Supplementary Material for: A Perception-inspired Deep Learning Framework for Predicting Perceptual Texture Similarity

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Abstract

Here we provide the figures of the similarity value prediction and retrieval experimental results on Procdeural Texture Dataset (PTD) with different texture similarity predicting methods. The similarity value prediction results are shown in Section I, the retrieval experiments with top 6 rankings and retrieval experiment based on different query texture with top 10 rankings are shown in Section II.

I. Similarity Value Prediction Experiments

In this section, the similarity value prediction experimental results are shown in Fig. 1 with different similarity prediction methods. The similarity values obtained by the observers and the predicted similarity values are shown in each bar chart. In Fig. 1, (a), (b), (c), (d), (e), (f), (g), (h), (i) shows the result of our methods, auto-encoder + CNN, auto-encoder + Gabor, auto-encoder + LBP, auto-encoder + PCANet, random forest + CNN, random forest + Gabor, random forest + LBP, random forest + PCANet respectively. From the figure, we can clearly see that our method obtained the more accurate preceptual similarity values than other methods. Compared with other methods, the similarity values obtained by the proposed method are much closer to the ground truth.

II. Retrieval Experiments with Top rankings

In this section, there top 6 textures ranked by the observers based on one query texture in the free-grouping and retrieved using different similarity predicting methods are shown in Fig. 2, Fig. 3 and Fig. 4 , and top 10 textures ranked by the observers based on another query texture in the free-grouping and retrieved using different similarity predicting methods are shown in Fig. 5. In each figure, the first column on the left is the query texture, and the images on the right are the ranking of the top N images. The corresponding G Measure and M Measure values are noted below.

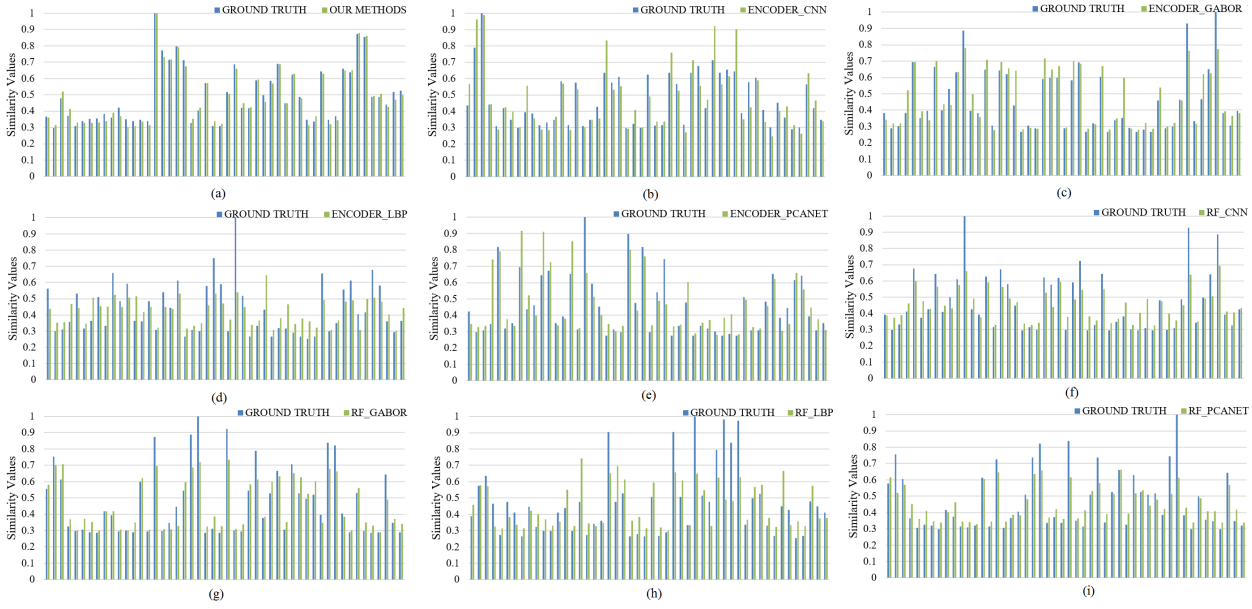
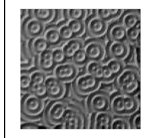


Fig. 1. Bar charts of the perceptual similarity values obtained by the observers and the predicted similarity values obtained using different similarity prediction methods. Here, (a), (b), (c), (d), (e), (f), (g), (h), (i) shows the result of our methods, auto-encoder + CNN, auto-encoder + Gabor, auto-encoder + LBP, auto-encoder + PCANet, random forest + CNN, random forest + Gabor, random forest + LBP, random forest + PCANet respectively. The prediction values of our method are much closer to the ground truth than other methods.



