

Supplementary Figure 1: p-value comparison. The p-value matrix compares the balanced accuracy of different methods using the Wilcoxon signed-rank test, where each cell reflects the p-value between the models in the row and column for **a)** the Ovarian dataset, **a)** the Pleural dataset, **a)** the Bladder dataset, and **a)** the Breast dataset.

Supplementary Figure 2: Representative patches. **a)** Source and **b)** target domains for the Ovarian (**first row**), Pleural (**second row**), and Bladder (**third row**) cancer datasets.

Supplementary Figure 3: FFT-Enhancer. **a)** An example of the importance of phase spectrum. The morphology and color of each combined image resemble its phase and amplitude spectrum images, respectively. **b)** Some examples of applying the FFT-Enhancer of images with different color spaces.

Supplementary Figure 4: k in VLAD. Balanced accuracy of the model across different values of k for VLAD encoding for Ovarian, Pleural, Bladder, and Breast datasets.

Supplementary Table 1: Slide-level classification performance comparison for Ovarian dataset

Supplementary Table 2: Slide-level classification performance comparison for Pleural dataset

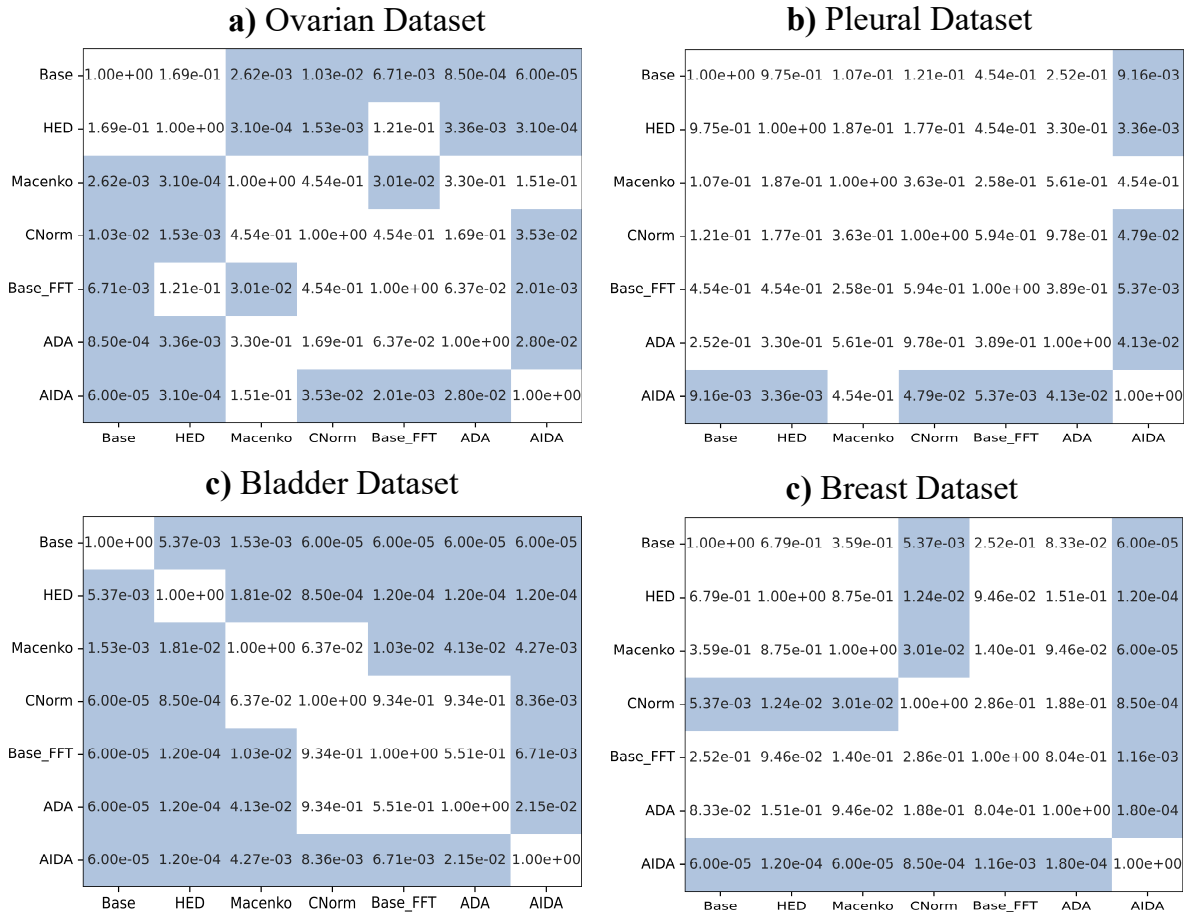
Supplementary Table 3: Slide-level classification performance comparison for Bladder dataset

