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Supporting Information for

Volcanic Earthquake Classification using Transformer Encoder

and Its Interpretability Evaluation

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**Introduction**

This supporting information provides three supplementary figures and one table.

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Figure S1. Learning curves for the model constructed in this study. The blue and red lines represent the training and validation losses, respectively.

グラフィカル ユーザー インターフェイス, グラフ

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Figure S2. Examples of inappropriate training data. (a) Time inversion. (b) P-wave onset reading is incorrect. (c) Labeled as a B-type earthquake but apparently has the characteristics of an A-type event. The white and black dotted lines in the waveforms represent the onset of the P- and S-waves picked by the experts, respectively.

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Figure S3. Same as Figure 4, but shows results after removing waveforms of events with large location errors. (a) The source-receiver distance relative to AWR. (b) Histograms of distances from the crater (Lat.: 36.4, Lon.: 138.52) to each station, showing all test data (red) and data with AWR less than 1.2 (blue). The total data is normalized to sum up to one. (c) The horizontal axis and the red histogram are the same as in (b). Blue represents the data histogram with a prediction probability value of over 99%. The total number of data is normalized to sum up to one.

Table S1. Comparison of Model Performances

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Model | Data without S label a | | | Random Sampling b | | |
| BACC | 0.943 | | | 0.920 | | |
| Event Type | A | B | Noise | A | B | Noise |
| Precision | 0.862 | 0.961 | 0.992 | 0.876 | 0.942 | 0.989 |
| Recall | 0.894 | 0.939 | 0.996 | 0.829 | 0.936 | 0.995 |
| F1 score | 0.878 | 0.950 | 0.994 | 0.852 | 0.939 | 0.992 |

a Models trained on B-type training data minus those with S-wave readings.

b Models trained to match the amount of data in the analysis stated abovea by randomly extracting data from the training data in B.