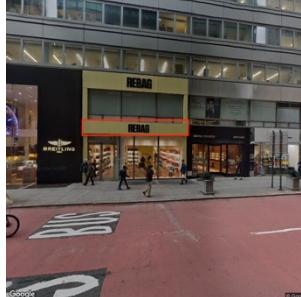
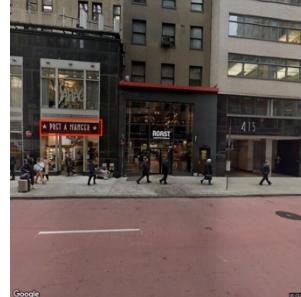


Saliency-aware color harmony models for outdoor signboard

Supplementary Material

Computer & Graphics

Table S1: Examples of signboards with the human-rated and predicted color harmony and color coherence scores from eight streets.

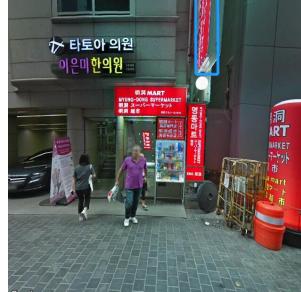
NYC			
Harmony			
	$r_{har} = 4.143$ $r_{har}(t) = 4.301$	$r_{har} = 5,$ $r_{har}(t) = 4.945$	$r_{har} = 4.857 ,$ $r_{har}(t) = 4.648$
Coherence			
	$r_{coh} = 5.857$ $r_{coh}(t) = 5.794$	$r_{coh} = 4$ $r_{coh}(t)= 4.056$	$r_{coh} = 5.714$ $r_{coh}(t)= 3.879$

*r is the average human rating, while r(t) is the corresponding prediction.

Seoul1

Harmony			
	$r_{har} = 55.429$ $r_{har}(t) = 5.334$	$r_{har} = 5.143$ $r_{har}(t) = 5.033$	$r_{har} = 4.143$ $r_{har}(t) = 3.839$
Coherence			
	$r_{coh} = 4.286$ $r_{coh}(t) = 4.356$	$r_{coh} = 5.429$ $r_{coh}(t) = 5.056$	$r_{coh} = 3.143$ $r_{coh}(t) = 4.696$

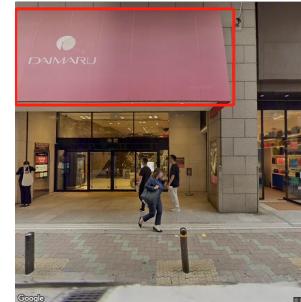
Seoul2

Harmony	 <p>$r_{har} = 5.286$ $r_{har}(t) = 5.239$</p>	 <p>$r_{har} = 42.286$ $r_{har}(t) = 4.369$</p>	 <p>$r_{har} = 2.714$ $r_{har}(t) = 2.798$</p>
Coherence	 <p>$r_{coh} = 5.143$ $r_{coh}(t) = 5.166$</p>	 <p>$r_{coh} = 5.143$ $r_{coh}(t) = 5.299$</p>	 <p>$r_{coh} = 2$ $r_{coh}(t) = 2.372$</p>

Milan

Harmony			
	$r_{har} = 5.857$ $r_{har(t)} = 5.741$	$r_{har} = 5.143$ $r_{har(t)} = 5.228$	$r_{har} = 3.857$ $r_{har(t)} = 4.319$
Coherence			
	$r_{coh} = 5.285$ $r_{coh(t)} = 5.290$	$r_{coh} = 5.571$ $r_{coh(t)} = 5.284$	$r_{coh} = 5.571$ $r_{coh(t)} = 4.745$

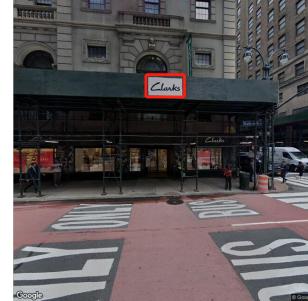
Osaka

Harmony			
	$r_{har} = 6$ $r_{har}(t) = 5.9$	$r_{har} = 4.429$ $r_{har}(t) = 4.361$	$r_{har} = 4.143$ $r_{har}(t) = 4.547$
Coherence			
	$r_{coh} = 5.571$ $r_{coh}(t) = 5.593$	$r_{coh} = 5.857$ $r_{coh}(t) = 5.899$	$r_{coh} = 4.714$ $r_{coh}(t) = 4.497$