Query Texture	Top 6 Ranking
	146 **151** **120** **57** **131** **76**
	Ranked by the Observers;
	146 **151** **120** **133** 97 74
	Similarity Predicted Method: Ours; G Measure = 0.8095; M Measure = 0.9178; Relevance Rate = 66.7%
	146 **130** 381 **151** 74 **76**
	Similarity Predicted Method: Encoder_CNN; G Measure = 0.6667; M Measure = 0.7399; Relevance Rate = 66.7%
	120 **151** **146** 97 374 37
	Similarity Predicted Method: Encoder_Gabor; G Measure = 0.6190; M Measure = 0.4634; Relevance Rate = 50%
	74 408 118 37 **133** **151**
	Similarity Predicted Method: Encoder_LBP; G Measure = 0.1429; M Measure = 0.0508; Relevance Rate = 33.3%
	151 **120** **146** 173 72 409
	Similarity Predicted Method: Encoder_PCANet; G Measure = 0.6190; M Measure = 0.4634; Relevance Rate = 50%
	151 **120** 146 **76** 74 **133**
	Similarity Predicted Method: RF_CNN; G Measure = 0.7143; M Measure = 0.4933; Relevance Rate = 66.7%
	151 **146** **120** 133 97 403
	Similarity Predicted Method: RF_Gabor; G Measure = 0.7619; M Measure = 0.6039; Relevance Rate = 50%
	57 **151** **133** **120** 74 403
	Similarity Predicted Method: RF_LBP; G Measure = 0.6190; M Measure = 0.3946; Relevance Rate = 50%
	151 **146** **120** 74 **76** 72
	Similarity Predicted Method: RF_PCANet; G Measure = 0.7143; M Measure = 0.5830; Relevance Rate = 66.7%

Fig. 2. Top 6 ranking of the textures in the retrieval experiments. The first column on the left is the query texture, and the images on the right are the ranking of the top 6 images. The corresponding G Measure and M Measure values are noted below.

