

Table 1: Spearman Rank Order Correlations of IQA Metrics With Human Mean Opinion Scores

		Grayscale Images									
		PSNR	VIF	SSIM	MS-SSIM	GSM	MAD	SR-SIM	FSIM	VSI	HaarPSI
	LIVE	0.8756	0.9636	0.9479	0.9513	0.9561	0.9672	0.9619	0.9634	0.9534	<b>0.9690</b>
	TID2008	0.5531	0.7491	0.7749	0.8542	0.8504	0.8340	0.8913	0.8804	0.8830	<b>0.9043</b>
	TID2013	0.6394	0.6769	0.7417	0.7859	0.7946	0.7807	0.8075	0.8022	0.8048	<b>0.8094</b>
	CSIQ	0.8058	0.9195	0.8756	0.9133	0.9108	0.9466	0.9319	0.9242	0.9372	<b>0.9546</b>
		Color Images									
	LIVE	0.8756	0.9636	0.9479	0.9513	0.9561	0.9672	0.9619	0.9645	0.9524	<b>0.9683</b>
	TID2008	0.5531	0.7491	0.7749	0.8542	0.8504	0.8340	0.8913	0.8840	0.8979	<b>0.9097</b>
	TID2013	0.6394	0.6769	0.7417	0.7859	0.7946	0.7807	0.8075	0.8510	<b>0.8965</b>	0.8732
	CSIQ	0.8058	0.9195	0.8756	0.9133	0.9108	0.9466	0.9319	0.9310	0.9423	<b>0.9604</b>
LIVE	jpg2k	0.8954	0.9696	0.9614	0.9627	0.9700	0.9692	0.9700	<b>0.9724</b>	0.9604	0.9684
	jpg	0.8809	<b>0.9846</b>	0.9764	0.9815	0.9778	0.9786	0.9823	0.9840	0.9761	0.9832
	gwn	0.9854	0.9858	0.9694	0.9733	0.9774	<b>0.9873</b>	0.9812	0.9716	0.9835	0.9845
	gblur	0.7823	<b>0.9728</b>	0.9517	0.9542	0.9518	0.9510	0.9660	0.9708	0.9527	0.9676
	ff	0.8907	<b>0.9650</b>	0.9556	0.9471	0.9402	0.9589	0.9466	0.9519	0.9430	0.9527
TID2008	gwn	0.9070	0.8797	0.8107	0.8086	0.8606	0.8386	0.8989	0.8758	<b>0.9229</b>	0.9177
	gwnc	0.8995	0.8757	0.8029	0.8054	0.8091	0.8255	0.8957	0.8931	<b>0.9118</b>	0.8982
	scn	0.9170	0.8698	0.8145	0.8209	0.8941	0.8678	0.9084	0.8711	<b>0.9296</b>	0.9271
	mn	0.8515	<b>0.8683</b>	0.7795	0.8107	0.7452	0.7336	0.7881	0.8264	0.7734	0.7909
	hfn	<b>0.9270</b>	0.9075	0.8729	0.8694	0.8945	0.8864	0.9195	0.9156	0.9253	0.9155
	in	<b>0.8724</b>	0.8327	0.6732	0.6907	0.7235	0.0650	0.7678	0.7719	0.8298	0.8269
	qn	0.8696	0.7970	0.8531	0.8589	0.8800	0.8160	0.8348	0.8726	0.8731	<b>0.8842</b>
	gblr	0.8697	0.9540	0.9544	0.9563	<b>0.9600</b>	0.9196	0.9551	0.9472	0.9529	0.9001
	den	0.9416	0.9161	0.9530	0.9582	<b>0.9725</b>	0.9433	0.9666	0.9618	0.9693	0.9711
	jpg	0.8717	0.9168	0.9252	0.9322	0.9393	0.9275	0.9393	0.9294	<b>0.9616</b>	0.9417
	jpg2k	0.8132	0.9709	0.9625	0.9700	0.9758	0.9707	0.9809	0.9780	0.9848	<b>0.9860</b>
	jpgt	0.7516	0.8585	0.8678	0.8681	0.8790	0.8661	0.8881	0.8756	<b>0.9160</b>	0.8921
	jpg2kt	0.8309	0.8501	0.8577	0.8606	0.8936	0.8394	0.8902	0.8555	0.8942	<b>0.8963</b>
	pn	0.5815	0.7619	0.7107	0.7377	0.7386	<b>0.8287</b>	0.7659	0.7514	0.7699	0.8010
bdist	0.6193	0.8324	0.8462	0.7546	<b>0.8862</b>	0.7970	0.7798	0.8464	0.6295	0.8026	
ms	0.6957	0.5096	0.7231	<b>0.7338</b>	0.7190	0.5163	0.5704	0.6554	0.6714	0.6051	
