USER-MANUAL

RAPID ON-SITE ESTIMATION OF RESPONSE SPECTRUM (ROSERS)

This tool, named as Rapid On-Site Estimation of Response Spectrum (ROSERS), uses a variational autoencoder (VAE) and deep neural network (DNN) framework to estimate a cross-dependent vector of component spectral acceleration (S_a) at 96 periods. The inputs to the framework include two site characteristics (soil shear-wave velocity V_{s30}; basin depth $Z_{2.5}$) and seven intensity measures (Arias intensity I_a; cumulative absolute velocity CAV; peak ground acceleration PGA; peak ground velocity PGV; peak ground displacement PGD; mean period T_m; significant duration D_{5-95}) computed from first three seconds of arriving ground motion waveform component. Hence, given the site characteristics and intensity measures, this tool returns a median prediction of the S_a at 96 periods. The executable is developed by Jawad Fayaz (https://jfayaz.github.io/layouts/codeandsoft.html/) and Carmine Galasso at University College London (UCL). For further details please read the article mentioned in the "Reference".

1. ROSERS Input File

The tool requires an input *csv* file that must be provided in the directory of the tool as shown in Figure 1 (user can provide any name for the *csv* file). The file must contain the two site characteristics (soil shear-wave velocity V_{s30} (in *m/s*); basin depth $Z_{2.5}$ (in *m*)) and seven intensity measures (Arias intensity I_a (in *m/s*); cumulative absolute velocity CAV (in *m/s*); peak ground acceleration PGA (in *g*); peak ground velocity PGV (in *m/s*); peak ground displacement PGD (in *m*); mean period T_m (in *sec*); significant duration D_{5-95}(in *sec*)) in the same format as shown in Figure 2 (to avoid any errors please use the example 'Inputs.csv' file). The users can provide any number of inputs by adding rows to the *csv* file in the same format
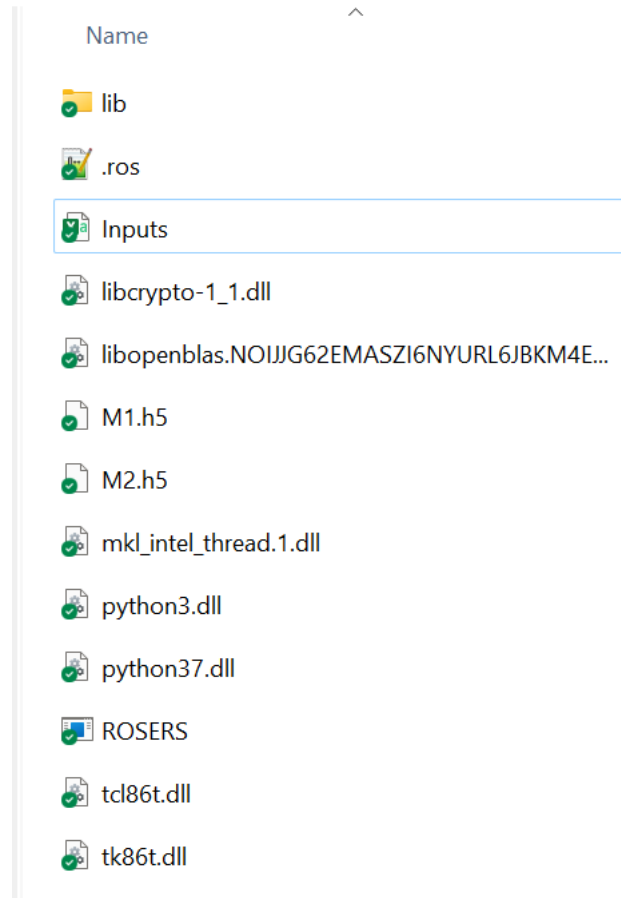
Figure 1: Directory of ROSERS

	A	B	C	D	E	F	G	H	I
1	Vs30(m/s)	Z2.5(m)	Ia(m/s)	CAV(m/s)	PGA(g)	PGV(m/s)	PGD(m)	Tm(s)	D595(s)
2	385.47	3323.7	9.14E-07	0.009167	0.000463	0.000124	6.68E-05	0.134848	2.62
3	584	820	1.41E-07	0.00227	0.000151	3.68E-05	2.93E-06	0.13346	2.58
4	719.52	694.5	1.58E-06	0.006343	0.000614	8.48E-05	3.86E-05	0.084721	2.21
5									
6									

Figure 2: Input *csv* file for ROSERS

2.   Calling ROSERS

The tool package consists of the executable application "ROSERS.exe" which can be easily called from any command line or programming language/software. An example to run the ROSERS program is given in Figure 3 which shows calling of the input *csv* file. The generalized syntax to run the executable is as follows:

<div align="center">

ROSERS.exe *InputFileName*

</div>
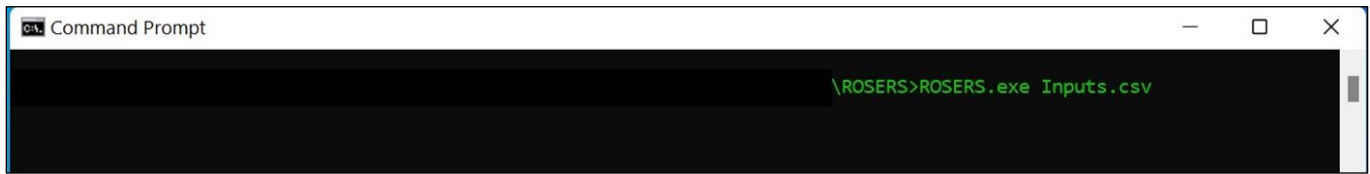
Figure 3: Calling "ROSERS.exe"

In case all the inputs are not properly provided the tool will throw an error as shown in Figure 4.
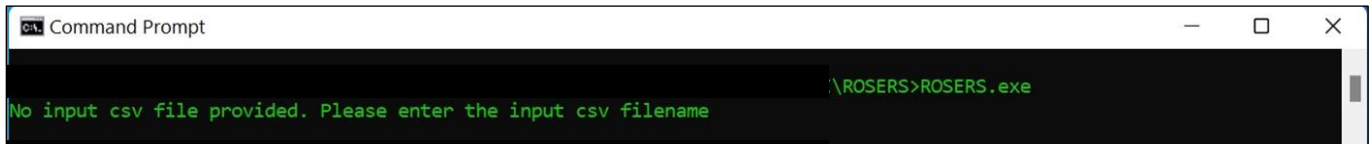
Figure 4: Error screen of "ROSERS.exe"

3.   ROSERS Outputs

The tool creates an "Outputs" folder in the current directory where results for all inputs are saved. The output screen of the framework is shown in Figure 5.
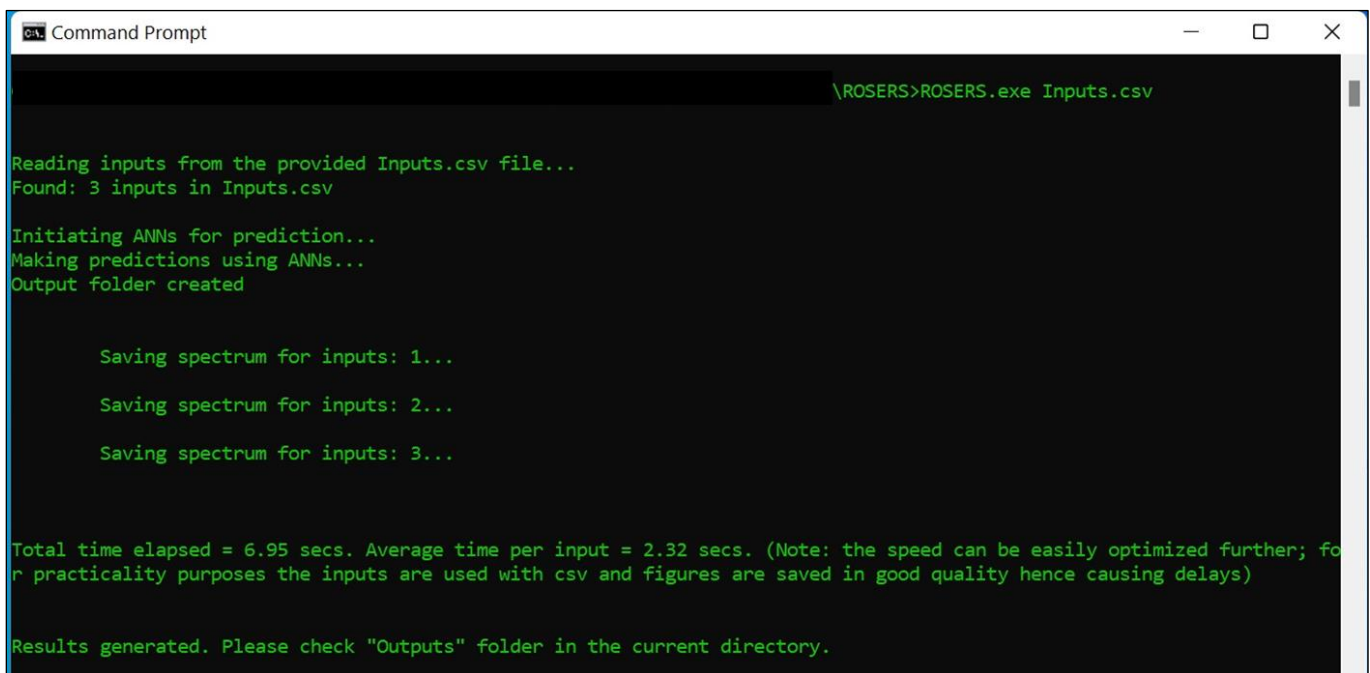
Figure 5: Output screen of "ROSERS.exe"