Supplementary Table 4: Slide-level classification performance comparison for Breast dataset

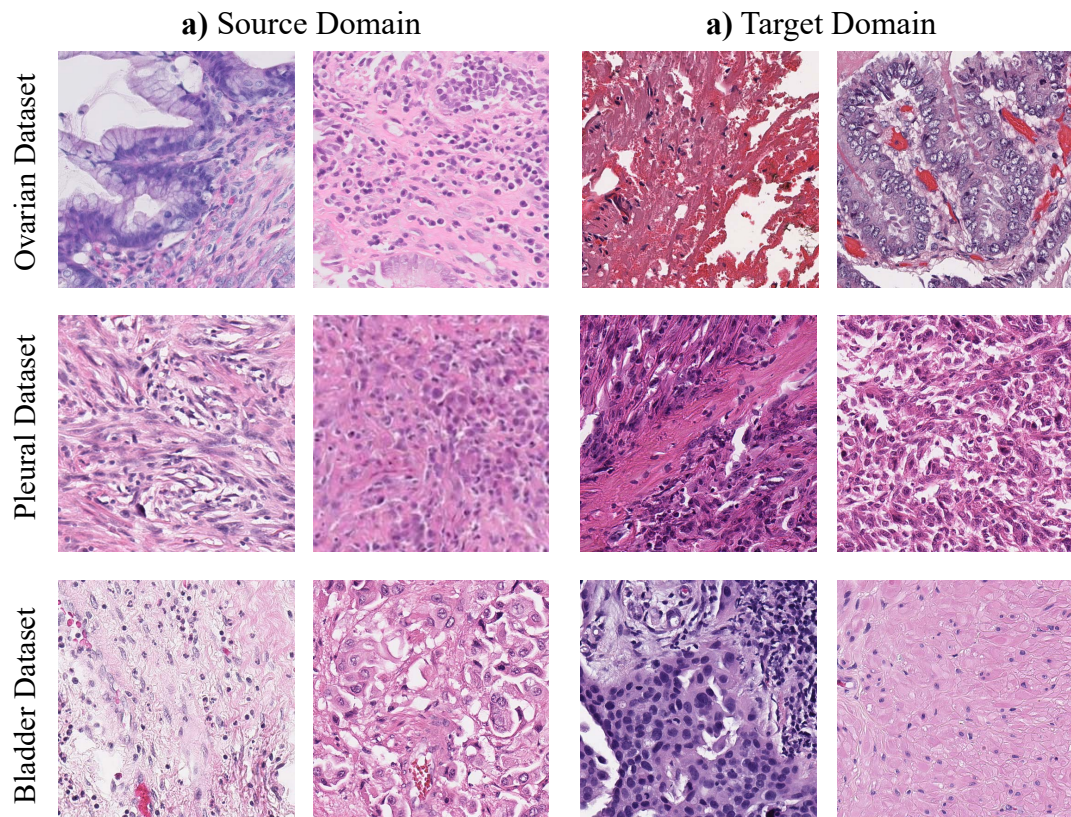
Supplementary Table 5: Slide-level classification performance comparison (balanced accuracy) for different backbones (MobileNet (Mob) and Vision Transformer (ViT))

Supplementary Table 6: Slide-level classification performance comparison (balanced accuracy) for experiments with CTransPath