ctrst	0.5859	<b>0.8188</b>	0.5246	0.6381	0.6691	0.2723	0.6475	0.6510	0.6557	0.6209	
TID2013	gwn	0.9291	0.8994	0.8671	0.8646	0.9064	0.8843	0.9251	0.9101	<b>0.9460</b>	0.9368
	gwnc	<b>0.8981</b>	0.8299	0.7726	0.7730	0.8175	0.8019	0.8562	0.8537	0.8705	0.8593
	scn	0.9200	0.8835	0.8515	0.8544	0.9158	0.8911	0.9223	0.8900	<b>0.9367</b>	0.9311
	mn	0.8323	<b>0.8450</b>	0.7767	0.8073	0.7293	0.7380	0.7855	0.8094	0.7697	0.7858
	hfn	0.9140	0.8972	0.8634	0.8604	0.8869	0.8876	0.9131	0.9040	<b>0.9200</b>	0.9069
	in	<b>0.8968</b>	0.8537	0.7503	0.7629	0.7965	0.2769	0.8280	0.8251	0.8741	0.8656
	qn	0.8808	0.7854	0.8657	0.8706	0.8841	0.8514	0.8497	0.8807	0.8748	<b>0.8893</b>
	gblr	0.9149	0.9650	0.9668	0.9673	<b>0.9689</b>	0.9319	0.9622	0.9551	0.9612	0.9149
	den	0.9480	0.8911	0.9254	0.9268	0.9432	0.9252	0.9398	0.9330	<b>0.9484</b>	0.9456
	jpg	0.9189	0.9192	0.9200	0.9265	0.9284	0.9217	0.9396	0.9339	<b>0.9541</b>	0.9512
	jpg2k	0.8840	0.9516	0.9468	0.9504	0.9602	0.9511	0.9672	0.9589	<b>0.9706</b>	0.9704
	jpgt	0.7685	0.8409	0.8493	0.8475	0.8512	0.8283	0.8543	0.8610	<b>0.9216</b>	0.8938
	jpg2kt	0.8883	0.8761	0.8828	0.8889	0.9182	0.8788	0.9165	0.8919	<b>0.9228</b>	0.9204
	pn	0.6863	0.7720	0.7821	0.7968	0.8130	<b>0.8315</b>	0.7967	0.7937	0.8060	0.8154
bdist	0.1552	0.5306	0.5720	0.4801	<b>0.6418</b>	0.2812	0.4722	0.5532	0.1713	0.4471	
ms	0.7671	0.6276	0.7752	<b>0.7906</b>	0.7875	0.6450	0.6562	0.7487	0.7700	0.7152	
ctrst	0.4400	<b>0.8386</b>	0.3775	0.4634	0.4857	0.1972	0.4696	0.4679	0.4754	0.4382	
ccs	0.0766	0.3099	0.4141	0.4099	0.3578	0.0575	0.3117	<b>0.8359</b>	0.8100	0.6735	
mgn	0.8905	0.8468	0.7803	0.7786	0.8348	0.8409	0.8781	0.8569	<b>0.9117</b>	0.8902	
cn	0.8411	0.8946	0.8566	0.8528	0.9124	0.9064	0.9259	0.9135	0.9243	<b>0.9275</b>	
lcn	0.9145	0.9204	0.9057	0.9068	0.9563	0.9443	0.9608	0.9485	0.9564	<b>0.9622</b>	
icqd	<b>0.9269</b>	0.8414	0.8542	0.8555	0.8973	0.8745	0.8810	0.8815	0.8839	0.8953	
cha	0.8872	0.8848	0.8775	0.8784	0.8823	0.8310	0.8758	<b>0.8925</b>	0.8906	0.8599	
ssr	0.9042	0.9353	0.9461	0.9483	<b>0.9668</b>	0.9567	0.9613	0.9576	0.9628	0.9651	
CSIQ	gwn	0.9363	0.9575	0.8974	0.9471	0.9440	0.9541	0.9628	0.9359	0.9636	<b>0.9666</b>
	jpeg	0.8881	<b>0.9705</b>	0.9546	0.9634	0.9632	0.9615	0.9671	0.9664	0.9618	0.9695
	jpg2k	0.9362	0.9672	0.9606	0.9683	0.9648	0.9752	0.9773	0.9704	0.9694	<b>0.9815</b>
	gpn	0.9339	0.9511	0.8922	0.9331	0.9387	0.9570	0.9520	0.9370	<b>0.9638</b>	0.9594
	gblr	0.9291	0.9745	0.9609	0.9711	0.9589	0.9682	0.9767	0.9729	0.9679	<b>0.9783</b>
	ctrst	0.8621	0.9345	0.7922	0.9526	0.9354	0.9207	<b>0.9528</b>	0.9438	0.9504	0.9450