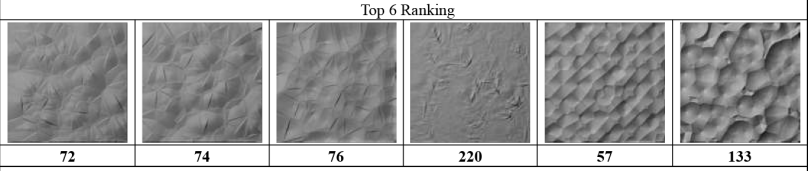
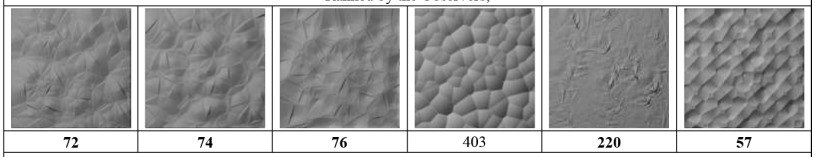
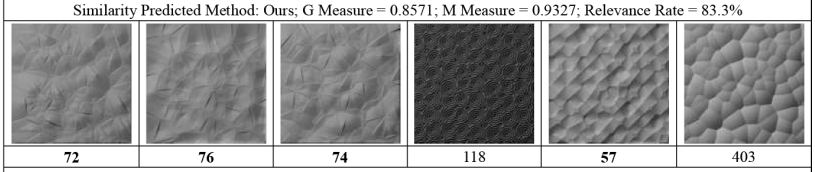
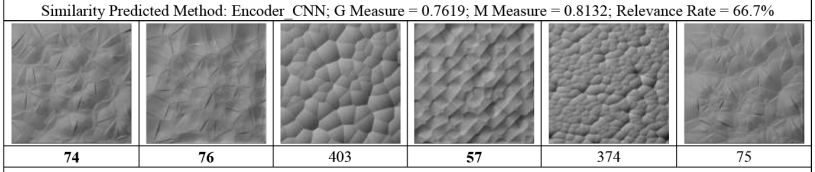
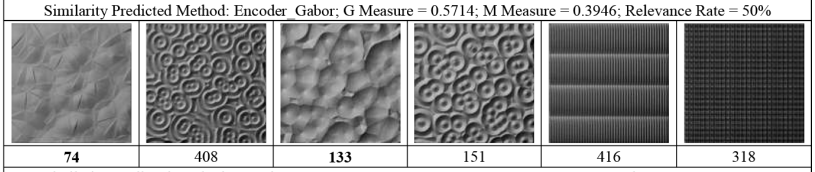
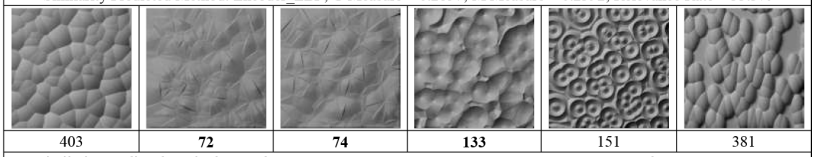
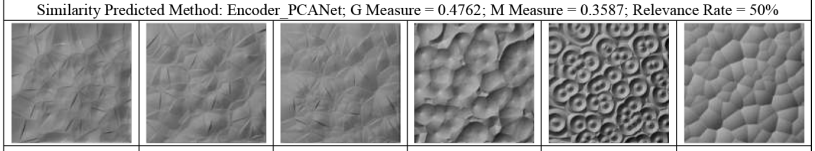
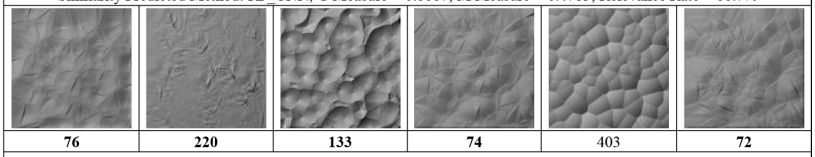
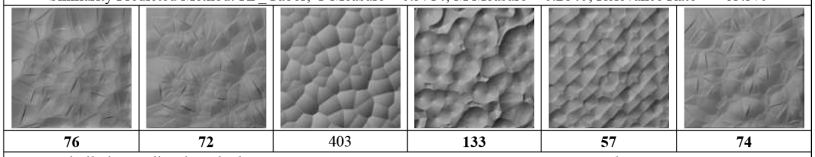
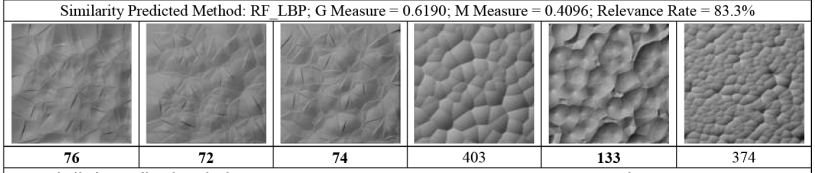
Query Texture	Top 6 Ranking
	
	72 **74** **76** **220** **57** **133**
	Ranked by the Observers;
	
	72 **74** **76** 403 **220** **57**
	Similarity Predicted Method: Ours; G Measure = 0.8571; M Measure = 0.9327; Relevance Rate = 83.3%
	
	72 **76** **74** 118 **57** 403
	Similarity Predicted Method: Encoder_CNN; G Measure = 0.7619; M Measure = 0.8132; Relevance Rate = 66.7%
	
	74 **76** 403 **57** 374 75
	Similarity Predicted Method: Encoder_Gabor; G Measure = 0.5714; M Measure = 0.3946; Relevance Rate = 50%
	
	74 408 **133** 151 416 318
	Similarity Predicted Method: Encoder_LBP; G Measure = 0.2857; M Measure = 0.2392; Relevance Rate = 33.3%
	
	403 **72** **74** **133** 151 381
	Similarity Predicted Method: Encoder_PCANet; G Measure = 0.4762; M Measure = 0.3587; Relevance Rate = 50%
	
	76 **74** **72** **133** 151 403
	Similarity Predicted Method: RF_CNN; G Measure = 0.6667; M Measure = 0.4783; Relevance Rate = 66.7%
	
