TABLE I: TBFD Performance of Nine Methods

Train	Test	Criteria	ROS	GAN	WGAN	SMOTE	BSMOTE	ENN	RUS	ADASYN	TDGN
Jan.	Feb.	P_r	0.7443	0.7506	0.7594	0.6508	0.7486	0.7904	0.3790	0.6552	**0.8214**
		R_e	0.6456	0.6700	0.6684	0.8223	0.7419	0.7811	**0.9460**	0.8065	0.8143
		F_1	0.6915	0.7080	0.7110	0.7265	0.7452	0.7857	0.5412	0.7230	**0.8178**
		G_m	0.7989	0.8139	0.8131	0.8965	0.8558	0.8791	**0.9331**	0.8882	0.8946
Feb.	Mar.	P_r	0.8491	**0.8601**	0.8562	0.8241	0.8453	0.8380	0.7406	0.8123	0.8524
		R_e	0.7806	0.7699	0.7748	0.8800	0.8151	0.8739	0.9284	0.8724	**0.9328**
		F_1	0.8135	0.8125	0.8135	0.8511	0.8299	0.8556	0.8239	0.8413	**0.8908**
		G_m	0.8730	0.8680	0.8704	0.9229	0.8913	0.9212	**0.9364**	0.9178	0.9151
Mar.	Apr.	P_r	0.3060	0.3704	0.3636	0.2667	0.4147	0.3292	0.1216	0.2990	**0.5156**
		R_e	0.5741	0.5787	0.5804	0.6938	0.6866	0.6801	0.7843	0.6798	**0.9654**
		F_1	0.3992	0.4517	0.4471	0.3853	0.5171	0.4436	0.2105	0.4154	**0.6721**
		G_m	0.7524	0.7567	0.7576	0.8243	0.8243	0.8185	**0.8581**	0.8174	0.7156
Apr.	May.	P_r	0.7315	**0.7429**	0.7309	0.5855	0.6927	0.7348	0.3129	0.5755	0.6943
		R_e	0.7339	0.7463	0.6959	0.8194	0.8091	0.8234	**0.9647**	0.8051	0.8917
		F_1	0.7327	0.7456	0.7130	0.6830	0.7464	0.7766	0.4726	0.6712	**0.7807**
		G_m	0.8542	0.8613	0.8318	0.8992	0.8958	**0.9043**	0.9582	0.8912	0.8280
May.	Jun.	P_r	0.6764	0.6640	0.6692	0.5730	0.6437	0.6704	0.3993	0.5575	**0.6807**
		R_e	0.7849	0.7247	0.7528	0.8531	0.8126	0.8667	0.9511	0.8245	**0.9757**
		F_1	0.7275	0.6930	0.7086	0.6855	0.7184	0.7561	0.5639	0.6652	**0.8019**
		G_m	0.8829	0.8475	0.8637	0.9164	0.8965	0.9261	**0.9619**	0.9007	0.8239
Average Value		P_r	0.6615	0.6776	0.6759	0.5800	0.6690	0.6726	0.3907	0.5799	**0.7129**
		R_e	0.7038	0.6979	0.6945	0.8137	0.7731	0.8051	0.9149	0.7977	**0.9160**
		F_1	0.6729	0.6822	0.6786	0.6663	0.7114	0.7235	0.5224	0.6632	**0.7927**
		G_m	0.8323	0.8295	0.8273	0.8919	0.8727	0.8899	**0.9296**	0.8831	0.8354
Average Ranking		P_r	4.2	2.8	3.4	7.4	4.8	3.6	9	7.6	**2.2**
		R_e	8	8	8	3.2	5.4	4	1.6	5.2	**1.6**
		F_1	6	5.8	5.6	5.8	3.4	2.6	8.4	6.2	**1**
		G_m	7.4	7.4	7.4	2.4	4.8	3.2	**1**	4.4	7