Lower correlation than HaarPSI. The difference is statistically significant with  $p < 0.05$ .

Higher correlation than HaarPSI. The difference is statistically significant with  $p < 0.05$ .

The highest correlation in each row is written in **boldface**.

Table 2: Kendall Rank Order Correlations of IQA Metrics With Human Mean Opinion Scores

		Grayscale Images									
		PSNR	VIF	SSIM	MSSSIM	GSM	MAD	SRSIM	FSIM	VSI	HaarPSI
	LIVE	0.6865	0.8282	0.7963	0.8044	0.8150	0.8427	0.8301	0.8335	0.8093	<b>0.8473</b>
	TID2008	0.4027	0.5860	0.5768	0.6568	0.6596	0.6445	0.7149	0.6945	0.7021	<b>0.7261</b>
	TID2013	0.4696	0.5147	0.5588	0.6047	0.6255	0.6035	<b>0.6407</b>	0.6292	0.6365	0.6372
	CSIQ	0.6084	0.7537	0.6907	0.7393	0.7374	0.7970	0.7725	0.7567	0.7795	<b>0.8126</b>
		Color Images									
	LIVE	0.6865	0.8282	0.7963	0.8044	0.8150	0.8427	0.8301	0.8363	0.8058	<b>0.8448</b>
	TID2008	0.4027	0.5860	0.5768	0.6568	0.6596	0.6445	0.7149	0.6991	0.7123	<b>0.7360</b>
	TID2013	0.4696	0.5147	0.5588	0.6047	0.6255	0.6035	0.6407	0.6665	<b>0.7183</b>	0.6923
	CSIQ	0.6084	0.7537	0.6907	0.7393	0.7374	0.7970	0.7725	0.7690	0.7857	<b>0.8241</b>
LIVE	jpg2k	0.7106	0.8473	0.8239	0.8252	0.8471	0.8448	0.8508	<b>0.8528</b>	0.8214	0.8435
	jpg	0.6912	<b>0.8944</b>	0.8650	0.8821	0.8714	0.8738	0.8877	0.8926	0.8631	0.8863
	gwn	0.8939	0.8981	0.8523	0.8649	0.8686	<b>0.9017</b>	0.8839	0.8563	0.8881	0.8941
	gblur	0.5847	<b>0.8594</b>	0.8010	0.8094	0.8056	0.8142	0.8420	0.8533	0.8059	0.8473
	ff	0.7069	<b>0.8395</b>	0.8207	0.8102	0.7920	0.8276	0.8050	0.8224	0.7958	0.8167
TID2008	gwn	0.7106	0.6783	0.6115	0.6087	0.6641	0.6410	0.7094	0.6758	<b>0.7390</b>	0.7301
	gwn	0.7050	0.6868	0.6018	0.6014	0.6070	0.6244	0.7220	0.7123	<b>0.7475</b>	0.7163
	scn	0.7176	0.6784	0.6112	0.6169	0.6998	0.6744	0.7257	0.6744	<b>0.7581</b>	0.7403
	mn	0.6439	<b>0.6892</b>	0.5771	0.6131	0.5905	0.5462	0.6046	0.6342	0.5941	0.6131
	hfn	<b>0.7344</b>	0.6741	0.6470	0.6377	0.6761	0.6717	0.7101	0.6984	0.7291	0.6988
	in	<b>0.6849</b>	0.6278	0.4729	0.4858	0.5202	0.0433	0.5554	0.5603	0.6299	0.6125
	qn	0.6769	0.6494	0.6644	0.6704	0.6968	0.6247	0.6539	0.6887	0.6988	<b>0.7073</b>
	gblr	0.7332	0.8186	0.8153	0.8165	<b>0.8335</b>	0.7559	0.8266	0.7996	0.8210	0.7183
	den	0.7848	0.7577	0.8163	0.8301	<b>0.8648</b>	0.7998	0.8503	0.8442	0.8588	0.8624
	jpg	0.6847	0.7183	0.7369	0.7470	0.7652	0.7357	0.7672	0.7389	<b>0.8246</b>	0.7838
	jpg2k	0.5839	<b>0.8503</b>	0.8297	0.8556	0.8705	<b>0.8536</b>	0.8871	0.8734	0.8980	<b>0.9009</b>
	jpgt	0.5590	0.6580	0.6665	0.6706	0.6867	0.6702	0.6928	0.6774	<b>0.7341</b>	0.7021
	jpg2kt	0.6394	0.6580	0.6710	0.6762	0.7070	0.6528	0.7046	0.6601	<b>0.7151</b>	0.7110
	pn	0.4094	0.6010	0.5032	0.5266	0.5331	<b>0.6172</b>	0.5691	0.5497	0.5703	0.6006
