

# Fast Earthquake Characterization using a Single Three Component Seismic Station by Machine Learning Techniques

\*Luis Hernan Ochoa Gutierrez<sup>1</sup>, Luis Fernando Niño Vasquez<sup>1</sup>, Carlos Alberto Vargas Jimenez<sup>1</sup>

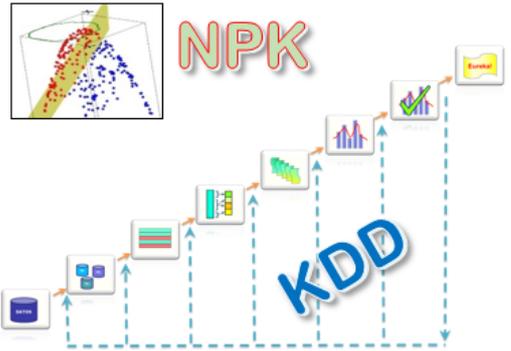
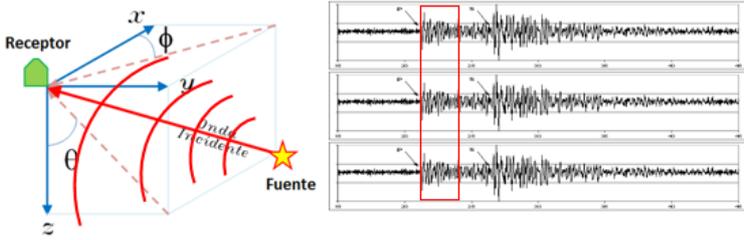
1. Universidad Nacional de Colombia

Earthquake early warning alerts generation is very useful, especially for the city of Bogotá-Colombia, given the social and economic importance of this city for the country. Based on the information from the seismological station “El Rosal” , which is a broadband and three components station, located very near the city that belongs to the Servicio Geológico Colombiano (SGC) a Support Vector Machine Regression (SVMR) model was developed, using a Normalized Polynomial Kernel, using as input some characteristics of the initial portion of the P wave used in earlier works such as the maximum amplitude, the linear regression coefficients of such amplitudes, the logarithmic adjustment parameters of the envelope of the waveform and the eigenvalues of the relationship between the three seismogram components of each band.

The model was trained and evaluated by applying a cross-correlation strategy, allowing to calculate the magnitude and location of a seismic event with only five seconds of signal. With the proposed model it was possible to estimate local magnitude with an accuracy of 0.19 units of magnitude, epicentral distance with an accuracy of about 11 km, the hipocentral depth with a precision of approximately 40 km and the arrival back-azimut with a precision of 45°. Accuracies obtained in magnitude and epicentral distance are better that those found in earlier works, where a large number of events were used for model determination, and the other hipocentral parameters precisions obtained here are of the same order.

This research work makes a considerable contribution in the generation of seismic early warning alerts, not only for the country but for any other place where proposed models here can be applied and is a very good starting point for future research.

Keywords: Early Warning, Support Vector Machines (SVM), Fast Seismic Characterization, Seismology, Bogotá-Colombia



Early Warning

SVM

