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Automatic Classifier Based on Dynamic Time Warping of Cepstrum for Events Detected in the English Channel: Earthquake or Marine Explosion?

The French NDC operates a network of 40 seismic stations in France. A major part of the events located in the English Channel concern submarine explosions, most of them being conducted by French Navy. The clear identification of earthquakes is important to understand the tectonic of this region. We developed a method to identify marine explosion. Underwater explosions generate a gas bubble which can cyclically shrink and expand. This phenomenon is called bubble pulse. This phenomenon induces an echo in the signal, which is bringing out by cepstral analysis. We use this property to identify underwater explosions. The originality of our approach was to compare cepstra each other, instead of using a detector of bubble peak (like F-statistic approaches). The drawback of such a method lies on the random position of the bubble peak (function of depth and yield) which is different from one explosion to another. Our approach is based on Dynamic Time Warping method associated to Euclidean distance. A k-nearest neighbour method is then used to classify events. This method leads to a correct identification of more than 90% reference events (313 explosions and 41 earthquakes).

Primary author: LETORT, Jean (CEA - Grenoble University)

Presenter: LETORT, Jean (CEA - Grenoble University)

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