	bdist	0.4423	0.6220	0.6495	0.5415	<b>0.7005</b>	0.5876	0.5799	0.6394	0.4577	0.5921
	ms	0.5011	0.3498	0.5278	<b>0.5448</b>	0.5298	0.3493	0.3951	0.4752	0.4906	0.4283
ctrst	0.4182	<b>0.5788</b>	0.3919	0.4797	0.5169	0.2042	0.4930	0.4886	0.4967	0.4619	
TID2013	gwn	0.7603	0.7081	0.6625	0.6612	0.7231	0.6921	0.7458	0.7203	<b>0.7892</b>	0.7686
	gwn	<b>0.7157</b>	0.6165	0.5545	0.5548	0.6082	0.5874	0.6537	0.6503	0.6733	0.6632
	scn	0.7272	0.6903	0.6493	0.6498	0.7337	0.6999	0.7502	0.6981	<b>0.7686</b>	0.7471
	mn	0.6297	<b>0.6534</b>	0.5770	0.6191	0.5721	0.5491	0.6013	0.6178	0.5871	0.6028
	hfn	0.7286	0.6705	0.6428	0.6345	0.6826	0.6816	0.7164	0.6960	<b>0.7301</b>	0.6971
	in	<b>0.7238</b>	0.6482	0.5394	0.5515	0.5905	0.1865	0.6215	0.6174	0.6794	0.6644
	qn	0.6944	0.6458	0.6753	0.6835	0.7001	0.6497	0.6711	0.6939	0.7045	<b>0.7104</b>
	gblr	0.7884	0.8370	0.8416	0.8429	<b>0.8481</b>	0.7693	0.8321	0.8161	0.8300	0.7399
	den	0.8089	0.7234	0.7789	0.7836	0.8135	0.7694	0.8073	0.7936	<b>0.8238</b>	0.8179
	jpg	0.7447	0.7274	0.7411	0.7460	0.7491	0.7238	0.7729	0.7558	<b>0.8121</b>	0.7992
	jpg2k	0.6740	0.8057	0.8007	0.8090	0.8276	0.8139	0.8477	0.8201	<b>0.8539</b>	0.8534
	jpgt	0.5594	0.6470	0.6552	0.6552	0.6648	0.6348	0.6655	0.6707	<b>0.7523</b>	0.7105
	jpg2kt	0.7087	0.6868	0.6914	0.7002	0.7356	0.6868	0.7312	0.6989	<b>0.7506</b>	0.7420
	pn	0.4894	0.5767	0.5703	0.5876	0.6088	<b>0.6336</b>	0.5912	0.5858	0.5974	0.6114
	bdist	0.0965	0.3662	0.4021	0.3354	<b>0.4584</b>	0.1853	0.3184	0.3775	0.1228	0.3036
	ms	0.5573	0.4462	0.5725	0.5849	<b>0.5895</b>	0.4609	0.4715	0.5596	0.5704	0.5209
ctrst	0.3064	<b>0.6064</b>	0.2928	0.3475	0.3749	0.1541	0.3560	0.3488	0.3586	0.3248	
ccs	0.0514	0.2200	0.2930	0.2873	0.2496	0.0487	0.2184	<b>0.6392</b>	0.6297	0.5230	
mgn	0.7013	0.6451	0.5712	0.5681	0.6327	0.6303	0.6784	0.6541	<b>0.7318</b>	0.6954	
cn	0.6199	0.7183	0.6711	0.6667	0.7467	0.7416	0.7658	0.7449	0.7612	<b>0.7692</b>	
lcn	0.7174	0.7685	0.7388	0.7440	0.8207	0.8052	0.8261	0.8044	0.8168	<b>0.8292</b>	
icqd	<b>0.7610</b>	0.6533	0.6438	0.6471	0.7057	0.6771	0.6874	0.6856	0.7013	0.7096	
cha	0.7192	0.7280	0.7159	0.7208	0.7244	0.6642	0.7208	<b>0.7407</b>	0.7334	0.6952	
ssr	0.7175	0.7813	0.7968	0.8025	<b>0.8469</b>	0.8290	0.8355	0.8262	0.8368	0.8461	
CSIQ	gwn	0.7643	0.8165	0.7190	0.7989	0.7848	0.8082	0.8272	0.7742	0.8272	<b>0.8367</b>
	jpeg	0.6936	<b>0.8564</b>	0.8167	0.8331	0.8346	0.8351	0.8443	0.8387	0.8271	0.8475
	jpg2k	0.7667	0.8489	0.8225	0.8438	0.8379	0.8707	0.8704	0.8471	0.8482	<b>0.8865</b>
	gpn	0.7612	0.7973	0.7136	0.7741	0.7732	0.8205	0.8029	0.7775	<b>0.8312</b>	0.8237
	gblr	0.7543	0.8661	0.8251	0.8483	0.8229	0.8494	0.8646	0.8535	0.8464	<b>0.8747</b>
	ctrst	0.6449	0.7775	0.5779	0.8123	0.7721	0.7460	<b>0.8165</b>	0.7937	0.8096	0.7928