	76 **220** **133** **74** 403 **72**
	Similarity Predicted Method: RF_Gabor; G Measure = 0.5714; M Measure = 0.2840; Relevance Rate = 83.3%
	
	76 **72** 403 **133** **57** **74**
	Similarity Predicted Method: RF_LBP; G Measure = 0.6190; M Measure = 0.4096; Relevance Rate = 83.3%
	
	76 **72** **74** 403 **133** 374
	Similarity Predicted Method: RF_PCANet; G Measure = 0.4783; M Measure = 0.6667; Relevance Rate = 66.7%

Fig. 3. Top 6 ranking of the textures in the retrieval experiments. The first column on the left is the query texture, and the images on the right are the ranking of the top 6 images. The corresponding G Measure and M Measure values are noted below.

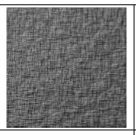
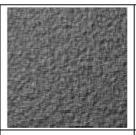
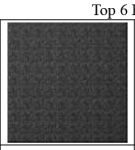
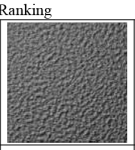
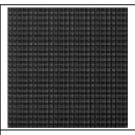
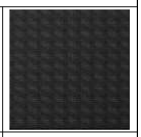
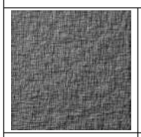
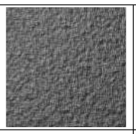
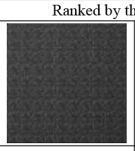
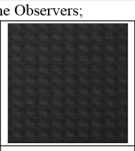
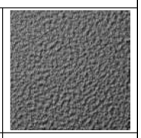
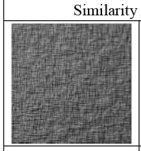
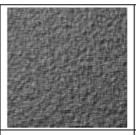
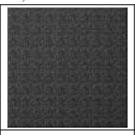
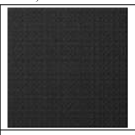
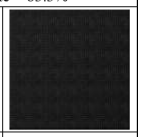
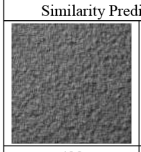
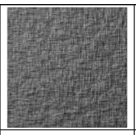
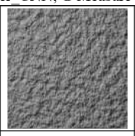
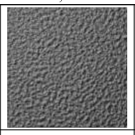
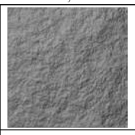
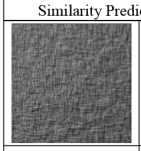
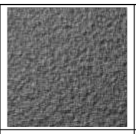
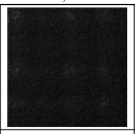
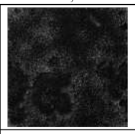
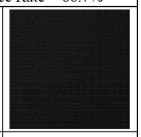
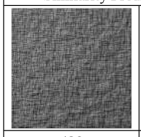
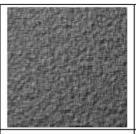
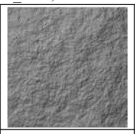
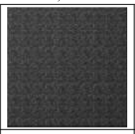
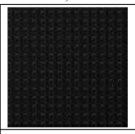
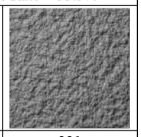
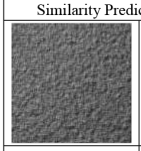
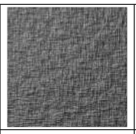
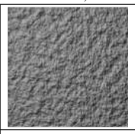
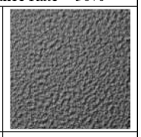
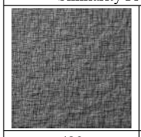
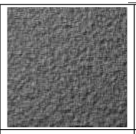
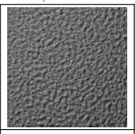
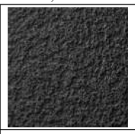
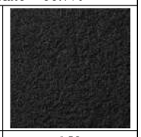
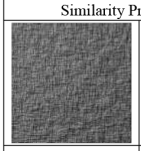
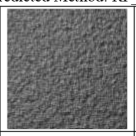
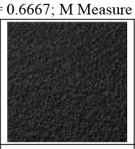
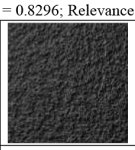
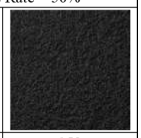
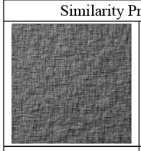
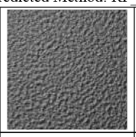
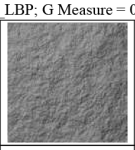
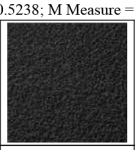
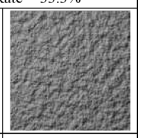
Query Texture	Top 6 Ranking					
						
