深圳大学
SHENZHEN UNIVERSITY

工作汇报

对自闭症相关工作介绍

导师：康莉　　汇报人：徐锦阳

一：多模态的相关实验

二：LSTM的相关实验

三：Glass Brain相关实验

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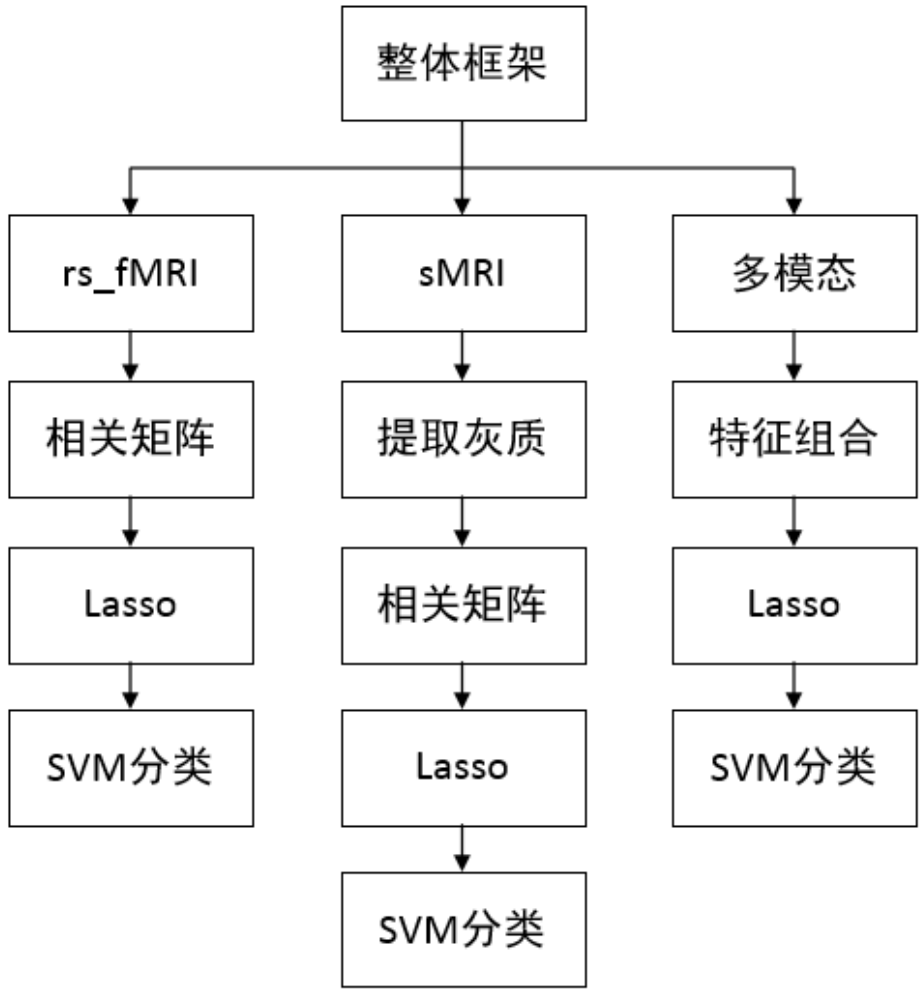
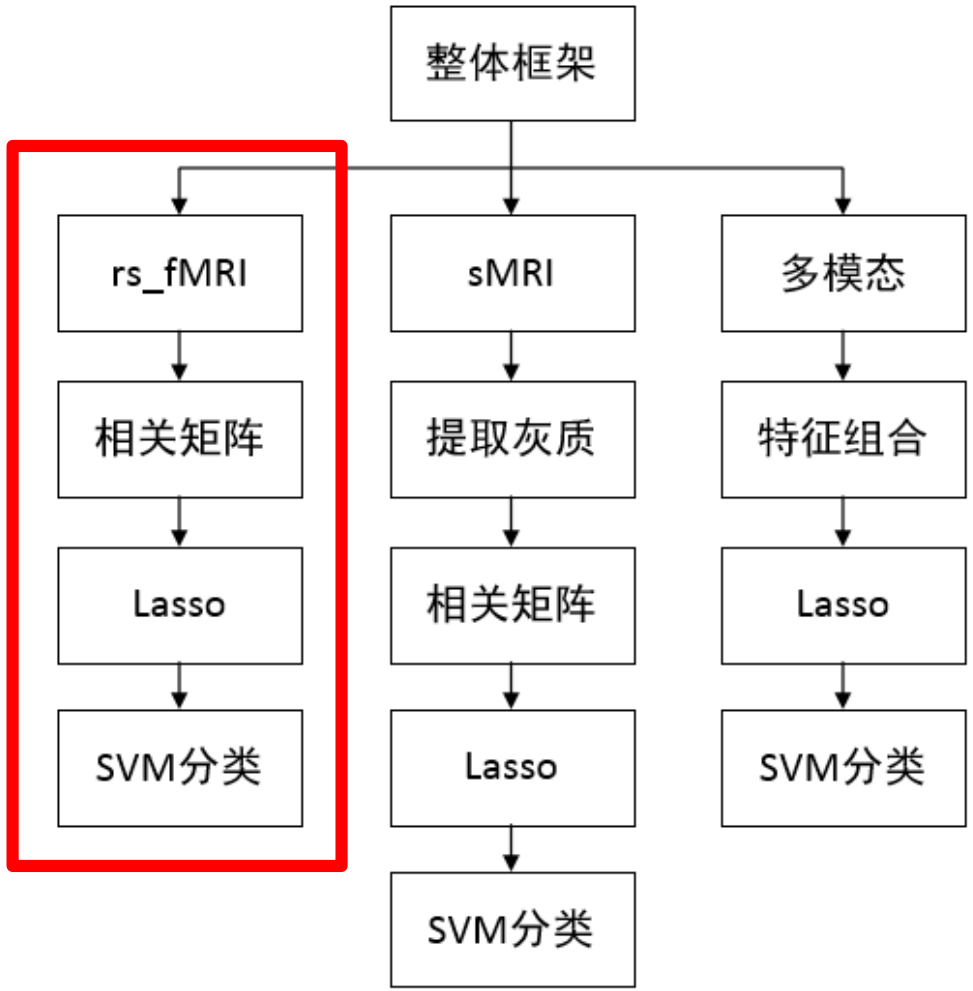
三：Glass Brain相关实验


整体框架
rs_fMRI
sMRI
多模态
相关矩阵
提取灰质
特征组合
Lasso
相关矩阵
Lasso
SVM分类
Lasso
SVM分类
SVM分类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数据集 aal, cc200,cc400 ,dosenbach160,ez,ho,tt

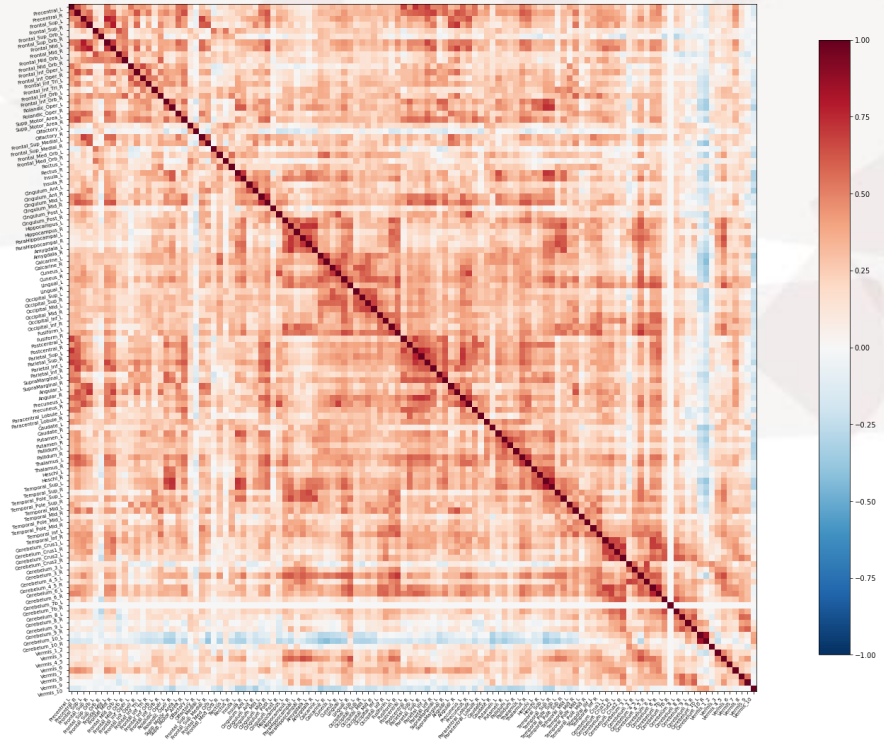
被　试 ASD(505), TC(530)