Lower correlation than HaarPSI. The difference is statistically significant with  $p < 0.05$ .

Higher correlation than HaarPSI. The difference is statistically significant with  $p < 0.05$ .

The highest correlation in each row is written in **boldface**.

Table 3: Pearson Correlations After Four Parameter Logistic Regression

		Grayscale Images									
		PSNR	VIF	SSIM	MSSSIM	GSM	MAD	SRSIM	FSIM	VSI	HaarPSI
	LIVE	0.8704	0.9591	0.9437	0.9488	0.9531	0.9686	0.9597	0.9619	0.9512	<b>0.9687</b>
	TID2008	0.5657	0.8082	0.7708	0.8396	0.8421	0.8306	0.8827	0.8704	0.8689	<b>0.8980</b>
	TID2013	0.6727	0.7697	0.7893	0.8296	0.8000	0.8207	0.8648	0.8558	0.8547	<b>0.8655</b>
	CSIQ	0.7991	0.9227	0.8614	0.8997	0.8963	0.9502	0.9232	0.9130	0.9248	<b>0.9512</b>
		Color Images									
	LIVE	0.8704	0.9591	0.9437	0.9488	0.9531	0.9686	0.9597	0.9628	0.9489	<b>0.9692</b>
	TID2008	0.5657	0.8082	0.7708	0.8396	0.8421	0.8306	0.8827	0.8723	0.8762	<b>0.9045</b>
	TID2013	0.6727	0.7697	0.7893	0.8296	0.8000	0.8207	0.8648	0.8737	<b>0.8992</b>	0.8928
	CSIQ	0.7991	0.9227	0.8614	0.8997	0.8963	0.9502	0.9232	0.9202	0.9294	<b>0.9579</b>
LIVE	jpg2k	0.8998	0.9775	0.9672	0.9687	0.9760	0.9767	0.9772	<b>0.9795</b>	0.9652	0.9753
	jpg	0.8876	0.9862	0.9795	0.9838	0.9849	0.9808	<b>0.9866</b>	0.9860	0.9835	0.9862
	gwn	0.9848	0.9822	0.9769	0.9831	0.9823	<b>0.9908</b>	0.9840	0.9776	0.9824	0.9792
	gblur	0.7688	<b>0.9742</b>	0.9474	0.9553	0.9441	0.9533	0.9679	0.9723	0.9484	0.9689
	ff	0.8897	0.9608	0.9556	0.9484	0.9357	<b>0.9614</b>	0.9473	0.9511	0.9409	0.9535
TID2008	gwn	<b>0.9341</b>	0.8705	0.8005	0.8002	0.8533	0.8234	0.8892	0.8696	0.9163	0.9173
	gwn	0.9261	0.8982	0.8161	0.8099	0.7869	0.8387	0.8807	0.8999	<b>0.9272</b>	0.9238
	scn	<b>0.9526</b>	0.8675	0.8200	0.8276	0.9015	0.8754	0.9138	0.8778	0.9374	0.9354
	mn	0.8745	<b>0.8913</b>	0.8096	0.8326	0.5507	0.7660	0.7523	0.8440	0.7334	0.8118
	hfn	<b>0.9715</b>	0.9459	0.8899	0.8849	0.8775	0.9038	0.9432	0.9354	0.9585	0.9558
	in	<b>0.8612</b>	0.8263	0.6543	0.6671	0.7079	0.1259	0.7475	0.7587	0.8166	0.8231
	qn	0.8757	0.8131	0.8602	0.8605	0.8743	0.8185	0.8376	0.8660	0.8667	<b>0.8895</b>
	gblr	0.8736	0.9411	0.9448	0.9448	<b>0.9488</b>	0.9226	0.9441	0.9408	0.9410	0.8969
	den	0.9468	0.9278	0.9592	0.9647	0.9752	0.9620	0.9722	0.9694	0.9714	<b>0.9774</b>
	jpg	0.8695	0.9550	0.9540	0.9612	0.9787	0.9604	0.9807	0.9730	<b>0.9856</b>	0.9680
	jpg2k	0.8653	0.9726	0.9657	0.9733	0.9808	0.9789	0.9865	0.9802	0.9849	<b>0.9870</b>
	jpgt	0.7695	0.8769	0.8822	0.8803	0.8861	0.8778	0.8973	0.8866	<b>0.9234</b>	0.8954
	jpg2kt	0.8537	0.8412	0.8462	0.8439	0.8776	0.8369	<b>0.8792</b>	0.8485	0.8044	0.8751
	pn	0.5902	0.7467	0.7054	0.7369	0.7007	<b>0.8318</b>	0.7519	0.7451	0.7418	0.7944
