Alzheimer's Disease Diagnosis via Interested Structure Selection in Magnetic Resonance Imaging

Guilin University of Electronic Technology
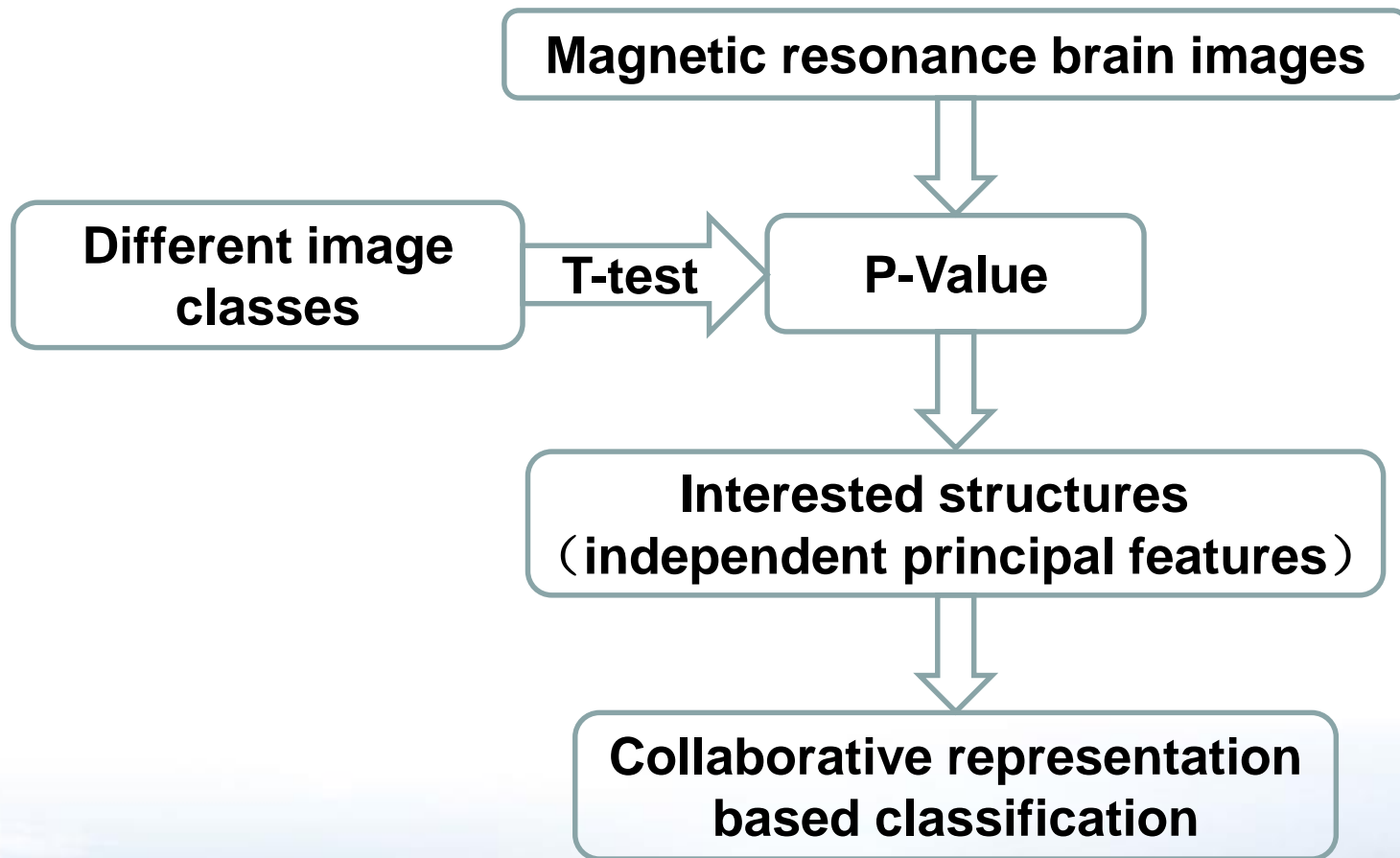
Chao Ma