以excel文件的形式打开一个cc400的形式如右图，每一列表示的是每一个ROI的血氧水平信号

#2001	#2002	#2101	#2102	#2111	#2112	#2201	#2202	#2211	#2212	#2301	#2302	#2311	#2312	#2321	#2322
-13.0956	-17.3692	-2.18834	-1.05784	3.868999	10.25993	-7.19797	-15.3437	5.547882	15.82063	-17.986	-32.3677	-24.6673	-20.4427	-2.7102	5.637586
-2.81198	7.276022	-3.80413	-1.42636	-3.78308	1.644563	-5.8104	-18.2112	-5.82263	-16.859	-15.8943	-1.44017	0.010776	-4.5696	-8.17924	-3.30927
3.065376	-5.6489	2.401772	-3.061	6.993122	-1.68451	1.692506	-3.76792	7.756364	-2.69656	-4.80717	2.8041	-16.1899	-5.86293	6.904699	-0.90167
-4.25708	-14.2509	-4.20934	-5.78588	-1.64077	5.251424	-3.14032	-14.4908	-4.02189	3.773643	-2.47919	-14.0696	-15.7112	-23.0803	-2.57111	-4.57058
8.879547	3.248909	-0.29204	-6.96796	-2.96782	-0.16418	1.04842	-6.81522	-2.97318	-7.21432	12.55757	-10.2003	-0.97099	-10.181	-1.10034	-4.63427
-4.78309	-3.96332	-12.3838	-14.8316	-1.28979	-3.32334	-7.29188	-26.4203	-1.62678	-21.2057	-4.47384	-10.6326	-1.12584	-7.03067	-8.98468	-12.8366
4.099473	7.099471	6.073005	0.214182	-1.84736	-4.16552	4.446156	5.663963	-3.23905	-12.2556	2.246396	7.14014	7.26787	9.883471	-3.35266	-0.84744
0.520484	14.45236	-2.26953	0.887335	0.535324	-0.2224	-3.64188	6.867989	-6.87745	-9.76606	4.275085	13.61092	7.920429	4.660241	-8.52777	-7.32393
3.665568	4.920647	8.956381	6.788508	4.330697	-3.75801	4.846626	23.28492	3.047851	-2.03277	-0.1755	24.33549	16.23863	22.34444	2.920193	-4.12615
5.117057	4.516843	10.24106	8.837848	4.949454	-0.78638	8.151481	15.79956	5.710613	11.62152	5.660611	13.21394	4.866885	4.08601	5.016446	12.70647
3.649076	14.39007	5.417062	11.26129	-0.7889	0.316585	9.074387	24.55617	-6.8103	6.828004	17.86939	20.61831	22.95399	19.32092	7.857076	2.319346
12.62667	11.1391	2.216767	9.519259	2.657026	4.867595	8.034438	18.41985	-1.95338	24.59977	17.63293	12.47686	17.75644	20.62883	1.802281	15.20682
12.82253	13.06024	11.99918	17.12107	3.787154	-0.19194	15.00567	29.88123	14.33477	19.17252	23.65103	13.25362	25.02205	26.75371	22.71122	23.59795
5.809164	2.520839	6.59765	15.23459	-0.06652	-0.37697	6.400087	24.43428	2.936175	14.74358	2.55771	17.85155	6.316189	11.96976	6.911979	4.339774
0.16553	6.665989	4.532725	4.305989	-0.48787	3.201232	4.060477	11.38365	-2.75005	9.184187	12.63603	12.29799	4.190585	2.528123	-11.8866	-1.93183
7.979466	9.068922	-3.9272	2.795983	-5.76334	-2.14583	-0.9865	5.209186	-1.97337	-5.7584	5.293123	11.67464	10.85583	13.08217	-3.93431	0.342544
-1.21116	5.575585	-6.85207	-4.91592	-2.54235	-3.57377	-3.91803	0.54784	-7.67975	-3.60101	-10.0726	-0.81545	-8.88266	-8.24158	2.655985	-8.33576
-3.90217	-6.80591	0.38983	-0.31141	-4.74695	-1.69853	-0.15946	4.020767	-6.54854	-1.85442	-16.5535	-15.2671	-10.3413	-10.9101	-15.1194	-8.53846
-17.0349	-12.4768	-0.55875	-6.00785	-3.92346	-5.77259	-1.2157	5.191713	0.855215	0.660576	-22.781	-1.46495	-16.5588	-8.11908	-10.3198	-3.86522
-19.6916	-22.3988	-3.54661	-5.87743	2.158623	2.790271	-5.42879	-0.98738	6.707277	22.17611	-17.6287	-11.4496	-18.3284	-24.9363	-0.64049	1.034858
-5.6231	-18.3885	-3.98677	-2.59606	-1.4738	0.60631	-8.79897	-5.60784	9.658618	10.04429	-1.64548	-24.3085	-4.88888	7.060945	5.148548	17.58846
-17.4642	-21.5573	-11.3264	-20.2617	2.619954	-1.60355	-15.8838	-37.0978	3.990958	3.928021	-4.74517	-41.2112	-7.52881	-16.1444	-6.64164	-10.534
1.597913	-10.0657	5.456318	-15.0644	0.696701	-13.7741	0.912249	-16.7302	0.526707	-17.4132	27.12364	0.542675	18.46568	11.62525	21.0682	6.903909
5.893324	-5.15807	4.824253	-7.00162	2.978213	0.365169	5.380322	-12.0055	12.74593	-6.81721	16.57167	-6.28413	16.55132	4.751224	29.60473	-5.21038
13.63542	0.815485	2.192459	-1.27313	0.245297	5.661237	0.763024	-19.3382	-6.53007	-18.569	15.97463	-2.89413	11.84416	-4.45859	4.360134	-12.3678
11.50435	9.360184	4.567045	-0.64468	1.553297	-5.33437	1.811945	-5.32874	-1.42103	-27.7403	-3.46561	7.508373	-3.17329	-4.98575	-0.30197	-10.9538
15.82003	30.66621	12.43145	17.79337	12.46377	15.55893	14.0321	26.80688	7.037399	9.911336	22.68528	35.57322	14.1136	36.53564	7.287877	13.19176
-0.03387	19.27998	10.0633	21.32337	3.492951	5.731015	9.422155	27.16228	8.366552	4.418435	6.62869	9.681163	6.244088	12.56782	3.694765	17.02453
-8.41591	-10.8965	-1.15251	5.77975	1.538038	6.635456	-4.69413	-4.35579	-4.41117	4.419132	-29.9353	-10.9797	-25.2797	-25.0461	-7.04838	12.40012
-22.4039	-16.5714	-14.8673	-14.0731	0.252538	-2.02283	-11.5337	-16.8365	0.027019	9.179432	-27.1331	-6.2882	-32.7673	-23.1165	-13.6247	-11.7542
-4.93485	-8.24316	-6.69836	-13.4982	-1.79051	-5.02946	-2.121	-4.55759	-4.35451	1.586522	-11.2987	-7.61955	-9.72339	-15.6709	-15.8642	-1.15346
3.529994	-1.44366	2.822842	-9.68368	0.50593	1.668604	-3.10271	-1.08549	1.516292	8.076096	0.969497	0.188167	1.356512	6.834133	-10.8651	-13.466

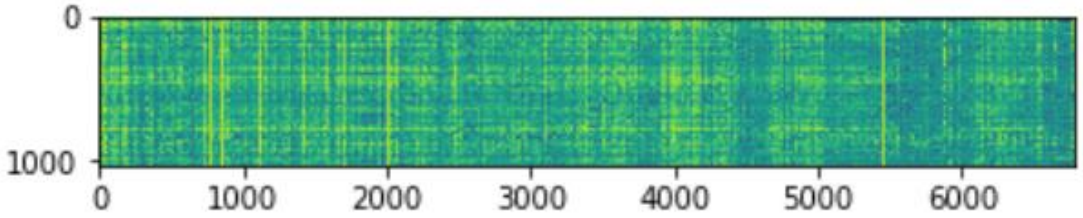
根据pearson相关系数构建相关矩阵

$$r = \frac{\sum_{i=1}^{n}(X_i - \overline{X})(Y_i - \overline{Y})}{\sqrt{\sum_{i=1}^{n}(X_i - \overline{X})^2}\sqrt{\sum_{i=1}^{n}(Y_i - \overline{Y})^2}}.$$

