

多输入输出的神经网络方案

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参赛算法和模型简介



数据特性

- 数据缺失严重，完整性不足
 - 大面积缺失
- 无地震样本会干扰预测性能
 - 回归模型难建立
- 数据情况复杂
 - 采样率不一致
 - 样本数少
 - 两种输入：电磁波和声音数据不易同时处理
 - 四种输出：地震有无，震级，经度，纬度



解决方案

- 数据缺失严重，完整性不足
 - 同一时间点均值补全
- 无地震样本会干扰预测性能
 - 用未来一次地震的信息进行补全
- 数据情况复杂
 - 统一采样率（10min）
 - 对震级分组编码
 - 对经纬坐标分组编码
 - 双输入三输出的神经网络



统一采样率 (10min)

- 将以10分钟一次频率重新采样
- 一天有144个样本



同一时间点均值补全

average										
StationID	19									
Time	1	2	3	4	5	6	7	8	9	10
Day										
7	0.134947	0.132206	0.135278	0.141292	0.123506	0.086277	0.131815	0.134886	0.134967	0.132444
8	0.140957	0.149097	0.148132	0.115326	0.128488	0.138001	0.148803	0.151442	0.150911	0.156651
9	0.139227	0.142641	0.138739	0.139484	0.146391	0.112929	0.127575	0.134864	0.137913	0.137353
10	0.150281	0.145968	0.117973	0.130145	0.127998	0.139629	0.141697	0.146545	0.149951	0.114505
11	0.130485	0.143935	0.147764	0.151546	0.156949	0.144282	0.139793	0.153683	0.154718	0.157214
...
141	0.013373	0.013586	0.013163	0.016910	0.017234	0.015813	0.016371	0.015966	0.015481	0.014745
142	0.013284	0.013770	0.013455	0.015267	0.015344	0.014610	0.013176	0.013559	0.014760	0.014171
143	0.017176	0.014328	0.013202	0.015136	0.015391	0.013438	0.014615	0.015948	0.014288	0.013642
144	0.010652	0.009706	0.010401	0.012160	0.012646	0.011220	0.012617	0.011760	0.013269	0.012392
145	0.014553	0.016440	0.012341	0.016933	0.014360	0.015824	0.011466	0.016717	0.012957	0.016415