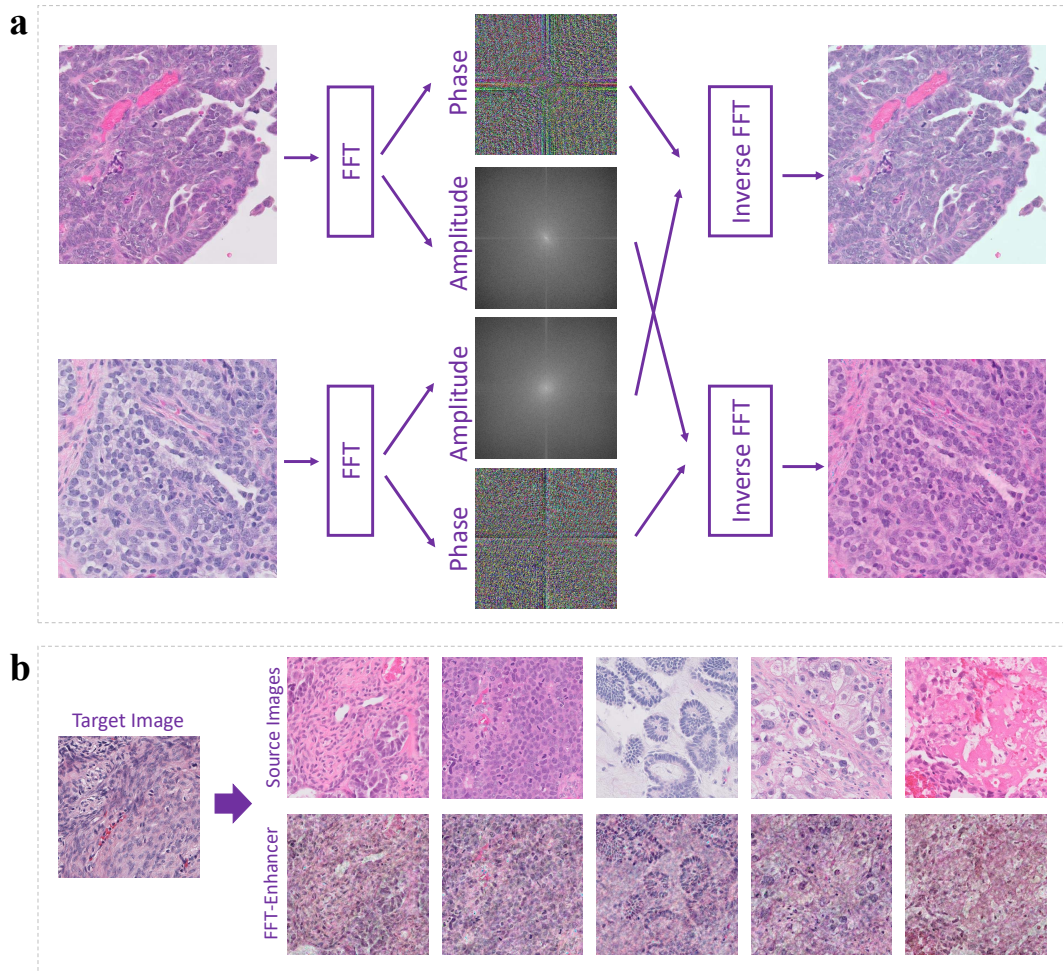
Supplementary Table 7: Comparative Analysis of Training Times and Computational Resources where “Training Time” refers to the duration required for training per epoch, measured in minutes, and “Param.” denotes the total parameter count, quantified in millions