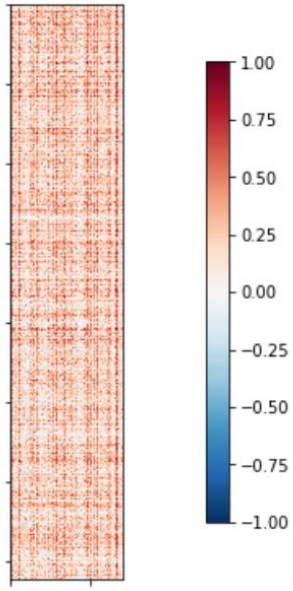


2111	Frontal_Sup_Orb_L
2112	Frontal_Sup_Orb_R
2201	Frontal_Mid_L
2202	Frontal_Mid_R
2211	Frontal_Mid_Orb_L
2212	Frontal_Mid_Orb_R
2301	Frontal_Inf_Oper_L
2302	Frontal_Inf_Oper_R
2311	Frontal_Inf_Tri_L
2312	Frontal_Inf_Tri_R
2321	Frontal_Inf_Orb_L
2322	Frontal_Inf_Orb_R
2331	Rolandic_Oper_L
2332	Rolandic_Oper_R
2401	Supp_Motor_Area_L
2402	Supp_Motor_Area_R
2501	Olfactory_L
2502	Olfactory_R
2601	Frontal_Sup_Medial_L
2602	Frontal_Sup_Medial_R
2611	Frontal_Med_Orb_L
2612	Frontal_Med_Orb_R
2701	Rectus_L
2702	Rectus_R
3001	Insula_L
3002	Insula_R

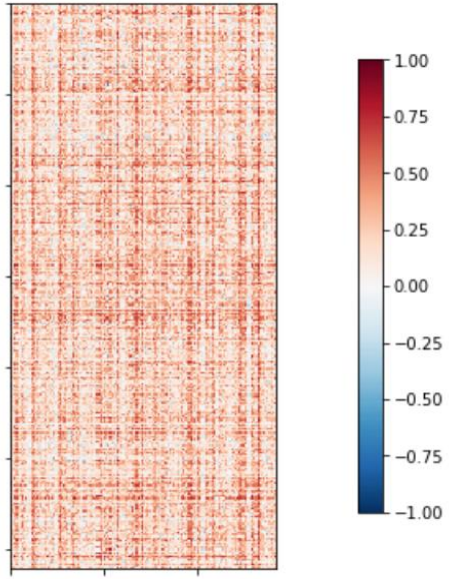
拉平效果图



Lasso+特征选择



(train)



(test)

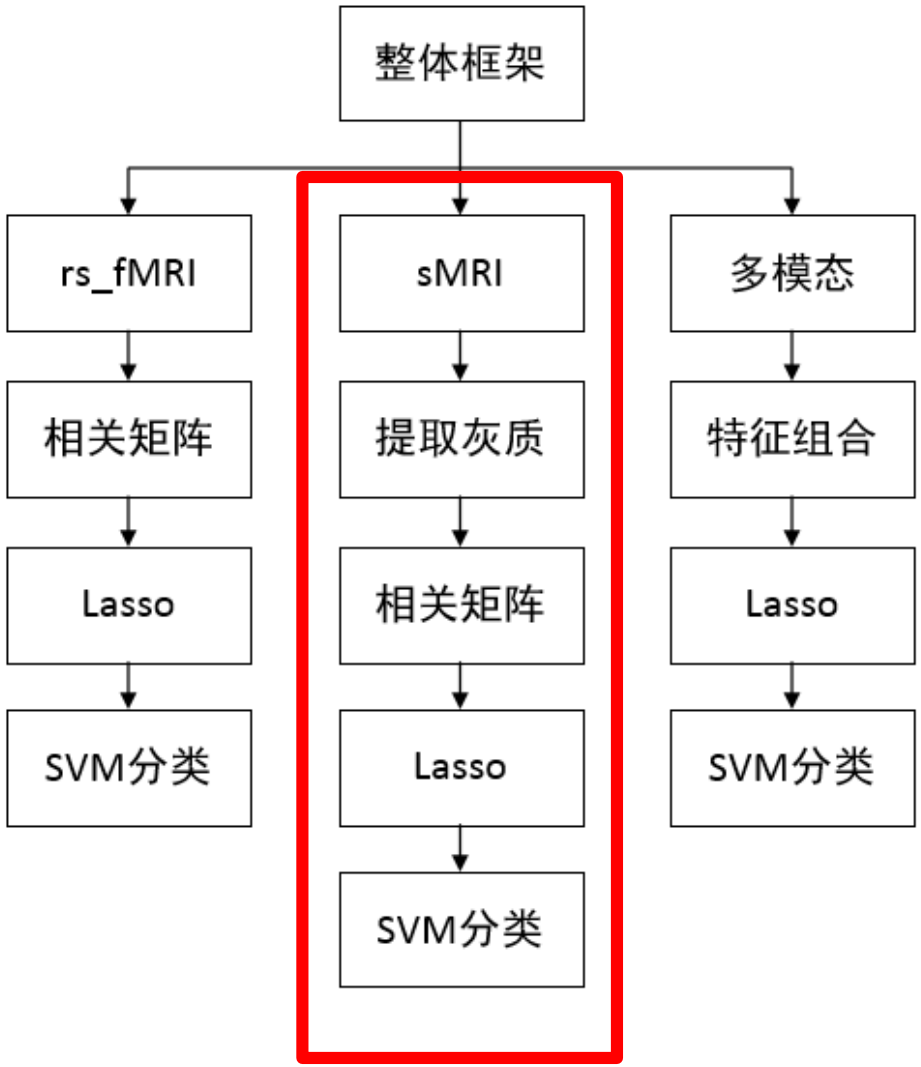
实验结果

表1　未使用lasso分类结果

	dos	ez	aal	cc200	cc400	ho	tt
svm	0.62	0.66	0.64	0.67	0.69	0.66	0.66
rfc	0.61	0.61	0.62	0.62	0.60	0.62	0.60
nb	0.56	0.59	0.56	0.56	0.58	0.57	0.56
knn	0.58	0.56	0.55	0.53	0.58	0.54	0.53

表2　使用lasso分类结果

	dos	ez	aal	cc200	cc400	ho	tt
svm	0.60	0.61	0.67	0.63	0.60	0.66	0.61
rfc	0.59	0.57	0.60	0.60	0.60	0.61	0.56
nb	0.60	0.59	0.62	0.66	0.58	0.64	0.61
knn	0.59	0.61	0.61	0.57	0.58	0.58	0.58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SVM分类
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特征组合
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数据集

