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Appendix

Annexure A: Datasets used for prediction of pillar stability prediction using Machine learning algorithms.

The pillar stability database previously collected by (Lunder,1997) This database contains 178 hard rock pillar cases from various mine sites: The database has been presented in (Wattimena,2014). Class 0 for stable, 1 for unstable, and 2 for failed.

Sr. No	w/h	UCS(Mpa)	PL(Mpa)	PL/UCS	Class
1	1	230	34.5	0.15	0
2	1	230	44.1	0.1917	0
3	1.11	230	26.2	0.1139	0
4	1	230	52.4	0.2278	0
5	1	230	51.7	0.2248	0
6	1.11	230	27.6	0.12	0
7	1	230	58.6	0.2548	0
8	1	230	64.8	0.2817	0
9	1	230	31.7	0.1378	0
10	1.11	230	33.1	0.1439	0
11	1	230	37.2	0.1617	0
12	1.43	230	52.4	0.2278	0
13	2	230	40	0.1739	0
14	1.1	230	34.5	0.15	0
15	1.43	230	52.4	0.2278	0
16	1.43	230	55.2	0.24	0
17	1.06	230	44.1	0.1917	0
18	1	230	49.7	0.2161	0
19	2.5	230	52.4	0.2278	0
20	2.5	230	54.5	0.237	0
21	2.5	230	59.3	0.2578	0
22	1.67	230	72.4	0.3148	0
23	2.22	230	86.9	0.3778	0
24	0.46	265	38	0.1434	0
25	0.54	176	26	0.1477	0
26	0.68	176	28	0.1591	0
27	0.68	265	40	0.1509	0
28	0.75	176	33	0.1875	0
29	0.75	176	29	0.164773	0
30	0.85	200	51	0.255	0

Appendix

31	0.88	176	29	0.1648	0
32	1	100	31	0.31	0
33	1	100	26	0.26	0
34	1.14	90	30	0.3333	0
35	1.25	176	37	0.2102	0
36	1.25	176	33	0.1875	0
37	1.33	72	36	0.5	0
38	1.43	316	75	0.2373	0
39	1.5	215	28	0.1302	0
40	1.65	121	55	0.4545	0
41	1.7	310	46	0.1484	0
42	2.14	215	29	0.1349	0
43	2.18	148	66	0.4459	0
44	2.2	316	76	0.2405	0
45	2.5	310	46	0.1484	0
46	2.83	72	31	0.4306	0
47	2.92	148	63	0.4257	0
48	4.2	72	39	0.5417	0
49	4.5	72	48	0.6667	0
50	1.7	94	26	0.2766	0
51	1.7	94	30	0.3191	0
52	2.5	94	35	0.3723	0
53	2	94	35	0.3723	0
54	1.6	94	35	0.3723	0
55	1.4	94	37	0.3936	0
56	2.6	94	60	0.6383	0
57	2.33	170	39.3	0.2312	0
58	2.33	170	55.6	0.3271	0
59	1.48	172	49.6	0.2884	0
60	1.8	172	56.7	0.3297	0
61	1	230	78.6	0.3417	1
62	1.11	230	92.4	0.4017	1
63	0.46	265	72	0.2717	1
64	0.56	176	28	0.1591	1
65	0.59	265	59	0.2226	1
66	0.63	160	70	0.4375	1
67	0.68	265	82	0.3094	1
68	0.83	100	31	0.31	1

69	0.89	90	32	0.3556	1
70	0.93	70	29	0.4143	1
71	1	176	43	0.2443	1
72	0.8	94	28	0.2979	1
73	1	94	34	0.3617	1
74	1.24	94	34	0.3617	1
75	1.3	94	35	0.3723	1
76	1.74	94	40	0.4255	1
77	1.5	94	47	0.5	1
78	1.67	94	48	0.5106	1
79	1.4	94	48	0.5106	1
80	1.8	94	53	0.5638	1
81	0.8	94	54	0.5745	1
82	0.92	94	55	0.5851	1
83	0.63	240	68	0.2833	1
84	1	240	84	0.35	1
85	1.03	240	74	0.3083	1
86	1.22	240	67	0.2792	1
87	0.88	100	39.3	0.393	1
88	0.88	100	47.5	0.475	1
89	0.83	100	31	0.31	1
90	0.74	100	29	0.29	1
91	0.74	100	31	0.31	1
92	0.66	100	47.5	0.475	1
93	0.62	100	31	0.31	1
94	0.59	100	29	0.29	1
95	0.55	100	29	0.29	1
96	0.53	100	31	0.31	1
97	0.51	100	37	0.37	1
98	0.47	100	41.4	0.414	1
99	0.45	100	25	0.25	1
100	1.95	172	99.9	0.5808	1
101	1.2	172	77.9	0.4529	1
102	1.15	172	70.8	0.4116	1
103	0.88	172	70.8	0.4116	1
104	1.74	172	85	0.4942	1
105	1.9	172	91.8	0.5337	1
106	1.28	172	63.8	0.3709	1