	420	**423**	**273**	**192**	**318**	**264**
	Ranked by the Observers;					
						
	420	**423**	**273**	**264**	254	**192**
	Similarity Predicted Method: Ours; G Measure = 0.8095; M Measure = 0.9118; Relevance Rate = 83.3%					
						
	420	**423**	**273**	**264**	254	277
	Similarity Predicted Method: Encoder_CNN; G Measure = 0.7619; M Measure = 0.8969; Relevance Rate = 66.7%					
						
	423	**420**	331	**192**	190	**273**
	Similarity Predicted Method: Encoder_Gabor; G Measure = 0.6667; M Measure = 0.5306; Relevance Rate = 66.7%					
						
	420	**423**	8	396	1	306
	Similarity Predicted Method: Encoder_LBP; G Measure = 0.5238; M Measure = 0.7623; Relevance Rate = 33.3%					
						
	420	**423**	190	**273**	308	331
	Similarity Predicted Method: Encoder_PCANet; G Measure = 0.6667; M Measure = 0.8296; Relevance Rate = 50%					
						
	423	**420**	**273**	254	331	**192**
	Similarity Predicted Method: RF_CNN; G Measure = 0.7143; M Measure = 0.5830; Relevance Rate = 66.7%					
						
	420	**423**	171	**192**	170	153
	Similarity Predicted Method: RF_Gabor; G Measure = 0.6667; M Measure = 0.8296; Relevance Rate = 50%					
						
	420	**423**	190	171	170	153
	Similarity Predicted Method: RF_LBP; G Measure = 0.5238; M Measure = 0.7623; Relevance Rate = 33.3%					
						
	420	192	190	171	153	331
	Similarity Predicted Method: RF_PCANet; G Measure = 0.4286; M Measure = 0.6054; Relevance Rate = 16.7%					

Fig. 4. Top 6 ranking of the textures in the retrieval experiments. The first column on the left is the query texture, and the images on the right are the ranking of the top 6 images. The corresponding G Measure and M Measure values are noted below.

