Supporting Information

Identifying Balls Feature in Large-scale Laser Point Cloud of Coal Mining Environment by Multi-scale Dynamic Graph Convolution Neural Network

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Table S1. Main MATLAB R2019a code for generating all geometric features.

Generate all geometric feature codes with feature number of 6

```
rule_list = [];
for i1=(0:1)
    rule_item1 = i1;
    for i2=(0:1)
        rule_item2 = rule_item1;
        rule_item2 = [rule_item2,i2];
        for i3=(0:1)
            rule_item3 = rule_item2;
            rule_item3 = [rule_item3,i3];
            for i4=(0:1)
                rule_item4 = rule_item3;
                rule_item4 = [rule_item4,i4];
                for i5=(0:1)
                    rule_item5 = rule_item4;
                    rule_item5 = [rule_item5,i5];
                    for i6=(0:1)
                        rule_item6 = rule_item5;
                        rule_item6 = [rule_item6,i6];
                        rule_list = [rule_list;rule_item6];
                    end
                end
            end
        end
    end
end
```

Table S2. Main MATLAB R2019a code for adding noise points to geometry point cloud.

Randomly generate different numbers of noise points in a certain coordinate range

```
random_noise_points_threhold = [10,1000];
random_noise_range = [0,5;
                      0,5;
                      0,5];
for k=0:1:floor(random_noise_points_threhold(1)+(random_noise_points_threhold(2)-random_noise_points_threhold(1))*rand())
    x_random = random_noise_range(1,1) + (random_noise_range(1,2)-random_noise_range(1,1))*rand();
    y_random = random_noise_range(2,1) + (random_noise_range(2,2)-random_noise_range(2,1))*rand();
    z_random = random_noise_range(3,1) + (random_noise_range(3,2)-random_noise_range(3,1))*rand();
    all_points = [all_points;x_random,y_random,z_random,0];
end
```