	bdist	0.6604	0.8437	0.8718	0.7901	<b>0.8979</b>	0.8229	0.7932	0.8534	0.6282	0.8134
	ms	0.7108	0.5953	0.7176	0.7233	<b>0.7445</b>	0.5709	0.6149	0.7007	0.6483	0.6226
ctrst	0.6415	<b>0.9032</b>	0.6083	0.7687	0.7355	0.3252	0.7604	0.7698	0.7694	0.7178	
TID2013	gwn	<b>0.9533</b>	0.9064	0.8681	0.8676	0.8685	0.8883	0.9318	0.9133	0.9477	0.9442
	gwn	<b>0.9244</b>	0.8734	0.8035	0.7993	0.8218	0.8396	0.8715	0.8630	0.9065	0.9075
	scn	<b>0.9514</b>	0.8854	0.8618	0.8656	0.9214	0.8999	0.9282	0.8987	0.9441	0.9385
	mn	0.8704	<b>0.8794</b>	0.8199	0.8243	0.5929	0.7913	0.7761	0.8375	0.6814	0.8197
	hfn	<b>0.9723</b>	0.9504	0.9065	0.9023	0.8828	0.9207	0.9191	0.9422	0.9636	0.9595
	in	<b>0.8872</b>	0.8520	0.7396	0.7524	0.7803	0.3735	0.8199	0.8158	0.8617	0.8624
	qn	0.8860	0.8075	0.8696	0.8695	0.8811	0.8569	0.8514	0.8793	0.8713	<b>0.8907</b>
	gblr	0.9146	<b>0.9531</b>	0.9514	0.9514	0.9525	0.9350	0.9467	0.9457	0.9452	0.9120
	den	0.9637	0.9258	0.9567	0.9602	<b>0.9730</b>	0.9613	0.9675	0.9635	0.9690	0.9719
	jpg	0.9162	0.9555	0.9543	0.9601	0.9745	0.9610	0.9780	0.9719	<b>0.9847</b>	0.9791
	jpg2k	0.9162	0.9666	0.9650	0.9685	0.9789	0.9734	0.9808	0.9741	<b>0.9830</b>	0.9824
	jpgt	0.7990	0.9072	0.9161	0.9143	0.9092	0.8929	0.9159	0.9165	<b>0.9454</b>	0.9220
	jpg2kt	0.8877	0.8693	0.8771	0.8794	0.9109	0.8835	0.9132	0.8924	<b>0.9183</b>	0.9101
	pn	0.6726	0.8062	0.7699	0.7976	0.8024	<b>0.8599</b>	0.8142	0.8057	0.8057	0.8413
	bdist	0.1449	0.5298	0.5651	0.4689	<b>0.6050</b>	0.4209	0.4652	0.5315	0.4102	0.5038
	ms	0.8029	0.7024	0.7930	0.8077	<b>0.8276</b>	0.6717	0.6541	0.7765	0.7498	0.7354
ctrst	0.6357	<b>0.8956</b>	0.5916	0.7490	0.7110	0.3682	0.6689	0.7481	0.6770	0.7016	
ccs	0.1401	0.3423	0.4349	0.4236	0.3738	0.0351	0.2491	<b>0.8374</b>	0.7744	0.6826	
mgn	<b>0.9201</b>	0.8614	0.7898	0.7901	0.8157	0.8525	0.8770	0.8653	0.9129	0.8967	
cn	0.8692	0.9321	0.9023	0.9011	0.9473	0.9418	0.9547	0.9462	0.9544	<b>0.9579</b>	
lcn	0.9428	0.9305	0.9169	0.9173	0.9635	0.9559	0.9671	0.9564	0.9634	<b>0.9692</b>	
icqd	<b>0.9308</b>	0.8655	0.8607	0.8613	0.8251	0.8760	0.8813	0.8906	0.8934	0.9101	
cha	0.9575	0.9721	0.9757	0.9766	0.9549	0.9668	<b>0.9795</b>	0.9788	0.9749	0.9615	
ssr	0.9286	0.9583	0.9665	0.9697	<b>0.9834</b>	0.9755	0.9782	0.9764	0.9800	0.9812	
CSIQ	gwn	0.9528	0.9594	0.8985	0.9471	0.9460	0.9544	0.9648	0.9380	0.9648	<b>0.9666</b>
	jpeg	0.8904	<b>0.9881</b>	0.9778	0.9822	0.9828	0.9823	0.9853	0.9849	0.9808	0.9875
	jpg2k	0.9467	0.9773	0.9692	0.9779	0.9731	0.9835	0.9873	0.9818	0.9745	<b>0.9900</b>
	gpn	0.9525	0.9546	0.8934	0.9436	0.9444	0.9613	0.9606	0.9436	<b>0.9655</b>	0.9649
	gblr	0.9247	0.9725	0.9520	0.9686	0.9501	0.9762	0.9790	0.9684	0.9629	<b>0.9792</b>
	ctrst	0.8986	0.9351	0.7890	0.9515	0.9340	0.9322	<b>0.9550</b>	0.9444	0.9524	0.9507

