid structural flood control measures, emergency responses, recovery and rehabilitation after flood impact.

A method that’s inefficient of

Using sensors such as Accelerometer, Gyroscope, Proximity Sensor, Gravitational ;reviewç and various other sensors available in a smart phone; data from these sensors can be recorded using the app, AndroSensor by Asim, Fiv, 2015.[4] The height

of the water in which the person with the smartphone is on foot is classified using various machine learning multi-class classifiers. The information and the conclusion drawn from the findings and research on this paper can be used to practically deal with situations of flood and water logging in urbanized environments. One such solution can be to create a mobile phone application which will detect the height of the water user is currently present in. This information could then be used in mapping mobile applications, such as google maps to show which area has what level of flooding. This information can be uploaded to an online database for further analysis and can aid in developing effective flood response strategies. Information from this database can be accessed by other remote individual users and other governmental and non-governmental organizations through an interface and they can then take appropriate actions.

This paper aims to analyze the waterlogged surroundings using general sensors which are very commonly present on smartphones which are generally easily available during situations of waterlogging and flood. The following sections of this paper are organized as follows; Section 2 is on data source and describes how the data was collected and what tools and measures were chosen for collection of data. Section 3 deals with preprocessing of the collected data, section 4 with analysis techniques used; section 5 describes the results obtained, Section 6 gives probable directions for promising work in future and Section 7 gives a brief conclusion to the paper.

II. EASE OF USE

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$$a + b = \gamma \quad (1)$$

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- There is no period after the “et” in the Latin abbreviation “et al.”.
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TABLE I
TABLE TYPE STYLES

Table Head	Table Column Head		
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^aSample of a Table footnote.

Figure Labels: Use 8 point Times New Roman for Figure labels. Use words rather than symbols or abbreviations when writing Figure axis labels to avoid confusing the reader. As an example, write the quantity “Magnetization”, or “Magnetization, M”, not just “M”. If including units in the label, present them within parentheses. Do not label axes only with units. In the example, write “Magnetization (A/m)” or “Magnetization {A[m(1)]}”, not just “A/m”. Do not label axes with a ratio of quantities and units. For example, write “Temperature (K)”, not “Temperature/K”.

ACKNOWLEDGMENT

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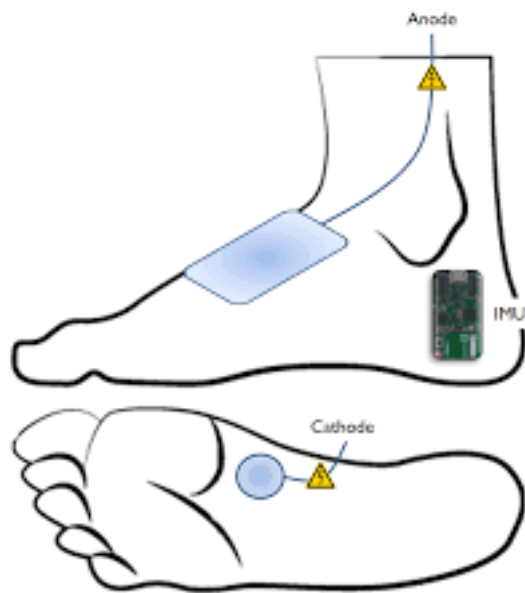


Fig. 1. Example of a figure caption.

REFERENCES

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