均值补全



对震级分组编码

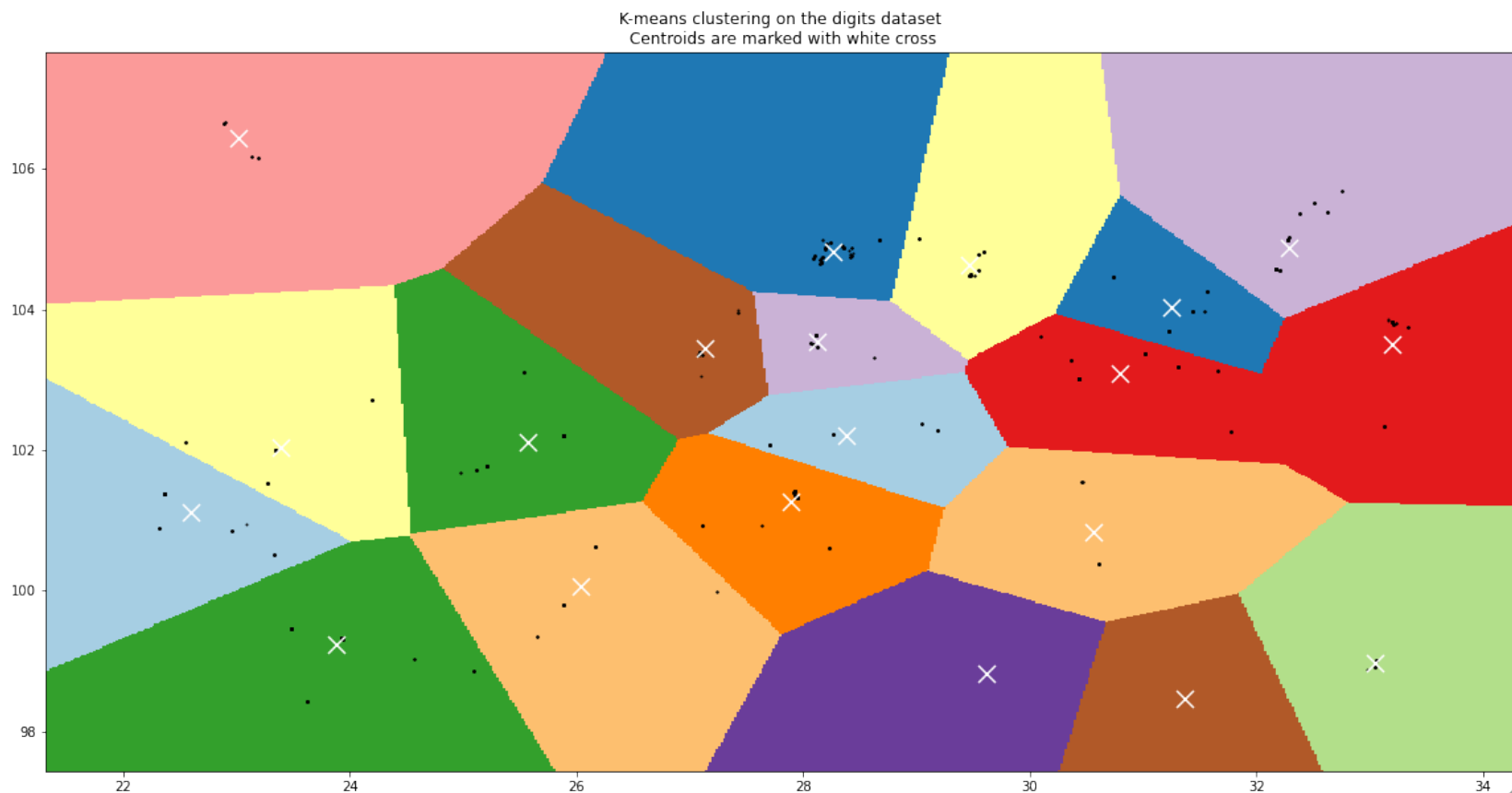
- 从3.5开始，每0.3为一组
- 共11组

3.5	3.6-3.8	3.9-4.1	4.2-4.4	4.5-4.7	4.8-5.0
5.1-5.3	5.4-5.6	5.7-5.9	6.0-6.2	6.3-6.5	6.6-6.8
6.9-7.0					

该范围中
无样本



对经纬坐标分组编码



使用k-means法，将所有可能坐标分为20种。



无地震样本会干扰预测性能

- 考虑
 - 地震的征兆会在超过一周前就存在
- 方案
 - 对于下一周无地震的样本，我们使用未来最先发生地震进行填充。
- 结果
 - 这一处理方式解决大量样本因为无地震，故而无经纬度和震级的尴尬处境，
 - 也提高了准确率。



神经网络的搭建1

电磁波数据输入

input_2: InputLayer	input:	(None, 197414)
	output:	(None, 197414)

对抗过拟合

dropout_2: Dropout	input:	(None, 197414)
	output:	(None, 197414)

dense_02: Dense	input:	(None, 197414)
	output:	(None, 512)

标准化

batch_normalization_3: BatchNormalization	input:	(None, 512)
	output:	(None, 512)

dense_020: Dense	input:	(None, 512)
	output:	(None, 1024)

全连接层 (Relu)

batch_normalization_4: BatchNormalization	input:	(None, 1024)
	output:	(None, 1024)

dense_021: Dense	input:	(None, 1024)
	output:	(None, 512)

标准化

batch_normalization_5: BatchNormalization	input:	(None, 512)
	output:	(None, 512)

声波数据输入

input_1: InputLayer	input:	(None, 208313)
	output:	(None, 208313)

对抗过拟合

dropout_1: Dropout	input:	(None, 208313)
	output:	(None, 208313)

dense_01: Dense	input:	(None, 208313)
	output:	(None, 512)

标准化

dense_010: Dense	input:	(None, 512)
	output:	(None, 1024)

batch_normalization_1: BatchNormalization	input:	(None, 1024)
	output:	(None, 1024)

dense_011: Dense	input:	(None, 1024)
	output:	(None, 512)

标准化

batch_normalization_2: BatchNormalization	input:	(None, 512)
	output:	(None, 512)

神经网络的搭建2

合并

concatenate_1: Concatenate	input:	[(None, 512), (None, 512)]
	output:	(None, 1024)

标准化

batch_normalization_6: BatchNormalization	input:	(None, 1024)
	output:	(None, 1024)

全连接层 (Relu)

dense_1: Dense	input:	(None, 1024)
	output:	(None, 2048)

dense_2: Dense	input:	(None, 2048)
	output:	(None, 2048)

dense_3: Dense	input:	(None, 2048)
	output:	(None, 2048)