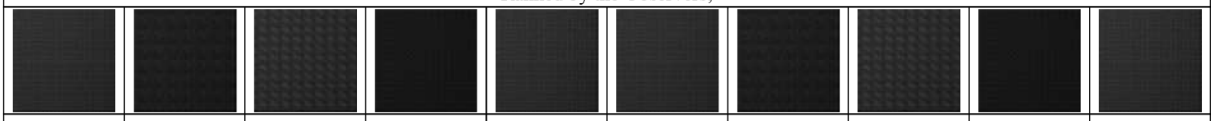
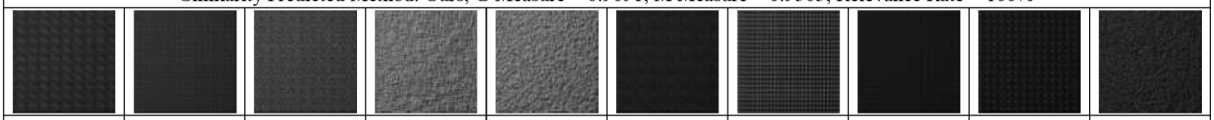
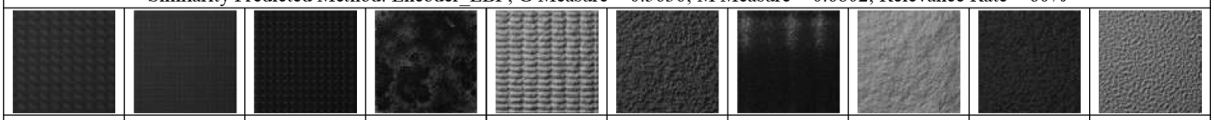
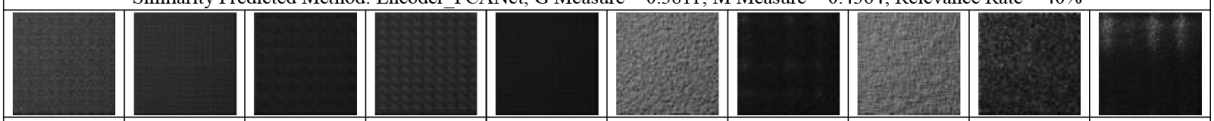
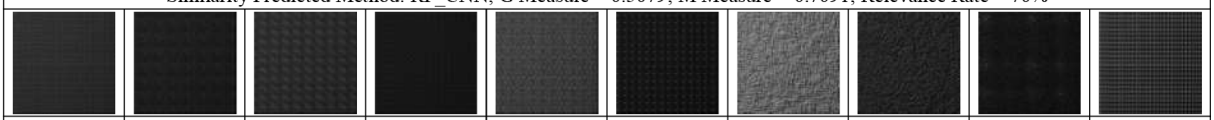
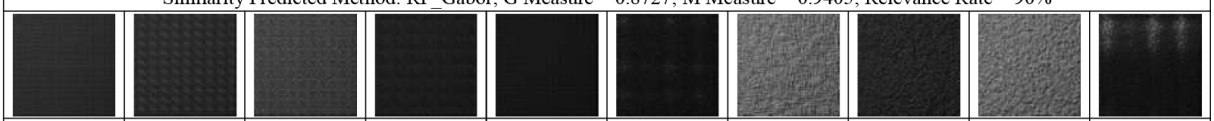
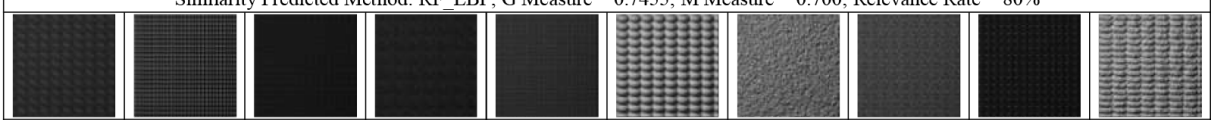
Query Texture	Top 10 Ranking
	254 **277** **264** **306** **308** **318** **273** **420** **423** **153**
	Ranked by the Observers;
	
	254 **277** **264** **306** **273** **308** **153** **318** **420** **423**
	Similarity Predicted Method: Ours; G Measure = 0.9091; M Measure = 0.9505; Relevance Rate = 100%
	
	264 **254** **273** **420** **423** **277** **318** **306** **308** **153**
	Similarity Predicted Method: Encoder_CNN; G Measure = 0.4698; M Measure = 0.7455; Relevance Rate = 100%
	254 **264** **306** **277** **273** 396 **420** **423** 192 **153**
	Similarity Predicted Method: Encoder_Gabor; G Measure = 0.7847; M Measure = 0.7636; Relevance Rate = 80%
	254 396 **264** **306** 1 390 8 **277** **423** **420**
	Similarity Predicted Method: Encoder_LBP; G Measure = 0.5636; M Measure = 0.6802; Relevance Rate = 60%
	
	264 **254** **308** 1 236 170 390 190 **153** 192
	Similarity Predicted Method: Encoder_PCANet; G Measure = 0.3811; M Measure = 0.4364; Relevance Rate = 40%
	
	273 **254** **277** **264** **306** **423** 396 **420** 36 390
	Similarity Predicted Method: RF_CNN; G Measure = 0.5079; M Measure = 0.7091; Relevance Rate = 70%
	
	254 **277** **264** **306** **273** **308** **420** **153** 396 **318**
	Similarity Predicted Method: RF_Gabor; G Measure = 0.8727; M Measure = 0.9405; Relevance Rate = 90%
	
	254 **264** **273** **277** **306** 396 **420** **153** **423** 390
	Similarity Predicted Method: RF_LBP; G Measure = 0.7455; M Measure = 0.700; Relevance Rate = 80%
	
	264 **318** **306** **277** **254** 409 **423** **273** **308** 236
	Similarity Predicted Method: RF_PCANet; G Measure = 0.7273; M Measure = 0.4059; Relevance Rate = 80%

Fig. 5. Top 10 ranking of the textures in the retrieval experiments. The first column on the left is the query texture, and the images on the right are the ranking of the top 10 images. The corresponding G Measure and M Measure values are noted below.