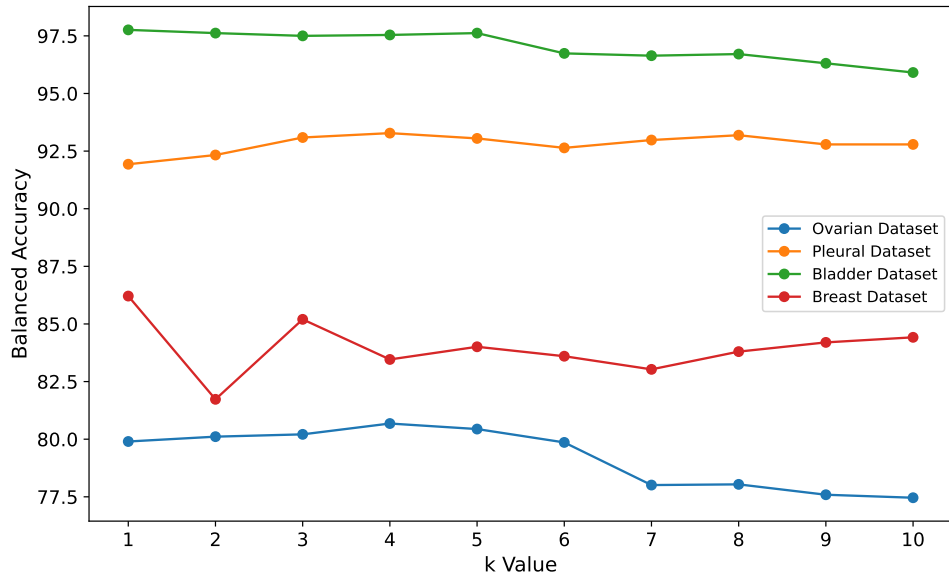
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Supplementary Figure 2: Representative patches. **a)** Source and **b)** target domains for the Ovarian (**first row**), Pleural (**second row**), and Bladder (**third row**) cancer datasets.



Supplementary Figure 3: FFT-Enhancer. **a)** An example of the importance of phase spectrum. The morphology and color of each combined image resemble its phase and amplitude spectrum images, respectively. **b)** Some examples of applying the FFT-Enhancer of images with different color spaces.



Supplementary Figure 4: k in VLAD. Balanced accuracy of the model across different values of k for VLAD encoding for Ovarian, Pleural, Bladder, and Breast datasets.

Supplementary Table 1: Slide-level classification performance comparison for Ovarian dataset

Split	Method	Source				Target			
		BACC	Kappa	F1	AUC	BACC	Kappa	F1	AUC
Split 1	Baseline	79.77	0.7246	0.7838	0.9350	61.08	0.6127	0.6131	0.8910
	HED[21]	79.07	0.7282	0.7814	0.9322	65.61	0.6583	0.6746	0.9056
	Macenko [26]	79.30	0.7102	0.7719	0.9319	73.56	0.6790	0.7400	0.9329
	CNorm [12]	80.62	0.7251	0.7892	0.9316	74.79	0.7165	0.7467	0.9300
	Baseline-FFT	80.71	0.7343	0.7826	0.9318	72.21	0.7026	0.7304	0.9284
	ADA	79.89	0.7250	0.7811	0.9297	75.49	0.7311	0.7525	0.9392
	AIDA	81.10	0.7313	0.7889	0.9329	76.54	0.7588	0.7885	0.9429
Split 2	Baseline	78.46	0.7060	0.7870	0.9445	71.29	0.6753	0.7191	0.9144
	HED[21]	78.77	0.7162	0.7960	0.9426	71.21	0.6940	0.7466	0.9378
	Macenko [26]	77.37	0.7010	0.7874	0.9429	74.13	0.6838	0.7543	0.9442
	CNorm [12]	76.86	0.6912	0.7726	0.9361	72.33	0.6764	0.7341	0.9327
	Baseline-FFT	77.60	0.7100	0.7851	0.9423	74.81	0.7194	0.7736	0.9408
	ADA	78.74	0.7133	0.7719	0.9318	77.95	0.7718	0.7999	0.9374
	AIDA	78.92	0.7158	0.7994	0.9494	80.08	0.7917	0.8313	0.9412
Split 3	Baseline	79.81	0.7055	0.7714	0.9483	61.59	0.5939	0.5986	0.8848
	HED[21]	79.63	0.7105	0.7835	0.9561	64.39	0.6357	0.6635	0.9168
	Macenko [26]	79.98	0.7162	0.7718	0.9518	72.78	0.6556	0.7189	0.9473
	CNorm [12]	79.94	0.7293	0.7866	0.9301	69.31	0.6464	0.6893	0.9344
	Baseline-FFT	78.74	0.7006	0.7732	0.9516	63.82	0.6448	0.6611	0.9288
	ADA	80.29	0.7329	0.7964	0.9536	69.03	0.6812	0.6968	0.9484
	AIDA	82.02	0.7403	0.8073	0.9589	70.84	0.7053	0.7333	0.9492
Average	Baseline	79.35	0.7120	0.7807	0.9426	64.65	0.6273	0.6436	0.8967
	HED[21]	79.16	0.7183	0.7869	0.9436	67.07	0.6627	0.6949	0.9201
	Macenko [26]	78.89	0.7091	0.7770	0.9422	73.49	0.6728	0.7377	0.9415
	CNorm [12]	79.14	0.7152	0.7828	0.9326	72.14	0.6798	0.7234	0.9324
	Baseline-FFT	79.02	0.7150	0.7803	0.9426	70.28	0.6889	0.7217	0.9327
	ADA	79.64	0.7237	0.7831	0.9384	74.16	0.7280	0.7831	0.9384
	AIDA	80.68	0.7291	0.7985	0.9471	75.82	0.7519	0.7844	0.9444