TABLE II: Experiments on Public Datasets When RF Is Used as a Classifier

Dataset	Criteria	ROS	GAN	WGAN	SMOTE	BSMOTE	ENN	RUS	ADASYN	DWGAN
D_1	P_r	0.4396	0.4531	0.4776	0.4545	0.4624	0.4036	0.3543	0.4787	**0.5000**
	R_e	0.3810	0.2762	0.3048	0.4286	0.4095	**0.6381**	0.5905	0.4286	0.3048
	F_1	0.4082	0.3432	0.3721	0.4412	0.4343	**0.4945**	0.4429	0.4523	0.3787
	G_m	0.5686	0.4975	0.5226	0.5999	0.5906	**0.6713**	0.6265	0.6052	0.5252
D_2	P_r	0.6811	0.7331	0.7375	0.6588	0.6511	0.5877	0.5806	0.6446	**0.7440**
	R_e	0.7056	0.6445	0.6413	0.7142	0.7254	0.8407	**0.8582**	0.7263	0.6536
	F_1	0.6932	0.6860	0.6861	0.6854	0.6862	0.6918	0.6926	0.6830	**0.6959**
	G_m	0.7951	0.7726	0.7715	0.7943	0.7979	0.8254	**0.8313**	0.7967	0.7794
D_3	P_r	0.8462	0.6667	0.7857	0.8095	0.8333	0.6786	0.8571	0.8750	**0.8846**
	R_e	0.7097	0.7200	0.8462	0.6800	0.6452	0.7600	0.6923	0.6774	**0.8846**
	F_1	0.7719	0.6923	0.8148	0.7391	0.7273	0.7170	0.7660	0.7636	**0.8846**
	G_m	0.7956	0.7313	0.8154	0.7761	0.7586	0.7514	0.7862	0.7890	**0.8887**
D_4	P_r	0.5526	0.6034	0.5714	0.5733	0.5432	0.4599	0.4880	0.5238	**0.6479**
	R_e	0.5060	0.4217	0.3855	0.5181	0.5301	**0.7241**	0.7011	0.5301	0.5287
	F_1	0.5283	0.4965	0.4604	0.5443	0.5366	0.5625	0.5755	0.5269	**0.5823**
	G_m	0.6533	0.6140	0.5856	0.6646	0.6631	**0.6874**	0.7003	0.6576	0.6831
D_5	P_r	0.5833	**0.6667**	0.6250	0.5600	0.5172	0.4808	0.4259	0.6296	0.6452
	R_e	0.3784	0.3243	0.2703	0.3784	0.4054	0.6410	0.5897	0.4595	**0.8696**
	F_1	0.4590	0.4364	0.3774	0.4516	0.4545	0.5495	0.4946	0.5313	**0.7407**
	G_m	0.5878	0.5544	0.5061	0.5850	0.5967	0.6985	0.6542	0.6477	**0.8919**
Average Value	P_r	0.6206	0.6246	0.6394	0.6112	0.6014	0.5221	0.5412	0.6304	**0.6843**
	R_e	0.5361	0.4773	0.4896	0.5438	0.5431	**0.7208**	0.6864	0.5644	0.6483
	F_1	0.5721	0.5309	0.5422	0.5723	0.5678	0.6030	0.5943	0.5914	**0.6564**
	G_m	0.6801	0.6340	0.6402	0.6840	0.6814	0.7268	0.7197	0.6992	**0.7537**
Average Ranking	P_r	5.0	4.2	4.0	5.0	5.6	8.2	7.6	4.2	**1.2**
	R_e	6.0	7.4	7.2	5.4	5.2	**1.8**	2.8	4.2	4.2
	F_1	4.4	8.2	6.8	5.8	5.6	3.6	3.2	5.2	**2.2**
	G_m	5.4	8.4	7.4	5.4	5.0	3.0	**2.4**	4.2	3.8

TABLE III: Experiments on Public Datasets When SVM Is Used as a Classifier

Dataset	Criteria	ROS	GAN	WGAN	SMOTE	BSMOTE	ENN	RUS	ADASYN	DWGAN
D_1	P_r	0.3676	0.3158	0.3333	0.3673	0.3482	0.3765	0.3667	0.3493	**0.4037**
	R_e	0.7143	0.1714	0.3714	0.6857	0.7429	0.6095	0.7333	**0.7619**	0.4190
	F_1	0.4854	0.2222	0.3514	0.4784	0.4742	0.4655	**0.4889**	0.4790	0.4112
	G_m	0.6640	0.3893	0.5343	0.6583	0.6489	0.6464	**0.6663**	0.6520	0.5816
D_2	P_r	0.5329	0.6500	0.7158	0.5411	0.4945	0.5220	0.5185	0.4949	**0.6815**
	R_e	0.8733	0.6252	0.5942	0.8737	0.9110	0.8731	0.8899	**0.9155**	0.6604
	F_1	0.6619	0.6373	0.6493	0.6683	0.6410	0.6534	0.6552	0.6425	**0.6708**
	G_m	0.8141	0.7476	0.7416	**0.8184**	0.8024	0.8085	0.8116	0.8038	0.7722
D_3	P_r	0.7188	0.7500	0.7857	0.8148	0.8333	0.6875	0.7692	0.7778	**0.9211**
	R_e	**0.8846**	0.8077	0.7097	0.6286	0.5714	0.8462	0.7692	0.8400	0.7778
	F_1	0.7931	0.7778	0.7458	0.7097	0.6780	0.7586	0.7692	0.8077	**0.8434**
	G_m	0.7748	0.7783	0.7711	0.7485	0.7223	0.7375	0.7774	0.8162	**0.8444**
D_4	P_r	0.5743	0.5294	0.5733	0.5521	0.4597	0.5154	0.5115	0.4741	**0.6625**
	R_e	0.6042	0.5422	0.5181	0.5521	0.6867	**0.7204**	0.7204	0.6627	0.5521
	F_1	0.5888	0.5357	0.5443	0.5521	0.5507	0.6009	0.5982	0.5528	**0.6023**
	G_m	0.6905	0.6650	0.6646	0.6601	0.6890	**0.7079**	0.7055	0.6902	0.6921
D_5	P_r	0.4154	0.4857	0.4750	0.4510	0.4259	0.4889	0.3659	0.4259	**0.5227**
	R_e	0.7105	0.4595	0.5135	0.6216	0.6216	0.5641	**0.7692**	0.6216	0.6053
	F_1	0.5243	0.4722	0.4935	0.5227	0.5055	0.5238	0.4959	0.5055	**0.5610**
	G_m	0.6882	0.6225	0.6479	0.6858	0.6738	0.6703	0.6444	0.6738	**0.7027**
Average Value	P_r	0.5218	0.5462	0.5766	0.5453	0.5123	0.5180	0.5063	0.5044	**0.6383**
	R_e	0.7574	0.5212	0.5414	0.6723	0.7067	0.7227	**0.7764**	0.7603	0.6029
	F_1	0.6107	0.5291	0.5568	0.5862	0.5699	0.6004	0.6015	0.5975	**0.6177**
	G_m	0.7263	0.6406	0.6719	0.7142	0.7073	0.7141	0.7210	**0.7272**	0.7186
Average Ranking	P_r	5.2	5.4	4.0	4.0	6.6	5.0	6.8	6.6	**1.2**
	R_e	3.4	7.6	8.2	5.2	3.8	4.4	2.8	**2.4**	6.2
	F_1	2.8	8.0	7.4	4.8	6.8	4.4	4.0	4.4	**2.2**
	G_m	**3.0**	7.2	7.6	4.6	6.0	5.0	3.6	4.0	3.8