Taipei

Harmony	 <p>$r_{har} = 3.857$ $r_{har}(t) = 3.972$</p>	 <p>$r_{har} = 3.857$ $r_{har}(t) = 3.832$</p>	 <p>$r_{har} = 5.857$ $r_{har}(t) = 5.647$</p>
Coherence	 <p>$r_{coh} = 4.857$ $r_{coh}(t) = 4.785$</p>	 <p>$r_{coh} = 5.286$ $r_{coh}(t) = 5.319$</p>	 <p>$r_{coh} = 3$ $r_{coh}(t) = 3.896$</p>

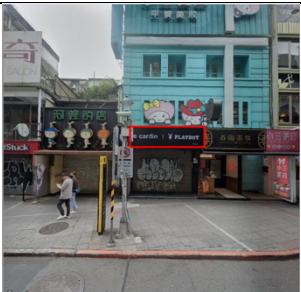
HK1

	Harmony	Coherence	
Harmony	 $r_{har} = 3.857$ $r_{har}(t) = 3.869$	 $r_{har} = 4$ $r_{har}(t) = 4.067$	 $r_{har} = 5.143$ $r_{har}(t) = 5.029$
Coherence	 $r_{coh} = 2.429$ $r_{coh}(t) = 3.078$	 $r_{coh} = 5$ $r_{coh}(t) = 4.914$	 $r_{coh} = 3.571$ $r_{coh}(t) = 3.558$

HK2

	Harmony	Coherence	
Harmony	 $r_{har} = 5.429$ $r_{har}(t) = 5.501$	 $r_{har} = 4.429$ $r_{har}(t) = 4.459$	 $r_{har} = 3.429$ $r_{har}(t) = 3.684$
Coherence	 $r_{coh} = 5.143$ $r_{coh}(t) = 5.311$	 $r_{coh} = 4.286$ $r_{coh}(t) = 4.412$	 $r_{coh} = 4$ $r_{coh}(t) = 4.194$

Table S2: Examples of signboards ordered by the predicted color harmony/coherence from high to low.

Harmony
 <p>Osaka-4-1 $r_{har} = 6$ $r_{har}(t) = 5.980$</p>
 <p>HK2-4-4 $r_{har} = 5.429$ $r_{har}(t) = 5.501$</p>
 <p>NYC-7-2 $r_{har} = 5.429$ $r_{har}(t) = 5.245$</p>
 <p>Milan-9-1 $r_{har} = 5.857$ $r_{har}(t) = 5.001$</p>
 <p>Taipei-4-3 $r_{har} = 5$ $r_{har}(t) = 4.747$</p>
 <p>Seoul1-8-2 $r_{har} = 4.429$ $r_{har}(t) = 4.595$</p>
 <p>HK1-13-5 $r_{har} = 3.571$ $r_{har}(t) = 4.247$</p>
 <p>NYC-9-2 $r_{har} = 5.143$ $r_{har}(t) = 4.004$</p>
 <p>Taipei-9-3 $r_{har} = 2.286$ $r_{har}(t) = 3.744$</p>
 <p>HK1-3-4 $r_{har} = 3.571$ $r_{har}(t) = 3.588$</p>
 <p>HK1-0-2 $r_{har} = 3$ $r_{har}(t) = 3.267$</p>
 <p>Seoul2-10-2 $r_{har} = 2.714$ $r_{har}(t) = 2.798$</p>

Coherence

 <p>Taipei-3-2 $r_{coh} = 5.429$ $r_{coh}(t) = 6.101$</p>	 <p>Osaka-8-3 $r_{coh} = 5.857$ $r_{coh}(t) = 5.899$</p>	 <p>Seoul1-14-1 $r_{coh} = 5.429$ $r_{coh}(t) = 5.506$</p>
 <p>Milan-4-2 $r_{coh} = 5.143$ $r_{coh}(t) = 5.504$</p>	 <p>Taipei-1-5 $r_{coh} = 5.286$ $r_{coh}(t) = 5.013$</p>	 <p>NYC-9-2 $r_{coh} = 4.857$ $r_{coh}(t) = 4.566$</p>
 <p>Seoul2-8-3 $r_{coh} = 3.857$ $r_{coh}(t) = 4.097$</p>	 <p>HK1-15-2 $r_{coh} = 3.571$ $r_{coh}(t) = 3.558$</p>	 <p>HK1-9-4 $r_{coh} = 3.143$ $r_{coh}(t) = 3.152$</p>
 <p>HK2-5-2 $r_{coh} = 2.143$ $r_{coh}(t) = 2.625$</p>	 <p>HK1-0-2 $r_{coh} = 2.571$ $r_{coh}(t) = 2.095$</p>	 <p>HK2-0-3 $r_{coh} = 1.857$ $r_{coh}(t) = 0.997$</p>

Table S3: The feature weights in each run of our LASSO regressor on color harmony (Top) and color coherence (Bottom).