Lower correlation than HaarPSI. The difference is statistically significant with  $p < 0.05$ .

Higher correlation than HaarPSI. The difference is statistically significant with  $p < 0.05$ .

The highest correlation in each row is written in **boldface**.

Table 4: Pearson Correlations Before Four Parameter Logistic Regression

		Grayscale Images									HaarPSI
		PSNR	VIF	SSIM	MSSSIM	GSM	MAD	SRSIM	FSIM	VSI	
LIVE		0.8585	0.9411	0.8290	0.7670	0.7799	0.9559	0.7758	0.8588	0.7842	<b>0.9644</b>
TID2008		0.5190	0.7769	0.7401	0.7897	0.7779	0.8290	0.8242	0.8301	0.8039	<b>0.8977</b>
TID2013		0.4785	0.7335	0.7596	0.7773	0.7966	0.8074	0.7984	0.8198	0.8052	<b>0.8649</b>
CSIQ		0.7512	0.9219	0.7916	0.7720	0.7471	<b>0.9500</b>	0.7520	0.8048	0.8035	0.9388
		Color Images									HaarPSI
		PSNR	VIF	SSIM	MSSSIM	GSM	MAD	SRSIM	FSIM	VSI	
LIVE		0.8585	0.9411	0.8290	0.7670	0.7799	0.9559	0.7758	0.8595	0.7647	<b>0.9592</b>
TID2008		0.5190	0.7769	0.7401	0.7897	0.7779	0.8290	0.8242	0.8341	0.8107	<b>0.9032</b>
TID2013		0.4785	0.7335	0.7596	0.7773	0.7966	0.8074	0.7984	0.8322	0.8373	<b>0.8904</b>
CSIQ		0.7512	0.9219	0.7916	0.7720	0.7471	<b>0.9500</b>	0.7520	0.8208	0.8392	0.9463
LIVE	jpg2k	0.8747	0.9476	0.8925	0.8697	0.8564	<b>0.9725</b>	0.8800	0.9036	0.8662	0.9673
	jpg	0.8650	0.9600	0.9279	0.9184	0.9131	0.9742	0.9028	0.9117	0.9037	<b>0.9779</b>
	gwn	<b>0.9792</b>	0.9632	0.9583	0.9181	0.8904	0.9764	0.8684	0.9263	0.9171	0.9791
	gblur	0.7744	0.9575	0.8881	0.8450	0.8565	0.9486	0.8411	0.9086	0.8544	<b>0.9576</b>
	ff	0.8753	<b>0.9560</b>	0.8619	0.8113	0.7925	0.9461	0.7837	0.8515	0.8151	0.9444
	gwn	<b>0.9336</b>	0.8657	0.7494	0.7433	0.8078	0.8165	0.8284	0.8076	0.8719	0.9029
TID2008	gwn	<b>0.9208</b>	0.8928	0.7758	0.7772	0.7833	0.8267	0.8625	0.8671	0.9045	0.9131
	scn	<b>0.9526</b>	0.8578	0.7678	0.7583	0.8422	0.8598	0.8492	0.8217	0.8862	0.9283
	mn	0.8627	<b>0.8900</b>	0.7496	0.7849	0.5512	0.7566	0.7345	0.8106	0.6114	0.7480
	hfn	<b>0.9680</b>	0.9441	0.8228	0.8176	0.8452	0.8931	0.8657	0.8597	0.8934	0.9393
	in	<b>0.8566</b>	0.8146	0.6202	0.6220	0.6218	0.0417	0.6912	0.7044	0.7651	0.8077
	qn	<b>0.8729</b>	0.7442	0.7239	0.7602	0.8090	0.7981	0.7586	0.7986	0.8077	0.8602
	gblr	0.8439	<b>0.9388</b>	0.8936	0.8745	0.8761	0.9227	0.9078	0.9078	0.8731	0.8934
	den	0.9428	0.8968	0.9208	0.9156	0.9052	0.9612	0.9133	0.9344	0.9162	<b>0.9739</b>
	jpg	0.8597	0.9327	0.9319	0.9279	0.9546	0.9487	0.9444	0.9299	0.9566	<b>0.9647</b>
	jpg2k	0.8629	0.9169	0.9492	0.9365	0.9564	0.9733	0.8965	0.9566	0.9632	<b>0.9856</b>
	jpgt	0.6258	0.8720	0.8375	0.8150	0.8441	0.8556	0.8573	0.8446	0.8705	<b>0.8882</b>
	jpg2kt	0.8528	0.8307	0.8252	0.7970	0.7958	0.8295	0.7932	0.7883	0.8142	<b>0.8688</b>
	pn	0.5831	0.7366	0.6685	0.6637	0.7013	<b>0.8242</b>	0.7381	0.7297	0.7314	0.7936
	bdist	0.6277	0.8340	0.8659	0.7861	<b>0.8822</b>	0.8007	0.7864	0.8410	0.6198	0.8069
	ms	0.6845	0.5896	0.6834	0.6735	<b>0.7431</b>	0.5709	0.6098	0.6700	0.6420	0.5358