The outputs consist of three files for each input row: 1) "LatentVariables_*i*.jpg" file showing the latent variable deduced for the input compared to the latent variables of the utilized database (shown in Figure 6), 2) "ReconSpectrum_*i*.jpg" file showing the reconstructed median S_a spectrum (shown in Figure 7),

and 3) "ReconSpectrum_*i*.out" file containing estimated values of $\log(S_a(T))$ in units of *g* corresponding to the 96 periods (shown in Figure 8). The outputs are developed for i^{th} row provided in the input file.
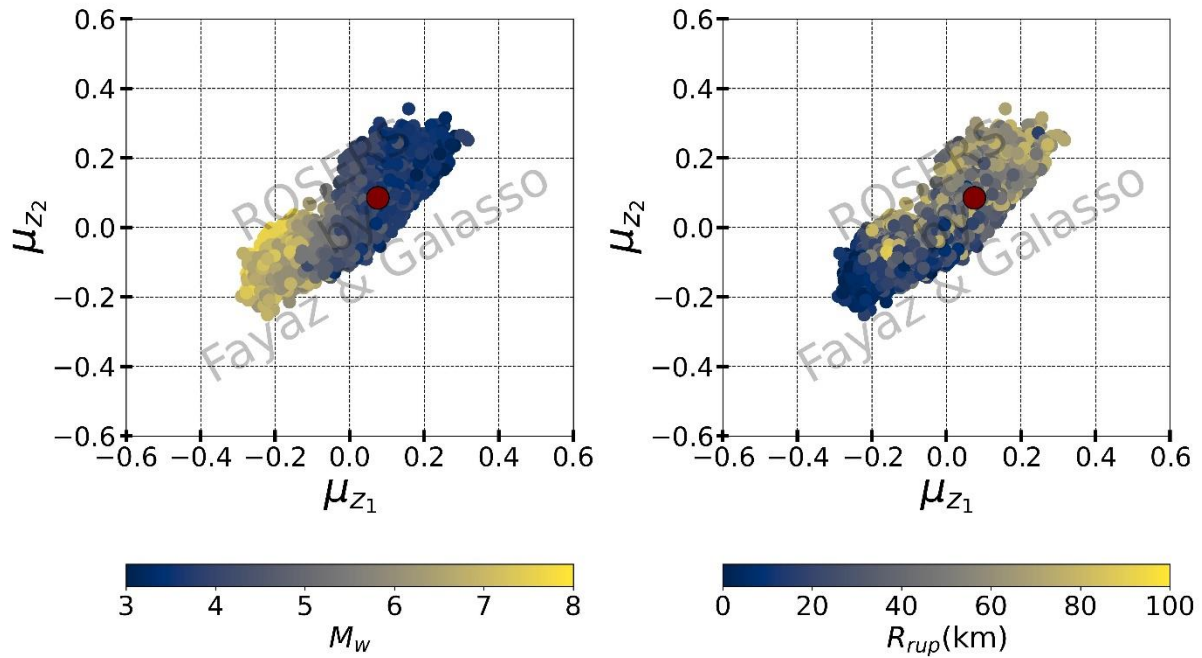
Figure 6: Estimated mean latent variables of the ith input
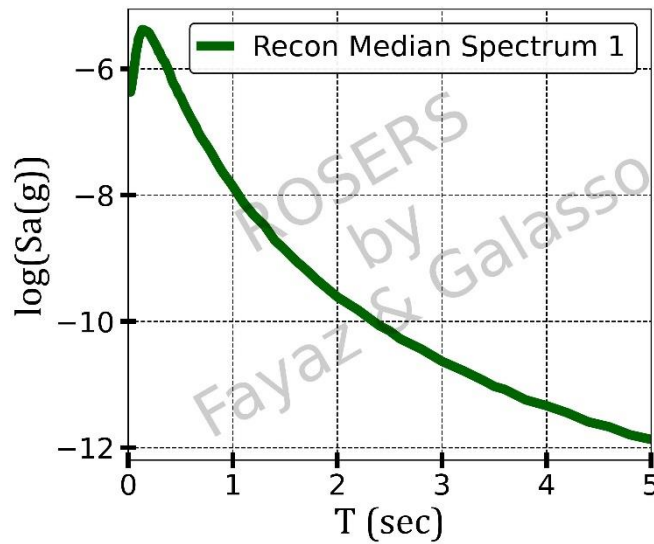
Figure 7: Estimated median S_a spectrum for the ith input

Figure 8: Estimated $\log(S_a(T)(g))$ at 96 periods for the ith input

Reference

Jawad Fayaz and Carmine Galasso (in-press). "A Deep Neural Network Framework for Real-Time On-Site Estimation of Acceleration Response Spectra of Seismic Ground Motions". *Computer-Aided Civil And Infrastructure Engineering*.