		Feature	Channel	Kfold Metrics	1	2	3	4	5	6	7	8	9	10	Variance	
Color Harmony	Color Difference	Separate Components Difference	Lightness	Min	0.188	-0.010	0.103	0.145	-0.082	0.048	-0.009	0.185	0.082	0.162	0.009	
				Average	1.922	2.192	2.261	1.982	3.162	1.778	2.223	1.617	2.399	1.894	0.186	
			Chroma	Min	-0.189	-0.027	-0.267	-0.277	-0.364	-0.031	-0.177	0.355	-0.039	-0.261	0.042	
				Average	-1.442	-1.388	-1.244	-1.351	-0.724	-1.553	-1.598	-1.746	-1.721	-1.628	0.090	
			Hue	Min	-0.272	-0.141	-0.105	-0.237	-0.205	-0.126	-0.016	-0.034	-0.198	-0.149	0.007	
				Average	-0.264	-0.165	-0.193	-0.255	-0.290	-0.259	-0.206	-0.291	-0.102	-0.280	0.004	
		Holistic Difference Interval	Color	Min	-0.968	-0.907	-1.057	-1.159	-0.709	-1.005	-0.455	-1.223	-0.705	-0.932	0.054	
				Average	-0.167	-0.203	-0.369	-0.101	-1.020	0.076	-0.536	0.281	-0.519	0.000	0.138	
	Area Balance	Saliency	Saliency	Entropy	-0.590	-0.566	-0.549	-0.496	-0.348	-0.441	-0.639	-0.368	-0.225	-0.514	0.016	
		Scalar Momment	Saliency, Chroma, Lightness	Entropy	-0.298	-0.431	-0.340	-0.535	-0.647	-0.527	-0.338	-0.513	-0.767	-0.353	0.023	
Error				MAE	0.659	0.670	0.632	0.701	0.949	0.777	1.008	0.818	0.736	0.689		
				MSE	0.753	0.641	0.629	0.833	1.326	0.812	1.453	1.163	0.967	0.761		

Avg(Variance)

0.057

Var(Variance)

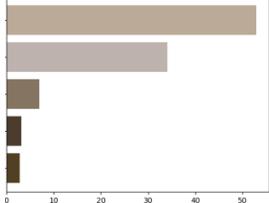
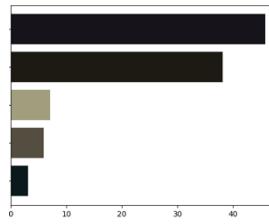
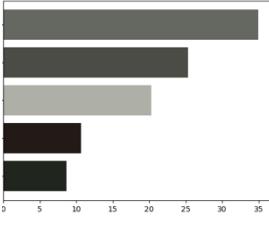
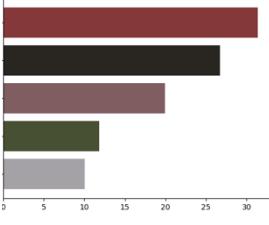
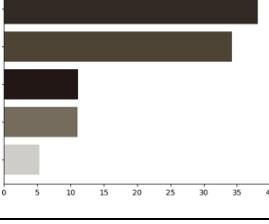
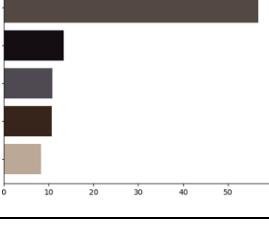
0.004