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107	3.03	172	91.8	0.5337	1
108	1.48	172	63.8	0.3709	1
109	3	172	42.5	0.2471	1
110	1.95	172	77.9	0.4529	1
111	1.11	230	104.8	0.4557	1
112	1.11	230	108.3	0.4709	1
113	1.5	230	127.6	0.5548	1
114	0.31	200	64	0.32	1
115	0.45	100	38	0.38	1
116	0.48	316	99	0.3133	1
117	0.5	100	38	0.38	1
118	0.5	90	49	0.5444	1
119	0.55	121	69	0.5702	2
120	0.56	176	31	0.1761	2
121	0.61	316	102	0.3228	2
122	0.68	176	38	0.2159	2
123	0.68	90	41	0.4556	2
124	0.75	176	57	0.3239	2
125	0.83	100	40	0.4	2
126	1.2	94	56	0.5957	2
127	0.9	94	48	0.5106	2
128	0.6	94	48	0.5106	2
129	0.6	94	48	0.5106	2
130	0.6	94	48	0.5106	2
131	0.76	94	50	0.5319	2
132	1.26	94	53	0.5638	2
133	1.4	94	55	0.5851	2
134	1	94	55	0.5851	2
135	0.96	94	55	0.5851	2
136	1.2	94	55	0.5851	2
137	1.6	94	58	0.617	2
138	1.5	94	58	0.617	2
139	1	94	58	0.617	2
140	0.5	94	58	0.617	2
141	1	94	59	0.6277	2
142	2	94	59	0.6277	2
143	1	94	59	0.6277	2
144	1	94	59	0.6277	2

145	1	94	59	0.6277	2
146	2.27	94	60	0.6383	2
147	0.6	94	60	0.6383	2
148	1.2	94	63	0.6702	2
149	1.2	94	54	0.5745	2
150	0.92	94	55	0.5851	2
151	1.32	94	56	0.5851	2
152	1.3	94	63	0.5957	2
153	1.4	94	63	0.6702	2
154	1.5	94	95	0.6702	2
155	0.78	240	83	0.3958	2
156	1.25	240	100	0.3458	2
157	1.25	240	82	0.4167	2
158	1.42	240	92	0.3417	2
159	1.75	240	88.7	0.3833	2
160	1	170	93.5	0.5218	2
161	1.02	172	93.5	0.5436	2
162	1.02	172	93.5	0.5436	2
163	1.4	172	93.5	0.5436	2
164	1.58	172	93.5	0.5436	2
165	1.08	172	93.5	0.5436	2
166	0.94	172	93.5	0.5436	2
167	0.87	172	93.5	0.5436	2
168	1.29	172	93.5	0.5436	2
169	1	172	93.5	0.5436	2
170	1.48	172	105.4	0.6128	2
171	1.38	172	93.5	0.5436	2
172	1.43	172	105.4	0.6128	2
173	1.3	172	98.6	0.5733	2
174	1.33	172	91.8	0.5337	2
175	0.96	172	88.4	0.514	2
176	1.78	172	98.6	0.5733	2
177	1.08	172	93.5	0.5436	2
178	0.62	172	93.5	0.5436	2

Appendix

Annexure B : Datasets of underground mine pillar for evaluating pillar stability using PCA and SSE tools.

The given datasets has been acquired from Indian coal mines and also compiled with previous availed datasets. 18 datasets used for validation and 45 datasets has been used for experiment.