TABLE IV: Experiments on Public Datasets When MLP Is Used as a Classifier

Dataset	Criteria	ROS	GAN	WGAN	SMOTE	BSMOTE	ENN	RUS	ADASYN	DWGAN
D_1	P_r	0.4375	0.4396	0.3623	0.4275	0.4775	0.3632	0.3604	0.4338	**0.4615**
	R_e	0.4118	0.3810	0.2381	0.5333	0.5048	**0.6952**	0.6762	0.5619	0.4000
	F_1	0.4242	0.4082	0.2874	0.4746	0.4907	**0.4771**	0.4702	0.4896	0.4286
	G_m	0.5885	0.5686	0.4550	0.6439	0.6464	0.6566	0.6507	**0.6584**	0.5847
D_2	P_r	0.5568	0.6514	0.6849	0.6129	0.5398	0.5220	0.5468	0.5312	**0.6673**
	R_e	0.8018	0.6038	0.6085	0.7263	0.8166	**0.8731**	0.8319	0.8301	0.6637
	F_1	0.6572	0.6267	0.6445	0.6648	0.6500	0.6534	0.6599	0.6478	**0.6655**
	G_m	0.8004	0.7356	0.7449	0.7888	0.7985	**0.8085**	0.8072	0.7991	0.7712
D_3	P_r	0.7742	0.7500	0.7333	0.7857	0.7500	0.7368	0.7742	0.7143	**0.8148**
	R_e	0.7742	0.8077	0.8462	0.6286	0.6774	0.8000	0.6857	0.7692	**0.8462**
	F_1	0.7742	0.7778	0.7857	0.6984	0.7119	0.7671	0.7273	0.7407	**0.8302**
	G_m	0.8032	0.7783	0.7774	0.7393	0.7513	0.7913	0.7625	0.7412	**0.8337**
D_4	P_r	0.4945	0.5106	0.4941	0.5195	0.4842	0.4641	0.4478	0.4607	**0.6207**
	R_e	0.5422	0.5783	0.5060	0.4819	0.5542	**0.7634**	0.6452	0.4940	0.6207
	F_1	0.5172	0.5424	0.5000	0.5000	0.5169	0.5772	0.5286	0.4767	**0.6207**
	G_m	0.6536	0.6751	0.6370	0.6323	0.6550	0.6790	0.6438	0.6202	**0.7242**
D_5	P_r	0.5313	0.5882	0.5714	0.5588	0.7143	0.4483	0.4490	0.5833	**0.7200**
	R_e	0.4595	0.5405	0.5882	0.5135	0.5405	**0.6667**	0.5641	0.5676	0.4865
	F_1	0.4928	0.5634	0.5797	0.5352	**0.6154**	0.5361	0.5000	0.5753	0.5806
	G_m	0.6321	0.6890	**0.7166**	0.6682	0.7092	0.6913	0.6552	0.7025	0.6759
Average Value	P_r	0.5589	0.5880	0.5692	0.5809	0.5932	0.5069	0.5156	0.5447	**0.6569**
	R_e	0.5979	0.5823	0.5574	0.5767	0.6187	**0.7597**	0.6806	0.6446	0.6034
	F_1	0.5731	0.5837	0.5594	0.5746	0.5970	0.6022	0.5772	0.5861	**0.6251**
	G_m	0.6956	0.6893	0.6662	0.6945	0.7121	**0.7253**	0.7039	0.7043	0.7179
Average Ranking	P_r	4.6	3.4	5.4	4.0	4.2	7.8	7.0	6.8	**1.4**
	R_e	6.2	5.8	5.4	7.0	5.4	**1.6**	3.4	4.6	5.2
	F_1	5.8	5.6	6.0	5.8	4.4	4.2	5.4	5.6	**2.2**
	G_m	5.0	5.8	6.0	7.0	4.4	**2.4**	5.0	5.0	4.4