Supplementary Table 2: Slide-level classification performance comparison for Pleural dataset

Split	Method	Source				Target			
		BACC	Kappa	F1	AUC	BACC	Kappa	F1	AUC
Split 1	Baseline	97.78	0.9580	0.9790	1.000	82.69	0.6576	0.8198	0.9920
	HED[21]	95.96	0.9164	0.9581	0.9973	84.76	0.6970	0.8465	0.9524
	Macenko [26]	96.10	0.9174	0.9586	0.9957	82.71	0.6581	0.8236	0.9815
	CNorm [12]	95.91	0.9082	0.9434	0.9920	82.78	0.6584	0.8253	0.9413
	Baseline-FFT	96.42	0.9272	0.9636	0.9931	82.31	0.6656	0.8189	0.9658
	ADA	97.14	0.9381	0.9690	0.9941	83.13	0.6659	0.8282	0.9655
	AIDA	97.59	0.9483	0.9741	0.9984	86.97	0.7423	0.8696	0.9789
Split 2	Baseline	89.25	0.8005	0.9000	0.9783	81.62	0.6355	0.8121	0.9071
	HED[21]	93.08	0.8590	0.9295	0.9705	79.87	0.5991	0.7947	0.8960
	Macenko [26]	88.83	0.7898	0.8947	0.9617	83.97	0.6816	0.8378	0.9630
	CNorm [12]	82.42	0.6726	0.8401	0.9372	83.16	0.6660	0.8172	0.9313
	Baseline-FFT	89.92	0.8111	0.9050	0.9689	78.96	0.6210	0.7845	0.9254
	ADA	88.42	0.7802	0.8898	0.9639	83.20	0.6665	0.8299	0.9296
	AIDA	91.08	0.8250	0.9123	0.9806	84.88	0.6979	0.8483	0.9342
Split 3	Baseline	89.92	0.8269	0.9131	0.9628	65.78	0.3196	0.6175	0.8749
	HED[21]	89.43	0.8059	0.9026	0.9640	65.84	0.3197	0.6092	0.7832
	Macenko [26]	94.20	0.8981	0.9490	0.9948	76.20	0.5279	0.7504	0.9020
	CNorm [12]	93.80	0.8988	0.9431	0.9897	72.71	0.4896	0.7072	0.8932
	Baseline-FFT	90.14	0.8173	0.9083	0.9800	70.46	0.4356	0.6829	0.9006
	ADA	91.34	0.8495	0.9244	0.9486	72.83	0.4598	0.7160	0.8558
	AIDA	91.17	0.8297	0.9146	0.9863	75.83	0.5206	0.7485	0.9268
Average	Baseline	92.32	0.8618	0.9307	0.9804	76.70	0.5376	0.7498	0.9247
	HED[21]	92.82	0.8604	0.9301	0.9773	76.82	0.5386	0.7501	0.8772
	Macenko [26]	93.04	0.8684	0.9341	0.9841	80.96	0.6225	0.8039	0.9488
	CNorm [12]	90.71	0.8265	0.9089	0.9730	79.55	0.6047	0.7832	0.9219
	Baseline-FFT	92.16	0.8519	0.9256	0.9807	77.24	0.5741	0.7621	0.9306
	ADA	92.30	0.8559	0.9277	0.9689	79.72	0.5974	0.7914	0.9170
	AIDA	93.28	0.8677	0.9337	0.9884	82.56	0.6536	0.8221	0.9466