machao199271@sina.cn

A new feature selection method

Magnetic resonance brain images

↓

Different image classes → **T-test** → P-Value

↓

Interested structures
（independent principal features）

↓

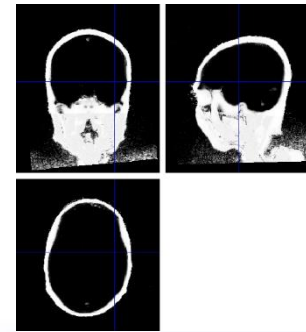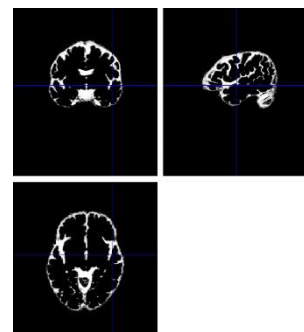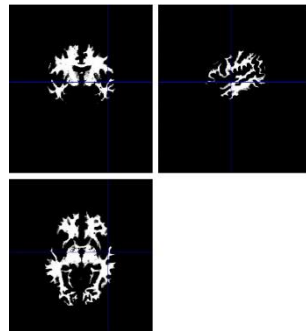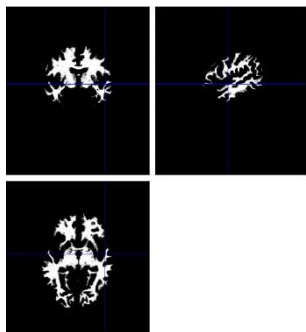Collaborative representation based classification

Method

- 1、Image pre-processing：statistical parametric mapping software

- 2、 Selecting the interested structures：T-test

- 3、Classification：collaborative representation based classification

Pre-processing

- 1、Normalization
- 2、Image aligning
- 3、Image segmentation

brain gray matter; brain white matter; cerebrospinal fluid; skull

Selecting the interested structures

- 1、 Parceled into 90 anatomical structures using statistical parametric mapping
- 2、 Calculated the significance level with T-test
- 3、 Got the mean of significance value
- 4、 Selected the interested structures

Classification and data

- Alzheimer's disease neuroimaging initiative database

- 50 AD, 50 NC, 55 MCI

- Collaborative representation based classification method

TABLE II.   ACCURACIES OF STRUCTURES WITH DIFFERENT NUMBERS.

Number of structures	NC vs AD					NC vs MCI				
	ACC	SEN	SPE	PAC	NAC	ACC	SEN	SPE	PAC	NAC
2	0.799	0.811	0.813	0.782	0.817	0.708	0.699	0.702	0.730	0.699
4	0.868	0.906	0.904	0.832	0.913	0.725	0.704	0.702	0.733	0.728
6	0.918	0.898	0.899	0.939	0.886	0.720	0.742	0.741	0.730	0.713
8	0.921	0.914	0.915	0.940	0.901	0.733	0.721	0.721	0.724	0.741
10	0.918	0.915	0.914	0.940	0.903	0.752	0.746	0.747	0.727	0.781
12	**0.922**	**0.924**	**0.925**	**0.943**	**0.915**	**0.750**	**0.756**	**0.759**	**0.776**	**0.734**
14	0.916	0.918	0.918	0.914	0.918	0.740	0.755	0.754	0.751	0.739
16	0.907	0.909	0.908	0.923	0.906	0.764	0.791	0.790	0.786	0.755
18	0.916	0.927	0.927	0.911	0.924	0.716	0.745	0.749	0.736	0.703

Comparison of different classifiers

SVM-support vector machine
FLD-fisher linear discriminant
CRC-collaborative representation
based classification

TABLE III.   THE COMPARISON OF SVM, FLD AND CRC.

	NC vs AD	NC vs MCI	MCI vs AD
SVM	0.828	0.715	0.822
FLD	0.645	0.656	0.641
CRC	**0.922**	**0.750**	**0.835**

Comparison of different classifiers

TABLE IV. ACCURACIES OF SINGLE MODALITY METHODS AND THE PROPOSED METHOD.

	modality	AD vs. NC	MCI vs. NC	
Vemuri model II[14]	MRI	0.885	—	
Vemuri model III[14]	MRI	0.893	—	
Mesrob[4]	MRI	0.911	—	
Tong[5]	MRI	0.917	0.792	
Proposed method	MRI	0.922	0.750	

TABLE V. ACCURACIES OF MUTI-MODALITY METHODS AND THE PROPOSED METHOD.

	modality	AD vs. NC	MCI vs. NC	
Hinrichs[15]	MRI+PET	0.876	—	
Gray[16]	MRI+PET+CSF+genetic	0.890	0.746	
Feng L[7]	MRI+PET	0.944	0.788	
Shi SVM[8]	MRI+PET	0.947	0.795	
Shi SRC[8]	MRI+PET	0.933	0.801	
Proposed method	MRI	0.922	0.750	

Conclusion

- 1、 Used statistical parametric mapping software to pre-process magnetic resonance images

- 2、 Selected interested structures based on T-test

- 3、 classified images by collaborative representation based classification.