总共1073，其中ASD有516个被试，TC有557个被试

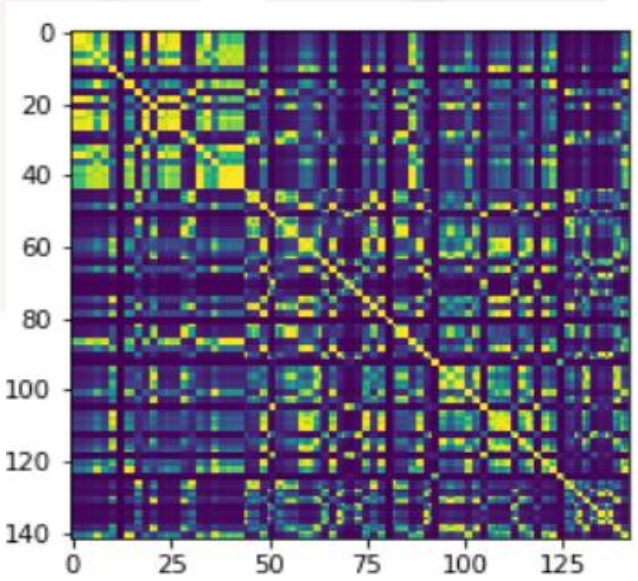
获取灰质中ROI的体积

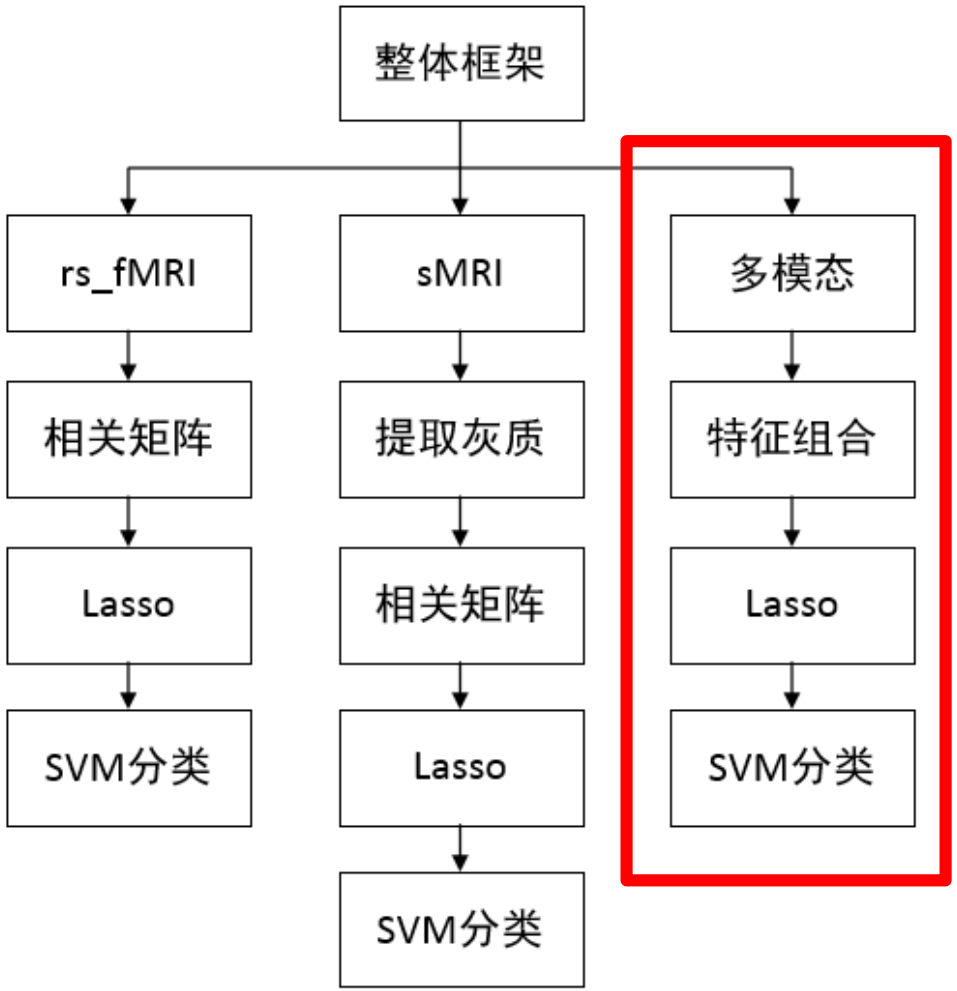
names	l3thVen	r3thVen	l4thVen	r4thVen	lAcc	rAcc	lAmy	rAmy	lBst	rBst
MPRAGE	0.3284	0.2298	0.7303	0.7749	0.001	0.004	0.0929	0.0846	1.9913	2.2598

构建相关矩阵

$$c(i,j) = \frac{1}{|gm(i) - gm(j)|^2 + 1}$$

gm(i)和gm(j)分别代表ROI的体积

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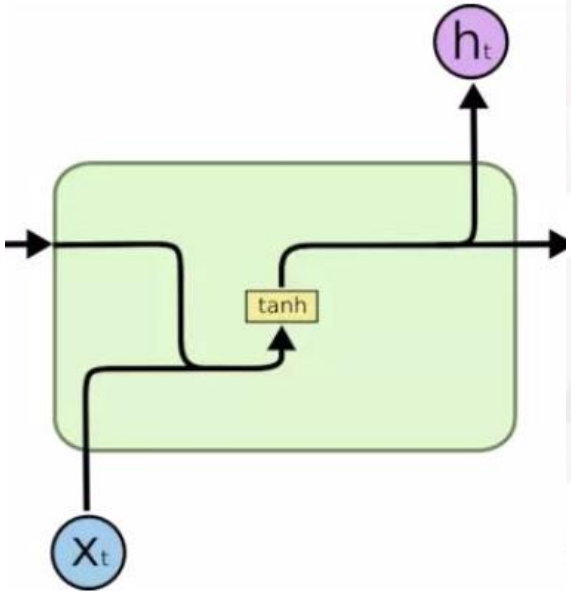
未做实验

