Machine-learning competition boosts earthquake prediction capabilities

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LOS ALAMOS, N.M., July 18, 2019—Three teams who applied novel machine learning methods to successfully predict the timing of earthquakes from historic seismic data are splitting $50,000 in prize money from an open, online Kaggle competition hosted by Los Alamos National Laboratory and its partners.

“Crowdsourcing for new approaches in earthquake forecasting helps us leverage a wide range of expertise in addressing one of the most important problems in Earth science, because of the devastating consequences of large quakes,” said Bertrand Rouet-Leduc, a Los Alamos researcher who prepared the data for the competition. “The winning teams’ results could have the potential to improve earthquake hazard assessments that could save lives and billions of dollars in infrastructure.”

Current scientific studies related to earthquake forecasting focus on three key points: when the event will occur, where it will occur, and how large it will be. The Kaggle competition provided a challenging dataset that was based on previously published laboratory analysis, to give the competitors a taxing project to explore.

More than 4,500 international teams were challenged to predict exactly when a laboratory-simulated quake would strike. The top finishers came very close to a perfect time forecasting, and the top three teams were “The Zoo” (members from Austria, Texas, Illinois, Greece and Germany), “Jun Koda” (Italy), “Character Ranking” (Japan), “Rez” (California) and “Glory or Death” (Seattle, Washington).

The winning team, “The Zoo,” led by Austrian computer scientist Philipp Singer, devised a solution that involved a multi-task, decision-tree approach applying four statistical features.

“The final prediction model is based on a combination of state-of-the-art machine learning models in the areas of neural networks and gradient boosted decision trees,” said Singer.

“Zoo team based their approach on published work by the Los Alamos group,” said Los Alamos’ Paul Johnson, project lead of work applying machine learning to earthquake fault problems.

Purdue University, Penn State and the U.S. Department of Energy Office of Science were cosponsors of the event, with DOE providing half of the prize money and Kaggle the other half.

“The Kaggle competition enabled us to access the broader machine learning community to determine if there are other methods for extracting information from geophysical

signals. Over 4,500 teams participated in the challenge and used a wide range of approaches," said Purdue Professor Laura Pyrak-Nolte.

The winning teams had diverse backgrounds from operation research, math, electrical engineering, physics, brain wave research, cartoon publishing, law and data science. An important aspect of Kaggle competitions is that the winning solutions are posted and updated continuously on the Kaggle site for the community to see and try to improve their forecasting abilities.

About Kaggle

Kaggle is an online science community owned by Google LLC that offers courses, collaboration and competitions to enhance machine-learning opportunities worldwide. The site has more than 1 million registered users, arguably the largest and most diverse data community in the world.