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Predicting the magnitude of earthquakes using Grammatical Evolution

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Abstract: Throughout history, human societies have sought to explain natural phenomena through the lens of mythology. Earthquakes, as sudden and often devastating events, inspired a range of symbolic and mythological interpretations across different civilizations. In ancient Greece, for example, seismic activity was attributed to the giant Enceladus, who, according to myth, was buried beneath the earth by the gods and would cause tremors as he struggled to break free from his subterranean prison. Similarly, in Norse mythology, earthquakes were believed to be the result of the imprisoned god Loki, who writhed in pain beneath the ground, shaking the earth as a consequence of his suffering. Other cultural traditions also developed unique cosmologies to explain seismic events. It was not until the 18th and 19th centuries that a more positivist and scientific approach began to emerge regarding the explanation of earthquakes, recognizing their origin as stemming from processes occurring beneath the Earth's surface. In the present century, the question of how earthquakes occur has been resolved, thanks to advancements in scientific, geological, and geophysical research. It is now well understood that seismic events result from the collision and movement of lithospheric or tectonic plates. The contemporary challenge that emerges, however, lies in whether such seismic phenomena can be accurately predicted. In this paper, a systematic attempt is made to use techniques based on Grammatical Evolution to determine the magnitude of earthquakes. These techniques use freely available data in which the history of large earthquakes is introduced before the application of the proposed techniques. From the execution of the experiments, it became clear that the use of these techniques can estimate the magnitude of earthquakes more effectively compared to other machine learning techniques from the relevant literature.

Keywords: Earthquakes; Machine learning; Evolutionary computation; Grammatical Evolution

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