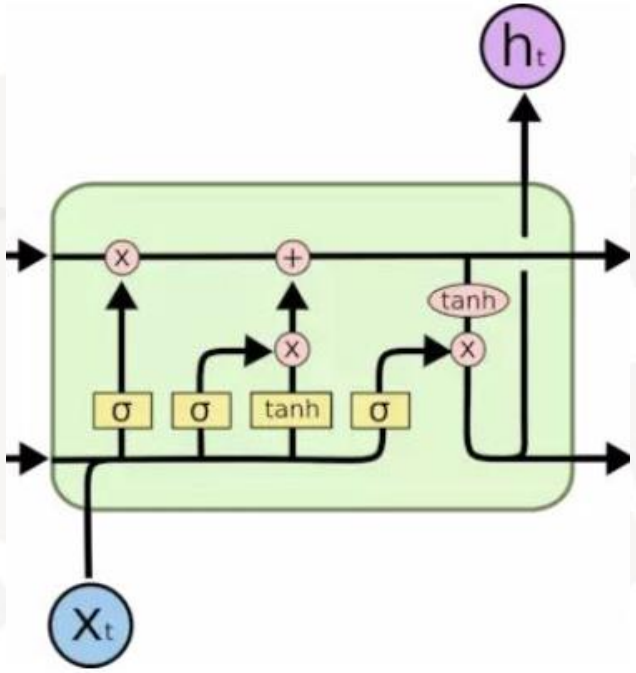
一：多模态的相关实验

二：LSTM的相关实验

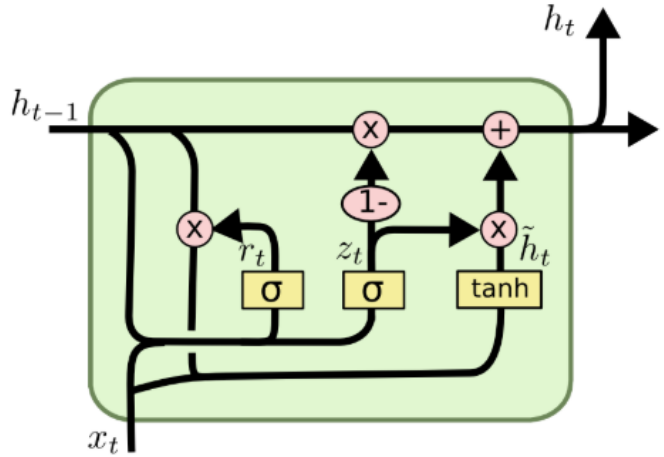
三：Glass Brain相关实验


h_t
tanh
X_t

RNN


h_t
x
+
tanh
σ
σ
tanh
σ
x
x
X_t

LSTM


h_t
h_{t-1}
x
+
1-
x
x
r_t
z_t
$\tilde{h}_t$
σ
σ
tanh
x_t

GRU

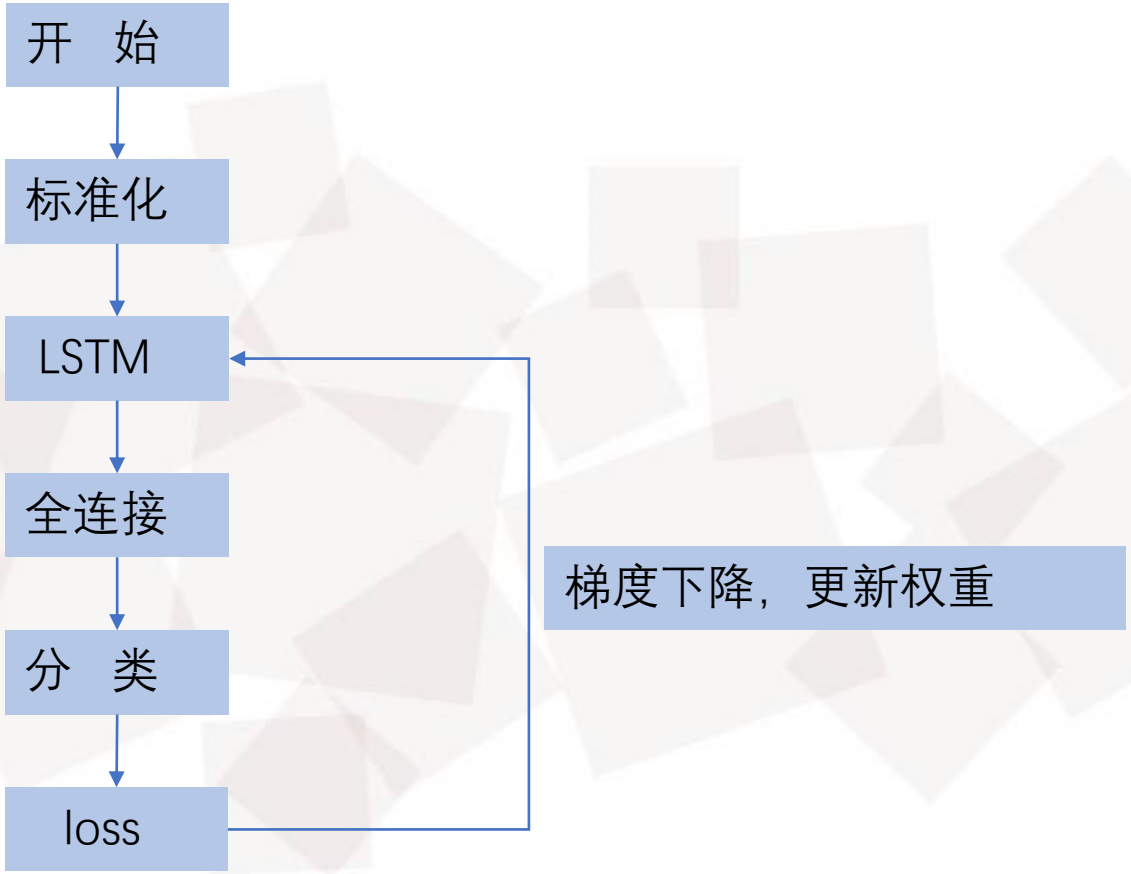
第一个实验

Z-score标准化

$$v_i' = \frac{v_i - v_m}{v_{sd}}$$

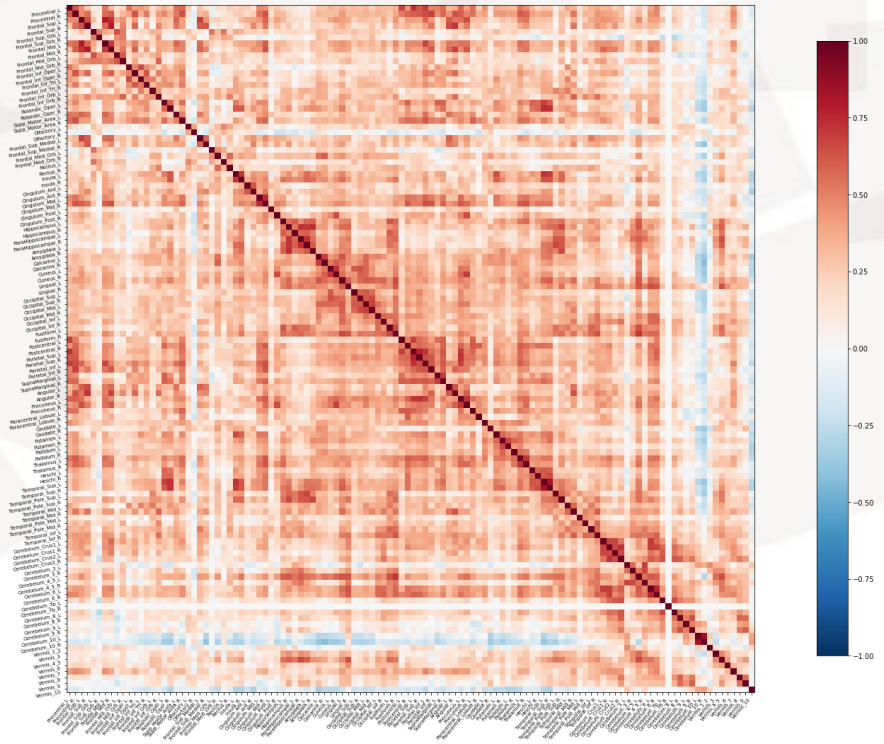
#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11	#12	#13	#14	#15	#16	#17
31.37913	94.99556	-29.6939	13.69547	9.467523	50.28454	38.30182	55.62358	-5.6061	-5.90238	60.98504	3.584819	14.97717	-7.43482	105.3419	96.56012	78.14935
10.28227	40.23048	-9.29923	-8.26822	-2.96799	-11.621	10.66102	82.32078	68.90225	33.21863	22.71589	36.13623	17.96544	24.48306	67.03628	38.10257	-11.1441
0.598608	-63.2631	1.88048	18.10274	-7.85791	-29.3514	-36.1553	10.09844	-12.5155	0.606756	-28.8378	90.64941	6.97132	-3.60109	22.22397	6.148417	35.77521
26.48986	15.72068	63.99031	-17.0908	-30.8997	22.89031	19.7102	-29.9685	-49.3557	-31.1521	39.10233	-97.6876	-12.0215	-34.9893	-18.106	-4.64013	-63.7314
19.99758	44.70937	49.31953	11.2943	6.541612	-7.5534	38.50812	-26.2447	-34.8009	19.97856	41.84854	107.8618	-8.3363	33.32216	-17.1433	9.971532	-26.267
-6.98104	2.606571	-7.9627	-42.4583	12.61115	-1.01851	32.37502	-79.8258	-40.3852	-6.94156	16.34775	70.93541	-2.09477	-0.98401	-95.6712	-27.9061	-8.05258
-42.3895	-27.1259	-60.9891	3.793348	-5.26678	-0.99039	-25.5753	-36.7822	-37.5995	-43.8702	25.90969	42.86994	16.77961	2.509358	-15.4284	-9.95289	21.40447
1.16676	15.41984	-12.9131	26.29881	18.98049	5.965125	45.55959	32.12545	41.30752	23.57795	-9.79746	-39.2107	-15.6793	-5.98163	12.19557	2.935562	-17.1318
34.11314	-73.1875	4.011065	24.48869	7.208504	-7.10633	-22.9445	23.34177	46.92379	-17.1029	-21.632	-34.4618	-16.4458	-6.92338	-13.4694	-10.4749	-20.0486
-21.3411	-108.753	-25.2655	-3.71898	-20.6573	-45.8628	-45.0552	17.84308	18.93251	-43.7377	-72.6583	-98.5306	4.57178	29.62986	0.393501	-59.5594	-50.0046
-19.7015	-34.5655	-20.844	14.90296	-5.33013	-17.3056	-14.9817	30.81564	41.82162	-10.946	-40.546	-29.6066	-2.86282	-5.78796	23.83932	-61.9564	21.16288
-23.7616	-69.7837	-0.33568	1.995457	-8.30316	-12.8816	-26.2429	-46.4914	11.30113	12.0491	-20.7175	-58.5891	-16.4775	-8.59609	-57.2368	-23.8165	-6.01562
9.461432	-104.962	16.19637	-38.5209	2.992059	-5.82762	-66.0425	-77.9753	-23.2662	0.606533	-81.3088	-17.1372	-15.9529	-48.5392	-119.613	-70.7672	9.776684
-52.4397	-25.8759	2.127013	-24.631	16.81879	40.77088	-10.4026	-55.1012	-14.361	21.12139	-24.8689	-52.3047	-5.28967	11.71478	-48.1266	-57.8355	-9.26417
27.78068	16.29105	0.101899	7.452136	-4.23				693	-1.68032	-34.4353	-63.9322	11.79049	23.4058	-51.1071	-50.2043	-24.3576
-29.086	23.279	-22.5185	0.312008	-8.79				353	-4.54441	0.024362	-27.1836	15.11556	20.11145	10.08785	28.4629	42.44532
-115.765	-111.028	2.868567	-5.08106	-22.3				735	-17.8654	-87.9215	-23.5243	-29.2826	-12.6305	-77.1322	-25.451	-31.9446
-72.8673	-29.199	48.53121	-16.5596	-16.7				507	-2.07539	-12.0779	80.09295	-19.5329	-13.7534	-22.2392	19.4477	-9.93957
36.20434	45.80531	4.799096	24.39651	-9.65				965	-8.01963	67.40373	-82.7498	3.218808	11.93677	49.314	67.49525	26.32973
142.3925	104.1491	8.196896	22.43938	8.721				827	-4.68835	53.37599	94.8642	19.14544	4.332779	84.38663	84.18097	16.7449
14.55849	8.778427	52.04757	29.16682	4.497643	-8.78922	12.3098	32.51349	-26.1486	-1.17279	47.62569	35.67874	9.350226	15.44404	52.10459	37.19643	-22.1792
-11.5706	37.66411	40.86396	17.53063	13.8847	4.60866	22.02725	60.84264	-47.1102	20.241	68.52955	-29.1693	-7.968	-2.20885	13.53489	36.04068	28.31358
-5.68777	-27.2532	8.483075	-29.9173	-6.92762	-18.1681	6.10539	-0.02213	-29.5981	16.68899	36.5835	68.63786	-24.5101	-36.3657	-28.0783	-40.3259	6.710701
9.409855	43.32215	4.328964	-15.6764	49.32855	35.59533	32.93795	51.6445	6.616515	47.71773	40.21504	-13.8154	9.562463	-30.923	10.47084	-14.0583	32.18112
-41.4047	45.28908	-33.3224	-18.2245	1.646969	12.38737	-0.85776	-12.9404	26.81647	-7.31038	-7.86806	21.70011	14.84169	15.81219	-13.0089	-10.6538	-10.7063
24.29151	53.79957	-8.93712	-11.2688	-18.7608	-34.7694	-6.58773	-20.9015	-18.8107	-32.7331	-6.20717	-83.8333	0.604435	-8.37574	-14.6056	-3.32271	13.2943
3.439747	-14.2726	42.41499	-2.03387	-3.50486	-22.6018	-40.7936	-36.1253	9.113219	13.93766	-59.0797	2.73142	-4.81522	-8.67878	-8.37224	-28.414	28.18287
-26.2966	54.81611	-10.7296	19.17713	21.43279	14.05384	3.605996	-8.46338	8.967455	30.52817	-10.8667	99.98989	2.838485	54.74111	63.22844	9.103505	-10.0318
4.158554	34.06197	-13.8097	19.94881	5.684839	-15.1387	44.24547	71.03961	2.437191	24.11843	-37.9975	-25.6387	8.700463	20.40052	37.39997	-0.53283	-30.7948
55.56936	7.399996	-8.52113	0.383955	2.417221	-23.0939	44.04811	-17.1078	34.75164	36.89312	34.74025	8.558377	-11.9062	19.40165	9.181863	-4.50208	-20.1664
27.86344	42.59215	7.743412	-2.58032	20.86737	12.50739	-8.47064	45.50363	-0.27777	2.714545	11.19114	22.40495	29.47964	-32.4958	43.37179	23.2395	-43.4841