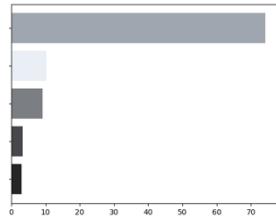
		Feature	Channel	Kfold Metrics	1	2	3	4	5	6	7	8	9	10	Variance			
				Lightness	Street-sign.	1.529	0.837	1.133	1.493	1.084	1.151	1.544	1.788	0.996	1.051	0.093		
Color Coherence	Color Difference	Hausdorff Distance	Sign.-street	3.529	3.648	3.802	3.965	3.739	3.824	3.809	4.012	4.517	4.004	0.073				
				Street-sign.	0.478	0.402	0.375	0.362	0.489	0.341	0.360	0.407	0.462	0.253	0.005			
			Chroma	Sign.-street	- 1.715	-1.952	-1.581	-1.732	-1.544	-1.492	-1.654	-1.746	-1.792	-1.588	0.019			
				Street-sign.	- 0.215	-0.709	-0.538	-0.340	-0.264	-0.326	-0.116	-0.342	-0.387	-0.394	0.027			
			Hue	Sign.-street	- 0.944	-0.712	-0.674	-0.688	-1.274	-0.549	-0.788	-1.191	-0.458	-0.361	0.088			
				Street-sign.	- 1.829	-0.940	-1.378	-1.494	-1.307	-1.443	-1.822	-1.932	-1.139	-1.549	0.100			
			Color	Sign.-street	- 3.956	-4.223	-4.275	-4.323	-4.045	-4.427	-4.274	-4.356	-4.801	-4.492	0.055			
				Saliency Gain	Saliency	Entropy Difference	- 0.230	-0.620	-0.379	-0.362	-0.553	-0.383	-0.349	-0.627	-0.364	-0.654	0.022	
			Scalar Momment Gain	Saliency, Chroma, Lightness		Entropy Difference	1.160	1.033	1.405	1.215	1.393	0.979	1.208	1.175	1.114	1.072	0.020	
			Error		MAE	0.784	0.822	0.745	0.866	1.100	0.882	0.943	1.033	0.819	0.746			
					MSE	0.836	1.214	0.810	1.054	1.676	1.085	1.359	1.505	1.152	1.021			

Avg(Variance) 0.050

Var(Variance) 0.001

Table S4: Examples of signboards with high color harmony scores and the extracted color patches.

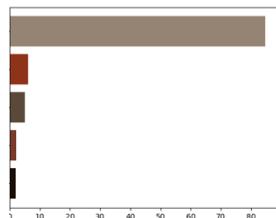
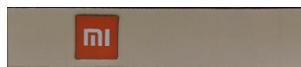
Signboard	Extracted Color Patch	ID, Ratings, Predicted Ratings
	 A horizontal bar chart showing color patches extracted from the Brioni signboard. The x-axis ranges from 0 to 50. The chart contains several bars of different colors, with the longest bar being a light brown shade reaching approximately 45 on the scale.	Milan-2-2 $r_{\text{har}} = 6.714$ $r_{\text{har}}(t) = 5.176$
	 A horizontal bar chart showing color patches extracted from the Breitling signboard. The x-axis ranges from 0 to 40. The chart contains several bars of different colors, with the longest bar being a dark blue/black shade reaching approximately 38 on the scale.	NYC-0-2 $r_{\text{har}} = 6.571$ $r_{\text{har}}(t) = 5.030$
	 A horizontal bar chart showing color patches extracted from the Fendi signboard. The x-axis ranges from 0 to 35. The chart contains several bars of different colors, with the longest bar being a dark grey shade reaching approximately 35 on the scale.	NYC-10-1 $r_{\text{har}} = 6.571$ $r_{\text{har}}(t) = 5.304$
	 A horizontal bar chart showing color patches extracted from the Puma signboard. The x-axis ranges from 0 to 30. The chart contains several bars of different colors, with the longest bar being a dark red shade reaching approximately 35 on the scale.	Osaka-0-1 $r_{\text{har}} = 6.286$ $r_{\text{har}}(t) = 3.591$
	 A horizontal bar chart showing color patches extracted from the My signboard. The x-axis ranges from 0 to 40. The chart contains several bars of different colors, with the longest bar being a dark brown shade reaching approximately 38 on the scale.	Seoul1-14-2 $r_{\text{har}} = 6$ $r_{\text{har}}(t) = 5.519$
	 A horizontal bar chart showing color patches extracted from the Loro Piana signboard. The x-axis ranges from 0 to 50. The chart contains several bars of different colors, with the longest bar being a dark brown shade reaching approximately 45 on the scale.	Milan-8-1 $r_{\text{har}} = 6$ $r_{\text{har}}(t) = 5.048$



Osaka-3-1

$$r_{har} = 6$$

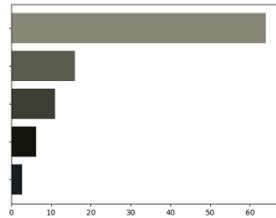
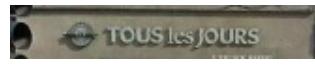
$$r_{har}(t) = 5.900$$



HK1-5-2

$$r_{har} = 6$$

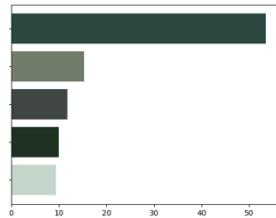
$$r_{har}(t) = 3.749$$



Seoul2-6-1

$$r_{har} = 5.857$$

$$r_{har}(t) = 5.192$$



NYC-2-3

$$r_{har} = 5.571$$

$$r_{har}(t) = 5.158$$