Chapter 11
The Application of Machine Learning for Predicting Global Seismicity

Viacheslav Shkuratskyy
https://orcid.org/0000-0001-9142-1262
York St. John University, UK

Aminu Bello Usman
York St. John University, UK

Michael S. O'Dea
York St. John University, UK

ABSTRACT

An earthquake is one of the deadliest natural disasters. Forecasting an earthquake is a challenging task since natural causes such as rainfall or volcanic eruptions disrupt data. Earthquakes can also be caused by human beings, such as mining or dams. Solar activity has also been suggested as a possible cause of earthquakes. Solar activity and earthquakes occur in different parts of the solar system, separated by a huge distance. However, scientists have been trying to figure out if there are any links between these two seemingly unrelated occurrences since the 19th century. In this chapter, the authors explored the methods of how machine learning algorithms including k-nearest neighbour, support vector regression, random forest regression, and long short-term memory neural networks can be applied to predict earthquakes and to understand if there is a relationship between solar activity and earthquakes. The authors investigated three types of solar activity: sunspots number, solar wind, and solar flares, as well as worldwide earthquake frequencies that ranged in magnitude and depth.

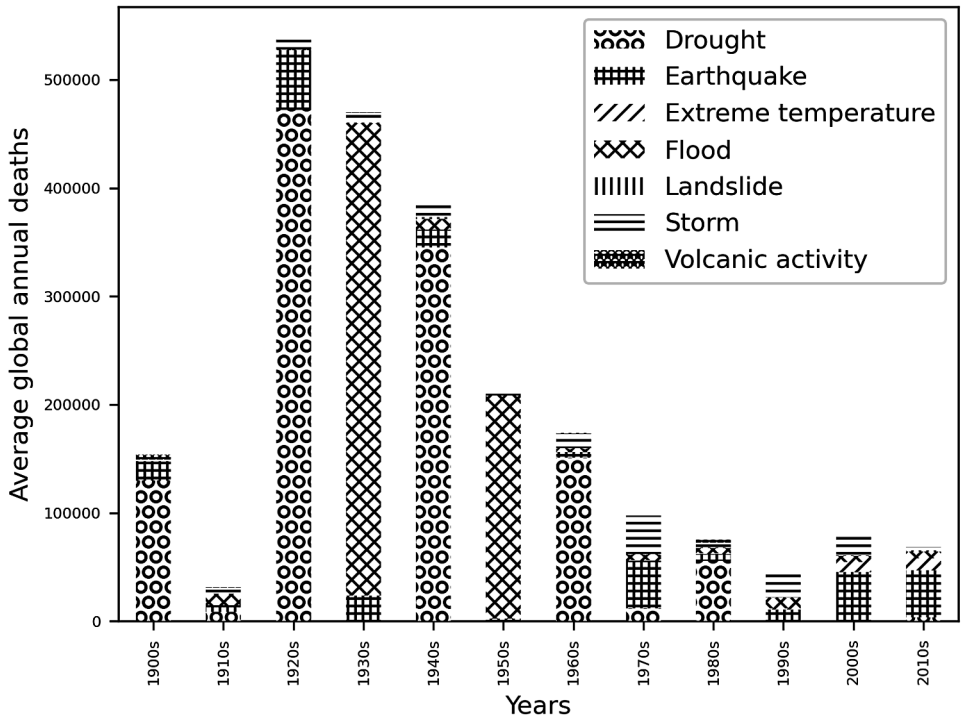
DOI: 10.4018/978-1-6684-6937-8.ch011

INTRODUCTION

Since ancient times cataclysmic disasters such as droughts, floods, earthquakes, volcanic eruptions, storms, and many other types of natural catastrophes, have had a profound impact on humans, at the cost of countless lives. These disasters are classified as natural disasters (Wirasinghe et al., 2013). The most severe natural disaster in recent history was the flood of the Yangtze–Huai River in China, in summer 1931. Up to 25 million people were affected by the effects of this flood (National Flood Relief Commission, 1933), hence it is considered the deadliest natural disasters since 1900 excluding epidemics and famines.

The number of deaths from natural disasters may change depending on the type of disaster and the affected area. But, from the average point of view, around 40,000 people per year are killed by natural disasters. For example, Figure 1 shows the yearly average of global annual deaths from natural disasters between 1900 and 2010s. The graph was created based on data from (*OFDA/CRED International Disaster Data*, 2021).

Figure 1. Yearly average global of annual deaths from natural disasters, by decade.



As seen in Figure 1 the three deadliest natural disasters are droughts, floods, and earthquakes. However, in the last decades, the most dangerous natural disasters for people are considered to be earthquakes, extreme temperature, and floods. Even though the average global death toll from natural disasters in the 21st century is less than in the previous century, the average death rate is still high.