对于每个尺寸为(176,200)的被试，设置输入的时间步长为176，输入大小为200

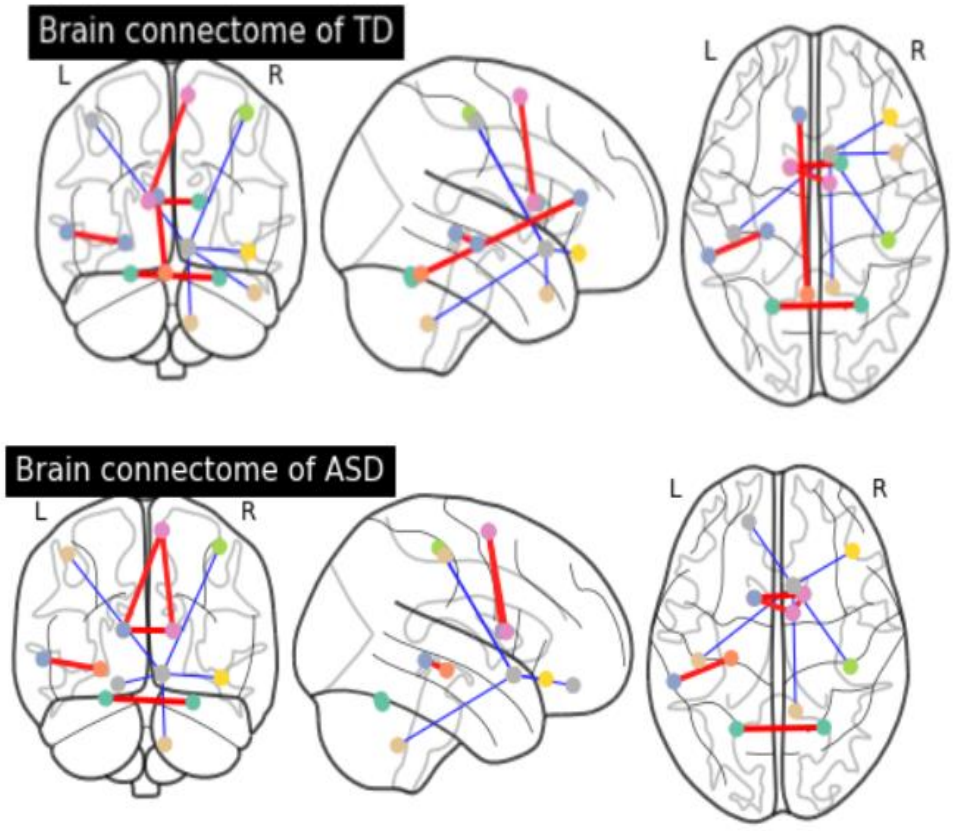

开　始
标准化
LSTM
全连接
分　类
loss
梯度下降，更新权重

第二个实验

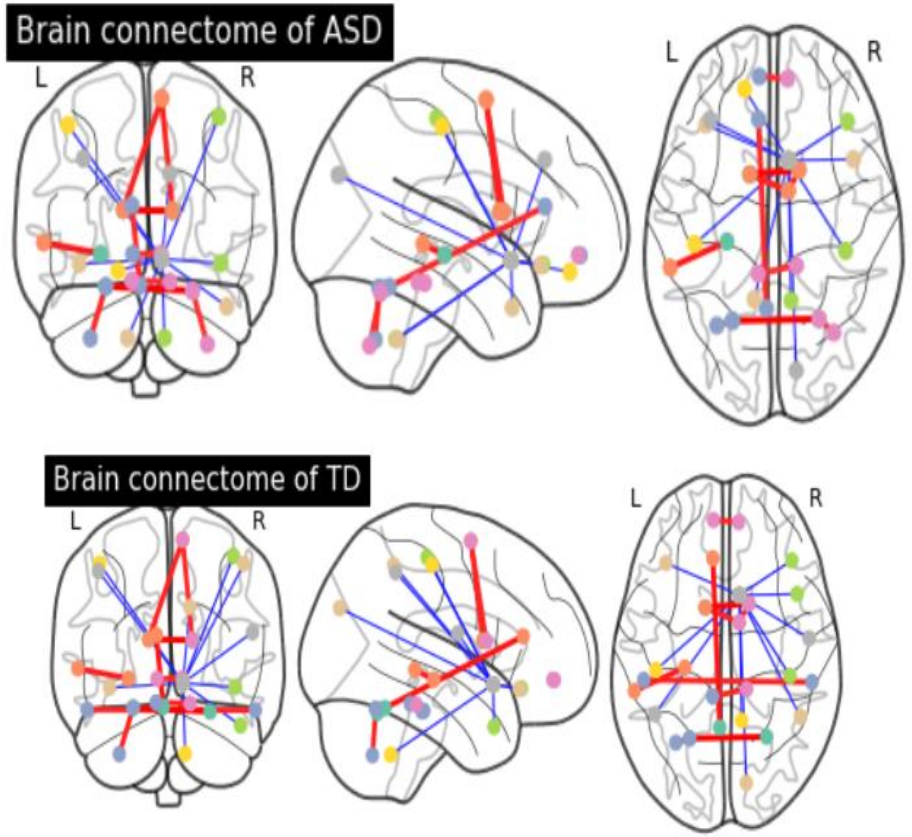
找出最相关和最不相关的ROI



平均相关矩阵



Top5相关与不相关ROI



Top10相关与不相关ROI

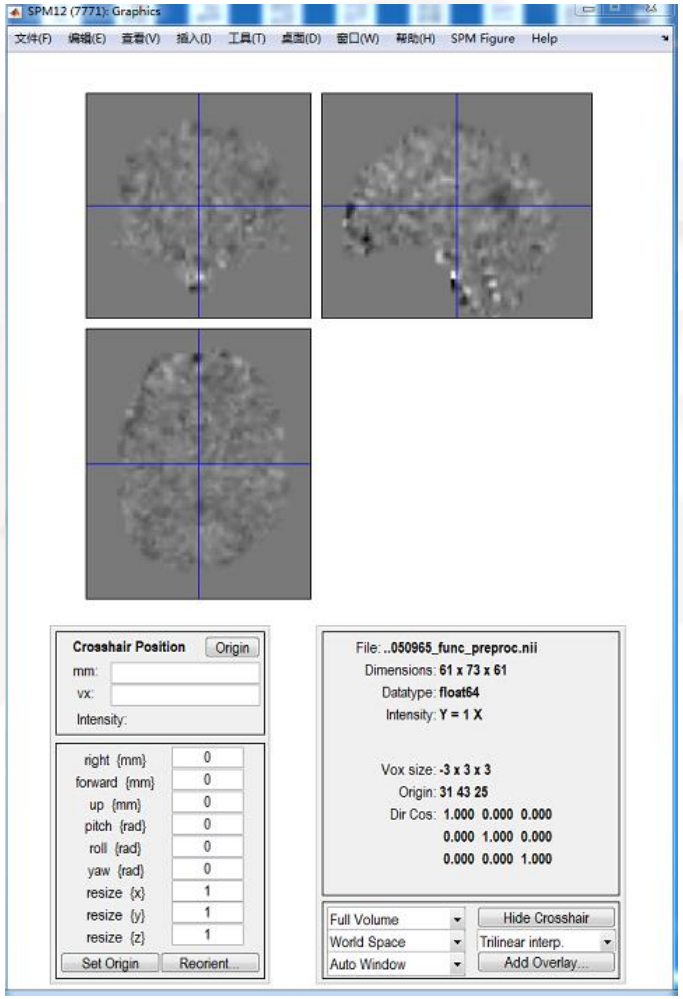
一：多模态的相关实验

二：LSTM的相关实验

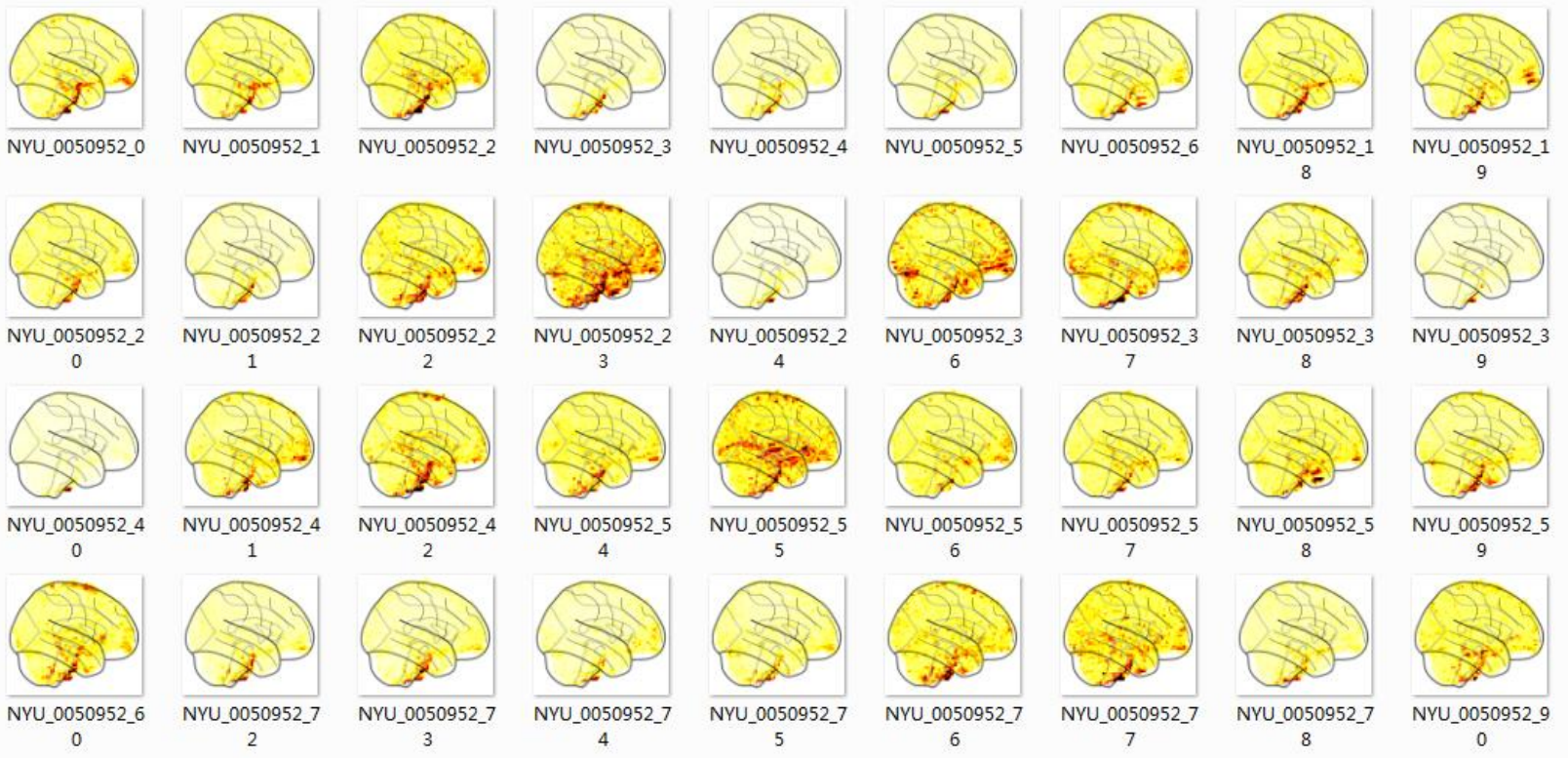
三：Glass Brain相关实验

数据集

func_preproc ,总共1035个被试



生成Glass Brain



实验