Supplementary Table 3: Slide-level classification performance comparison for Bladder dataset

Split	Method	Source				Target			
		BACC	Kappa	F1	AUC	BACC	Kappa	F1	AUC
Split 1	Baseline	99.73	0.9928	0.9964	1	53.46	0.0751	0.4316	0.6991
	HED[21]	99.28	0.9856	0.9928	1	60.22	0.2106	0.5456	0.7430
	Macenko [26]	99.50	0.9927	0.9964	1	69.34	0.3969	0.6734	0.8877
	CNorm [12]	99.09	0.9852	0.9926	1	69.27	0.4028	0.6744	0.9317
	Baseline-FFT	98.56	0.9675	0.9838	0.9982	71.16	0.4438	0.7049	0.8847
	ADA	96.76	0.9157	0.9577	1	69.42	0.4022	0.6797	0.8411
	AIDA	98.38	0.9577	0.9788	1	73.36	0.4802	0.7343	0.8561
Split 2	Baseline	95.90	0.9140	0.9567	0.9946	52.92	0.0636	0.4148	0.8686
	HED[21]	96.15	0.9203	0.9599	0.9997	53.90	0.0849	0.4434	0.7982
	Macenko [26]	99.17	0.9840	0.9920	0.9999	60.02	0.2117	0.5395	0.8916
	CNorm [12]	97.15	0.9406	0.9703	0.9975	76.01	0.5396	0.7547	0.9647
	Baseline-FFT	93.04	0.8594	0.9295	0.9919	75.69	0.5267	0.7457	0.9453
	ADA	89.66	0.7854	0.8915	0.9802	72.12	0.4613	0.7064	0.9415
	AIDA	94.91	0.8965	0.9481	0.9951	80.89	0.6320	0.8091	0.9483
Split 3	Baseline	98.62	0.9721	0.986	1	57.94	0.1709	0.5197	0.8515
	HED[21]	97.02	0.9413	0.9706	0.9986	58.85	0.1898	0.5375	0.8687
	Macenko [26]	96.55	0.9315	0.9656	0.9995	69.91	0.4137	0.6826	0.9149
	CNorm [12]	97.27	0.9443	0.9721	1	75.92	0.539	0.7578	0.9631
	Baseline-FFT	98.64	0.9721	0.986	0.9991	76.59	0.5497	0.7664	0.9408
	ADA	98.57	0.972	0.986	1	77.90	0.5716	0.7756	0.9372
	AIDA	100	1	1	1	78.69	0.5886	0.7884	0.9366
Average	Baseline	98.08	0.9596	0.9797	0.9982	54.77	0.1032	0.4554	0.8064
	HED[21]	97.48	0.9491	0.9744	0.9994	57.66	0.1618	0.5088	0.8033
	Macenko [26]	98.41	0.9694	0.9847	0.9998	66.42	0.3408	0.6318	0.8981
	CNorm [12]	97.84	0.9567	0.9783	0.9992	73.73	0.4938	0.7290	0.9532
	Baseline-FFT	96.75	0.9330	0.9664	0.9964	74.48	0.5067	0.7390	0.9236
	ADA	95.00	0.8910	0.9451	0.9934	73.15	0.4784	0.7206	0.9066
	AIDA	97.76	0.9514	0.9756	0.9984	77.65	0.5669	0.7733	0.9137

Supplementary Table 4: Slide-level classification performance comparison for Breast dataset