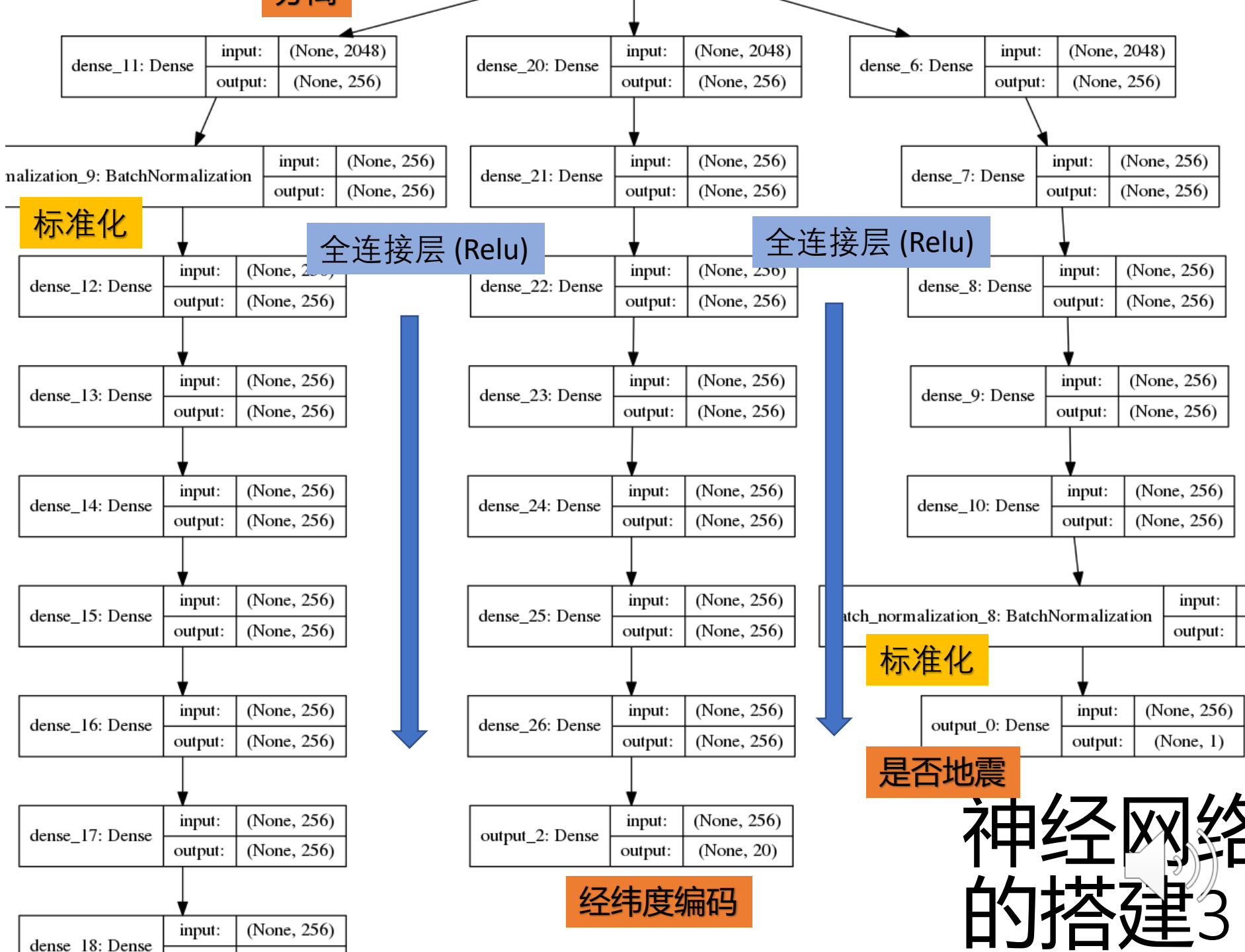
dense_4: Dense	input:	(None, 2048)
	output:	(None, 2048)

dense_5: Dense	input:	(None, 2048)
	output:	(None, 2048)

标准化

batch_normalization_7: BatchNormalization	input:	(None, 2048)
	output:	(None, 2048)





dense_13: Dense	input:	(None, 256)
	output:	(None, 256)

dense_14: Dense	input:	(None, 256)
	output:	(None, 256)

dense_15: Dense	input:	(None, 256)
	output:	(None, 256)

dense_16: Dense	input:	(None, 256)
	output:	(None, 256)

dense_17: Dense	input:	(None, 256)
	output:	(None, 256)

dense_18: Dense	input:	(None, 256)
	output:	(None, 256)

dense_19: Dense	input:	(None, 256)
	output:	(None, 256)

output_1: Dense	input:	(None, 256)
	output:	(None, 11)

震级编码

全连接层 (Relu)

dense_23: Dense	input:	(None, 256)
	output:	(None, 256)

dense_24: Dense	input:	(None, 256)
	output:	(None, 256)

dense_25: Dense	input:	(None, 256)
	output:	(None, 256)

dense_26: Dense	input:	(None, 256)
	output:	(None, 256)

output_2: Dense	input:	(None, 256)
	output:	(None, 20)

经纬度编码

全连接层 (Relu)

dense_9: Dense	input:	(None, 256)
	output:	(None, 256)

dense_10: Dense	input:	(None, 256)
	output:	(None, 256)

batch_normalization_8: BatchNormalization	input:	
	output:	

标准化

output_0: Dense	input:	(None, 256)
	output:	(None, 1)

是否地震

神经网络的搭建4

模型总结