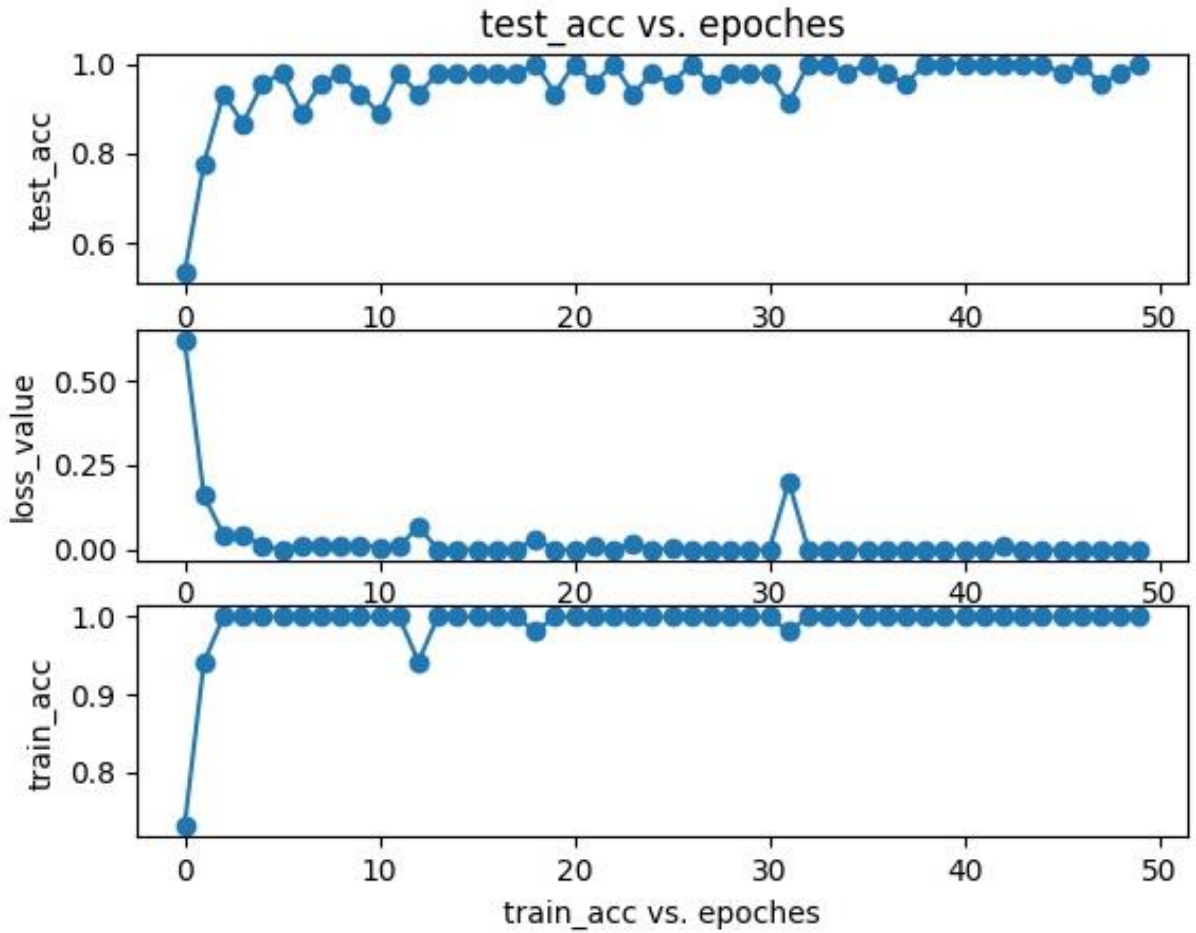
站点：NYU

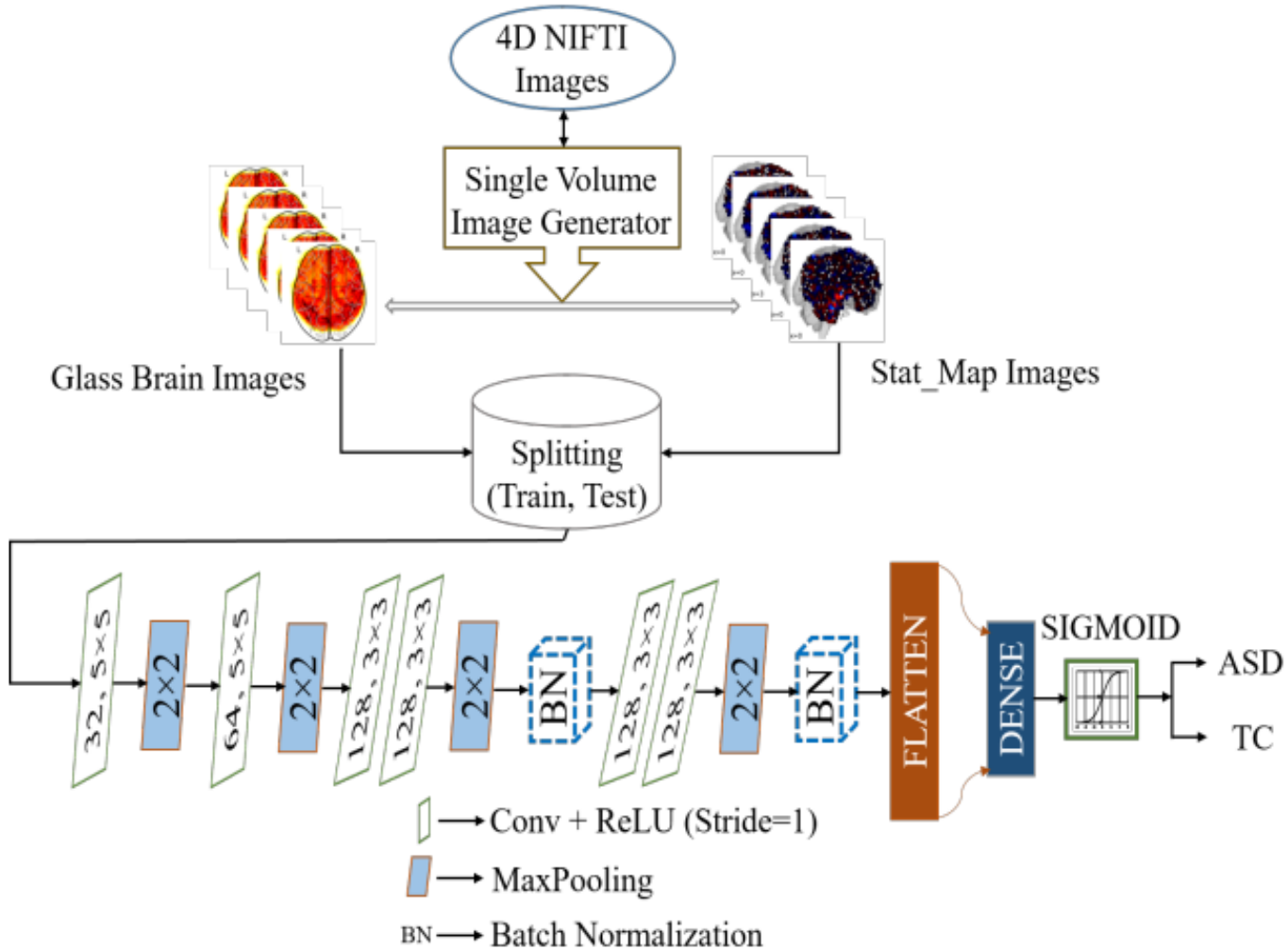
数据量：ASD(75)，TC(100)，分别生成了13200和17424张glass brain

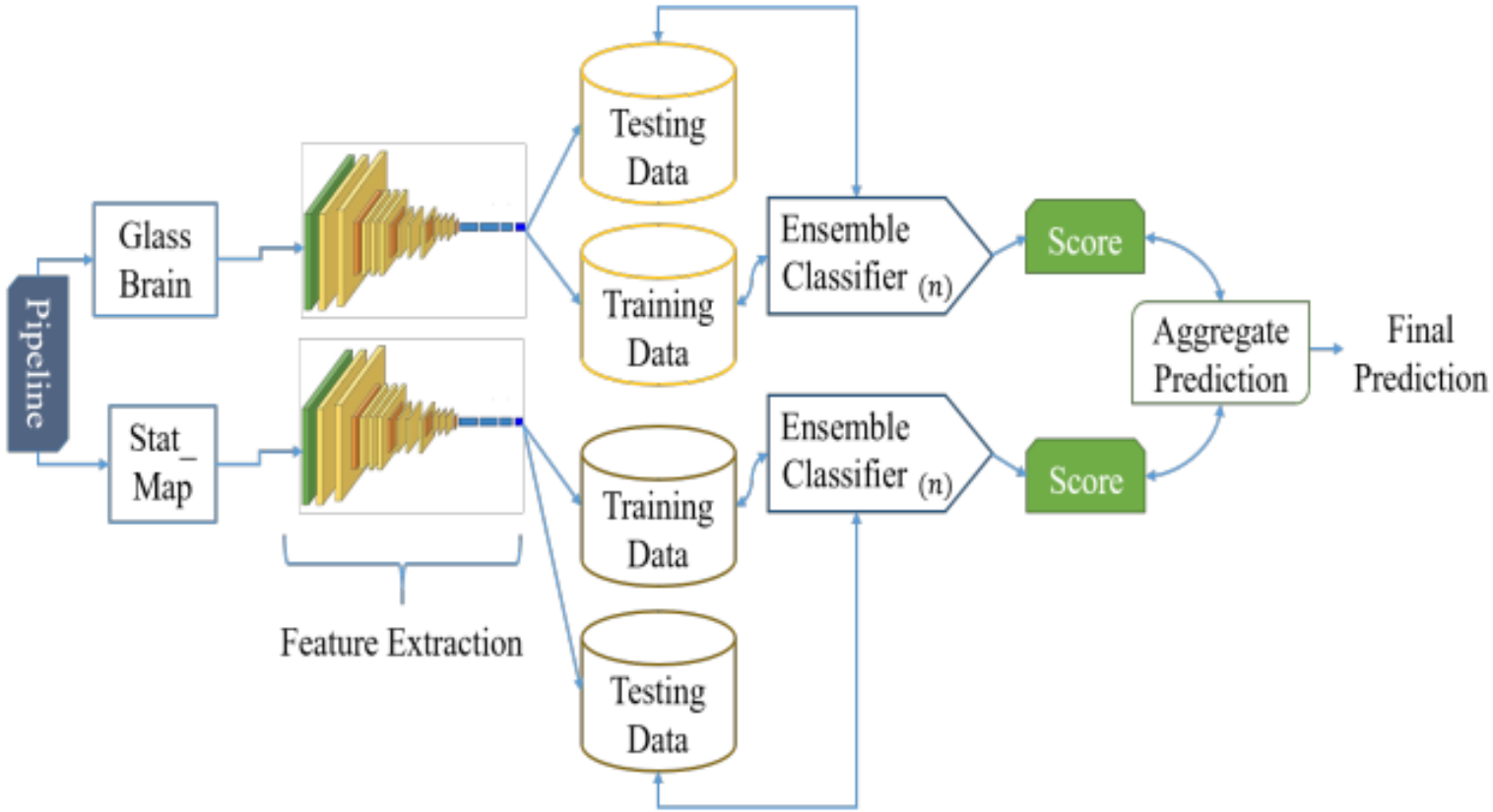
划分数据集：8:2

网络：ResNet18+3个全连接层

训练结果


test_acc vs. epoches
test_acc
1.0
0.8
0.6
0
10
20
30
40
50
loss_value
0.50
0.25
0.00
train_acc
1.0
0.9
0.8
train_acc vs. epoches


4D NIFTI Images
Single Volume Image Generator
Glass Brain Images
Stat_Map Images
Splitting (Train, Test)
32, 5×5
2×2
64, 5×5
2×2
128, 3×3
128, 3×3
2×2
BN
128, 3×3
128, 3×3
2×2
BN
FLATTEN
DENSE
SIGMOID
ASD
TC
Conv + ReLU (Stride=1)
MaxPooling
BN Batch Normalization


Pipeline
Glass Brain
Stat_ Map
Feature Extraction
Testing Data
Training Data
Training Data
Testing Data
Ensemble Classifier (n)
Ensemble Classifier (n)
Score
Score
Aggregate Prediction
Final Prediction

计划安排

一：拓展Glass Brain和Stat_Map的实验

二：基于图卷积网络对相关矩阵做实验

谢谢！