Split	Method	Source				Target			
		BACC	Kappa	F1	AUC	BACC	Kappa	F1	AUC
Split 1	Baseline	79.37	0.4248	0.6877	0.8302	53.17	0.0671	0.5129	0.4938
	HED[21]	84.43	0.5279	0.7485	0.8949	54.32	0.1093	0.5208	0.4648
	Macenko [26]	69.44	0.2479	0.5383	0.8455	51.66	0.0463	0.4487	0.6420
	CNorm [12]	79.59	0.5071	0.7395	0.9025	61.75	0.2805	0.6187	0.7555
	Baseline-FFT	70.42	0.2524	0.5488	0.8742	52.75	0.0750	0.4715	0.7126
	ADA	79.45	0.4157	0.6749	0.9382	54.35	0.1120	0.5151	0.7082
	AIDA	82.48	0.4857	0.7214	0.9435	74.45	0.5002	0.7475	0.7892
Split 2	Baseline	75.85	0.4253	0.6948	0.7903	54.28	0.0549	0.4808	0.5398
	HED[21]	81.53	0.5189	0.7441	0.8956	68.79	0.3676	0.6813	0.7212
	Macenko [26]	83.37	0.5844	0.7862	0.9109	68.87	0.3953	0.6938	0.8029
	CNorm [12]	97.06	0.9258	0.9626	0.9969	66.58	0.3772	0.6729	0.8158
	Baseline-FFT	83.82	0.5739	0.7776	0.9428	73.95	0.5130	0.7534	0.8326
	ADA	82.73	0.5424	0.7579	0.9337	69.64	0.3981	0.6967	0.7542
	AIDA	84.75	0.5926	0.7880	0.9356	75.27	0.4943	0.7423	0.8474
Split 3	Baseline	88.03	0.7601	0.8800	0.9167	58.00	0.1691	0.5730	0.5965
	HED[21]	89.46	0.7890	0.8945	0.9637	49.60	-0.0108	0.4344	0.5058
	Macenko [26]	88.00	0.7576	0.8784	0.9589	56.19	0.1513	0.5317	0.6878
	CNorm [12]	90.29	0.7639	0.8809	0.9641	66.84	0.3262	0.6522	0.7760
	Baseline-FFT	89.83	0.7963	0.8982	0.9738	55.56	0.1422	0.5204	0.7481
	ADA	92.06	0.8401	0.9200	0.9526	57.48	0.1855	0.5677	0.6619
	AIDA	91.39	0.8258	0.9126	0.9481	72.60	0.4865	0.7411	0.8042
Average	Baseline	81.08	0.5367	0.7542	0.8457	55.15	0.0971	0.5222	0.5434
	HED[21]	85.14	0.6119	0.7957	0.9181	57.57	0.1554	0.5455	0.5639
	Macenko [26]	80.27	0.5300	0.7343	0.9051	58.91	0.1976	0.5581	0.7109
	CNorm [12]	88.98	0.7323	0.8610	0.9545	65.06	0.3280	0.6479	0.7824
	Baseline-FFT	81.36	0.5408	0.7415	0.9303	60.75	0.2434	0.5818	0.7645
	ADA	84.75	0.5994	0.7843	0.9415	60.49	0.2319	0.5932	0.7081
	AIDA	86.21	0.6347	0.8073	0.9424	74.11	0.4936	0.7436	0.8136

Supplementary Table 5: Slide-level classification performance comparison (balanced accuracy) for different backbones (MobileNet (Mob) and Vision Transformer (ViT))