	ctrst	0.5819	<b>0.8816</b>	0.5158	0.7686	0.7068	0.2573	0.6978	0.7275	0.6995	0.6446
TID2013	gwn	<b>0.9519</b>	0.9010	0.7954	0.7891	0.8500	0.8732	0.8569	0.8435	0.8928	0.9248
	gwn	0.8948	0.8641	0.7615	0.7629	0.8216	0.8297	0.8603	0.8543	0.8975	<b>0.8998</b>
	scn	<b>0.9513</b>	0.8783	0.7840	0.7681	0.8420	0.8804	0.8371	0.8240	0.8714	0.9261
	mn	0.8447	<b>0.8772</b>	0.7569	0.7929	0.5934	0.7804	0.7615	0.8214	0.6585	0.7737
	hfn	<b>0.9607</b>	0.9454	0.8342	0.8307	0.8575	0.9098	0.8702	0.8669	0.8939	0.9415
	in	<b>0.8856</b>	0.8489	0.6625	0.6541	0.6602	0.2741	0.7183	0.7216	0.7776	0.8325
	qn	<b>0.8855</b>	0.7805	0.7514	0.7752	0.8199	0.8365	0.7677	0.8096	0.8119	0.8643
	gblr	0.8952	<b>0.9530</b>	0.8832	0.8616	0.8565	0.9336	0.8893	0.8922	0.8548	0.9030
	den	0.9572	0.8914	0.9199	0.9110	0.9116	0.9602	0.9114	0.9304	0.9187	<b>0.9690</b>
	jpg	0.8972	0.9332	0.9278	0.9207	0.9470	0.9510	0.9343	0.9242	0.9479	<b>0.9750</b>
	jpg2k	0.9078	0.9184	0.9424	0.9183	0.9462	0.9663	0.8772	0.9360	0.9494	<b>0.9787</b>
	jpgt	0.6410	0.9000	0.8721	0.8476	0.8697	<b>0.8537</b>	0.8772	0.8761	0.8972	<b>0.9177</b>
	jpg2kt	0.8834	0.8692	0.8260	0.7929	0.7960	0.8648	0.7914	0.8010	0.8179	<b>0.8913</b>
	pn	0.6702	0.7686	0.7481	0.7376	0.7718	<b>0.8513</b>	0.8034	0.7957	0.7971	0.8376
	bdist	0.1448	0.5027	0.5589	0.4608	<b>0.5939</b>	0.3184	0.4436	0.5237	0.1356	0.4441
	ms	0.7482	0.6829	0.7309	0.6823	<b>0.8153</b>	0.6654	0.6364	0.7103	0.7367	0.6365
ctrst	0.4812	<b>0.8730</b>	0.4941	0.7268	0.6701	0.2601	0.6520	0.6838	0.6595	0.5916	
ccs	0.1378	0.3404	0.4349	0.4237	0.3739	0.0351	0.2491	0.6069	<b>0.6852</b>	0.6003	
mgn	<b>0.9187</b>	0.8559	0.7358	0.7301	0.7903	0.8422	0.8049	0.8008	0.8505	0.8786	
cn	0.8548	0.8992	0.8459	0.8105	0.9286	0.9280	0.9260	0.9214	0.9301	<b>0.9571</b>	
lcni	0.9372	0.9034	0.9058	0.8917	0.9472	0.9520	0.9439	0.9364	0.9463	<b>0.9686</b>	
icqd	<b>0.9227</b>	0.8582	0.8083	0.7767	0.8240	0.8626	0.7574	0.8053	0.8083	0.8826	
cha	0.8569	0.9441	0.9519	0.9071	<b>0.9563</b>	0.9560	0.8819	0.9478	0.9498	0.9549	
ssr	0.9167	0.9067	0.9528	0.9197	0.9601	0.9658	0.9135	0.9412	0.9449	<b>0.9791</b>	
CSIQ	gwn	0.9437	<b>0.9590</b>	0.8043	0.8254	0.8517	0.9486	0.8669	0.7959	0.8875	0.9433
	jpeg	0.7898	0.9590	0.9165	0.9064	0.8964	0.9696	0.8731	0.9077	0.8833	<b>0.9780</b>
	jpg2k	0.9270	0.9360	0.8967	0.8843	0.8793	0.9808	0.8428	0.9106	0.9008	<b>0.9853</b>
	gpn	0.9527	<b>0.9552</b>	0.7844	0.7790	0.8293	0.9548	0.7777	0.8160	0.8698	0.9470
	gblr	<b>0.9081</b>	0.9627	0.8692	0.8670	0.8575	<b>0.9713</b>	0.8675	0.8843	0.8761	0.9623
	ctrst	0.8888	0.9294	0.7666	0.9003	0.8656	<b>0.9306</b>	0.8878	0.8765	0.8686	0.9229

Lower correlation than HaarPSI. The difference is statistically significant with  $p < 0.05$ .

Higher correlation than HaarPSI. The difference is statistically significant with  $p < 0.05$ .

The highest correlation in each row is written in boldface.