Sl/no	D	B	W	H	W/H	UCS	PL	D/250	PS	FoS
1	42.0	3.0	9.0	3.0	3.0	43.9	1.9	0.2	10.3	5.5
2	45.0	3.0	9.0	3.0	3.0	48.6	2.0	0.2	11.2	5.6
3	45.0	3.0	9.0	2.0	4.5	35.0	2.0	0.2	11.5	5.7
4	55.0	3.5	11.5	2.5	4.6	18.3	2.1	0.2	7.9	3.9
5	55.0	3.5	11.5	2.5	4.6	18.3	2.1	0.2	7.9	3.9
6	56.0	3.0	9.0	3.0	3.0	36.0	2.5	0.2	9.0	3.6
7	60.0	3.5	11.5	2.0	5.8	18.5	2.2	0.2	9.8	4.3
8	60.0	3.2	11.8	2.5	4.7	35.7	3.2	0.2	11.5	3.6
9	65.0	3.4	13.1	3.0	4.4	43.9	3.3	0.3	12.2	3.7
10	65.0	3.0	10.5	2.7	3.9	43.0	3.7	0.3	11.8	3.2
11	65.0	3.0	10.5	2.7	3.9	42.0	3.7	0.3	11.6	3.2
12	65.0	3.2	13.3	3.0	4.4	41.0	4.2	0.3	11.8	2.8
13	65.0	3.5	13.0	1.8	7.2	25.7	2.9	0.3	13.5	4.6
14	67.0	3.2	13.3	3.0	4.4	43.9	4.3	0.3	12.3	2.8
15	67.0	3.0	10.5	2.6	4.0	44.0	3.8	0.3	12.3	3.3
16	70.0	3.0	10.5	2.5	4.2	35.6	3.9	0.3	11.0	2.8
17	70.0	3.2	13.3	3.0	4.4	37.6	4.5	0.3	11.2	2.5
18	75.0	3.2	13.3	2.9	4.6	43.0	4.9	0.3	12.6	2.6
19	75.0	3.5	13.0	2.5	5.2	26.7	3.4	0.3	10.6	3.1
20	81.0	3.5	13.0	2.8	4.6	41.6	3.7	0.3	12.6	3.4
21	85.0	3.0	10.5	2.8	3.8	43.8	4.8	0.3	11.8	2.5
22	85.0	3.0	10.5	2.8	3.8	43.0	4.8	0.3	11.7	2.4
23	85.0	3.5	13.0	3.0	4.3	43.8	3.9	0.3	12.4	3.2
24	94.0	3.2	16.3	3.0	5.4	43.0	8.5	0.4	13.9	1.6
25	94.0	3.2	16.3	3.0	5.4	43.0	8.5	0.4	13.9	1.6
26	95.0	4.0	18.5	2.5	7.4	34.0	4.7	0.4	15.4	3.3
27	101.0	3.2	16.3	2.8	5.8	43.0	9.2	0.4	14.8	1.6
28	102.0	3.2	16.3	3.0	5.4	42.0	9.2	0.4	13.9	1.5
29	105.0	3.2	16.3	2.8	5.8	43.8	9.5	0.4	15.0	1.6
30	185.0	4.0	26.5	3.0	8.8	60.0	16.8	0.7	24.5	1.5
31	185.0	4.0	26.5	3.0	8.8	55.0	16.8	0.7	23.6	1.4
32	190.0	4.0	26.5	3.0	8.8	56.0	17.3	0.8	24.0	1.4
33	190.0	4.0	26.5	3.0	8.8	66.0	17.3	0.8	25.8	1.5
34	200.0	4.0	26.5	2.8	9.5	55.0	8.8	0.8	25.5	2.9
35	230.0	4.0	26.5	2.2	12.0	65.0	20.9	0.9	34.4	1.6

36	240.0	3.6	26.0	2.0	13.0	60.0	31.3	1.0	36.1	1.2
37	245.0	4.0	35.5	2.4	14.8	65.0	37.3	1.0	40.1	1.1
38	250.0	4.2	35.3	2.5	14.1	55.0	31.3	1.0	36.9	1.2
39	265.0	4.2	35.3	2.4	14.7	55.0	33.2	1.1	39.1	1.2
40	275.0	4.2	35.3	2.2	16.0	80.0	34.5	1.1	47.9	1.4
41	275.0	4.0	35.5	2.5	14.2	85.0	41.9	1.1	44.2	1.1
42	280.0	4.0	35.5	2.2	16.1	60.0	42.7	1.1	44.3	1.0
43	295.0	4.2	35.3	2.2	16.0	75.0	37.0	1.2	48.0	1.3
44	295.0	4.2	35.3	2.2	16.0	65.0	37.0	1.2	46.0	1.2
45	300.0	4.2	35.3	2.2	16.0	65.0	37.6	1.2	46.3	1.2

LIST OF PUBLICATIONS

1. Enhanced prediction of hard rock pillar stability using Fuzzy rough feature selection followed by random forest. Journal of Mines, Metal and Fuels (Nov 2019).
2. Assessment of coal pillar stability using principal component analysis and stepwise selection and elimination. Journal of Mines, Metal and Fuels (March 2021).