Split	Method	Ovarian		Pleural		Bladder		Breast	
		Source	Target	Source	Target	Source	Target	Source	Target
Split 1	ADA (Mob)	77.32	75.93	86.82	81.54	100	67.91	76.47	52.28
	AIDA (Mob)	81.84	76.80	89.55	90.47	100	69.07	81.21	67.01
	ADA (ViT)	80.50	71.19	93.96	89.30	99.00	74.48	78.87	56.91
	AIDA (ViT)	81.30	73.10	94.55	90.11	98.56	76.21	79.84	61.90
Split 2	ADA (Mob)	71.19	69.87	95.33	83.73	87.44	69.48	80.13	52.16
	AIDA (Mob)	72.85	70.73	96.42	86.71	87.44	77.76	80.83	74.78
	ADA (ViT)	76.18	72.99	95.42	86.71	93.08	68.52	79.58	71.18
	AIDA (ViT)	77.19	72.66	96.67	88.96	94.06	69.86	80.49	73.04
Split 3	ADA (Mob)	79.32	70.62	91.72	82.42	97.60	77.69	90.26	55.80
	AIDA (Mob)	80.05	75.75	95.29	87.69	97.62	82.38	88.07	68.95
	ADA (ViT)	79.68	64.64	92.83	79.76	98.05	80.06	89.87	56.18
	AIDA (ViT)	82.27	70.87	96.09	85.01	96.62	81.47	90.58	61.35
Average	ADA (Mob)	75.94	72.14	91.29	82.56	95.01	71.69	82.29	53.41
	AIDA (Mob)	78.25	74.43	93.75	86.53	95.02	76.40	83.37	70.25
	ADA (ViT)	78.79	69.61	94.07	85.26	96.71	74.35	82.77	61.42
	AIDA (ViT)	80.25	72.21	95.77	88.03	96.41	75.85	83.64	65.43

Supplementary Table 6: Slide-level classification performance comparison (balanced accuracy) for experiments with CTransPath

Split	Method	Ovarian		Pleural		Bladder		Breast	
		Source	Target	Source	Target	Source	Target	Source	Target
Split 1	CTransPath [46]	67.76	47.21	87.97	73.08	98.04	74.32	74.77	60.01
	ADA-CTransPath-Aug	80.61	79.06	94.79	75.09	100	59.96	81.91	74.11
	ADA-CTransPath-NoAug	77.39	70.09	93.05	78.45	98.26	59.83	82.97	57.32
	AIDA-CTransPath-Aug	81.12	79.41	94.01	76.37	100	60.66	81.49	71.26
	AIDA-CTransPath-NoAug	81.40	83.77	95.70	78.69	98.26	59.96	82.96	76.21
Split 2	CTransPath [46]	70.51	50.19	89.75	77.38	85.90	86.15	80.60	70.21
	ADA-CTransPath-Aug	82.31	81.82	94.75	66.47	90.51	65.72	80.26	80.80
	ADA-CTransPath-NoAug	77.90	77.19	96.42	60.78	85.64	66.74	78.28	79.07
	AIDA-CTransPath-Aug	82.87	82.49	97.08	69.22	92.31	60.66	78.26	80.53
	AIDA-CTransPath-NoAug	82.16	81.54	95.42	70.48	88.72	67.7	78.28	79.07
Split 3	CTransPath [46]	69.64	50.83	75.91	56.92	88.10	79.14	79.96	63.56
	ADA-CTransPath-Aug	79.00	80.13	93.86	68.37	98.07	62.71	89.80	62.31
	ADA-CTransPath-NoAug	70.13	73.71	94.57	66.90	90.95	65.25	85.42	74.53
	AIDA-CTransPath-Aug	80.33	80.90	93.54	73.25	95.69	64.66	92.07	73.91
	AIDA-CTransPath-NoAug	76.86	82.71	93.72	72.14	98.10	66.02	87.98	77.07
Average	CTransPath [46]	69.30	49.41	84.54	69.13	90.68	79.87	78.44	64.60
	ADA-CTransPath-Aug	80.64	80.34	94.47	69.98	96.19	62.71	83.99	72.41
	ADA-CTransPath-NoAug	75.14	73.66	94.68	68.71	91.62	65.25	81.22	67.74
	AIDA-CTransPath-Aug	81.44	80.93	94.88	72.95	96.00	63.42	83.94	75.23
	AIDA-CTransPath-NoAug	80.14	82.67	94.95	73.77	95.03	64.56	83.07	77.45

Supplementary Table 7: Comparative Analysis of Training Times and Computational Resources where “Training Time” refers to the duration required for training per epoch, measured in minutes, and “Param.” denotes the total parameter count, quantified in millions

Model	Param. (millions)	FLOPs	Training Time
Base	11	9.51×10^9	7
AIDA	78	9.58×10^9	10