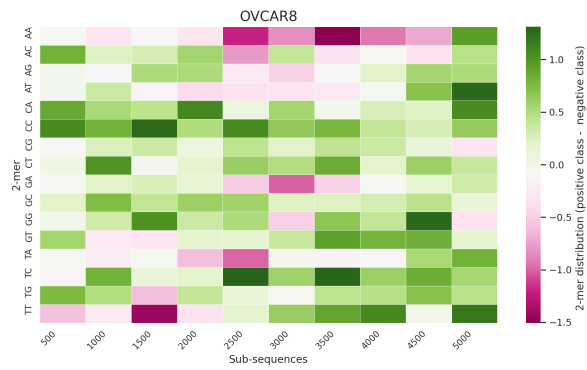
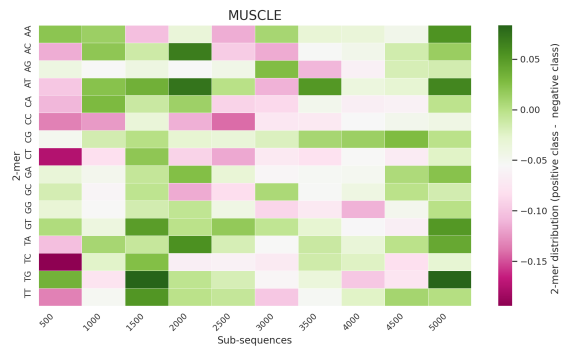
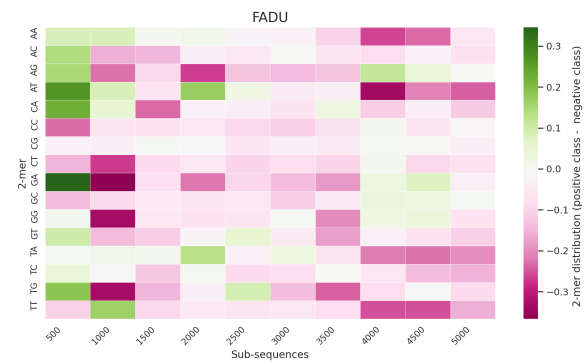
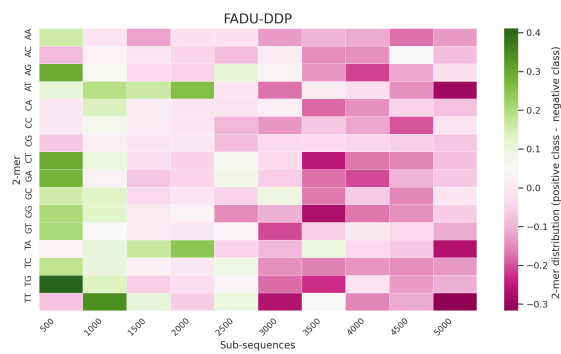
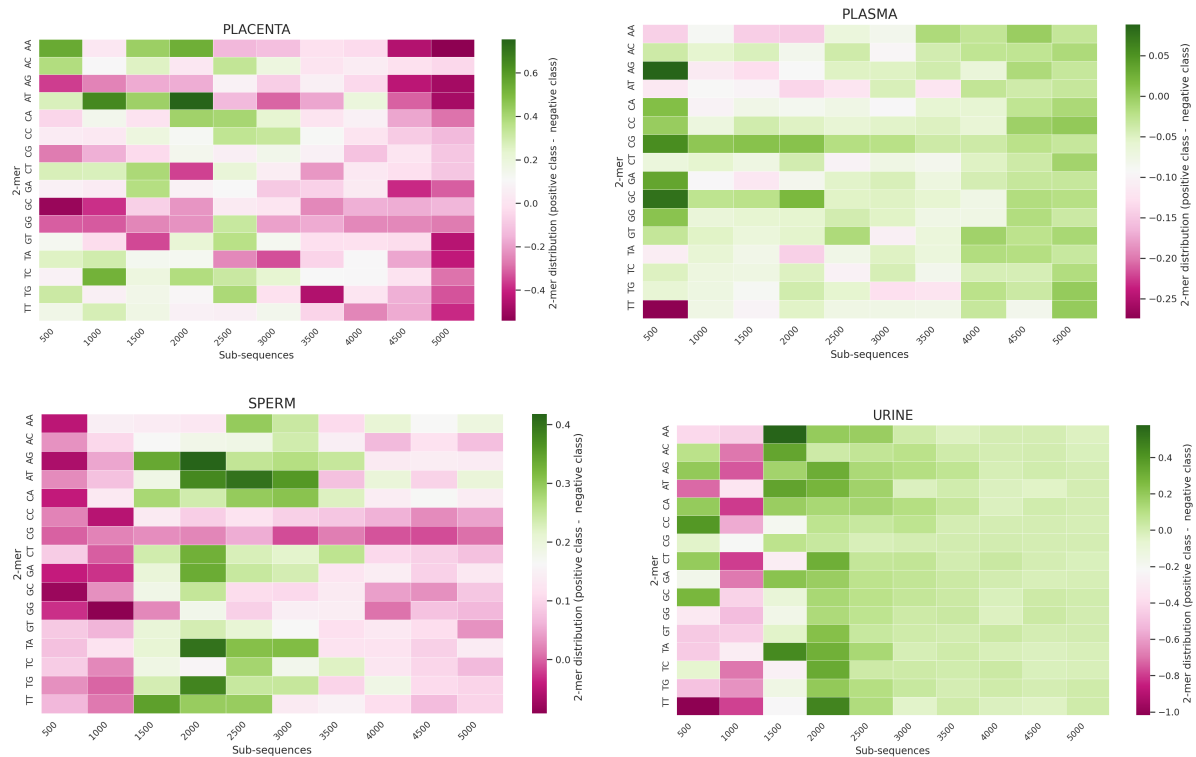


Supplementary Information iLEC-DNA

2-mer Distribution Over Remaining Datasets





Performance Values of Stage 1, 2 and 3

Table S1: Performance values in terms of diverse evaluation measures across stage 1, 2 and 3 over C4-2B dataset.

5000	Stage 1 and 2 (C4-2B)							
Type	Accuracy	Sensitivity	Specificity	Recall	F1	MCC	AUC-ROC	
SCPSDNC	71.044	69.799	72.297	69.799	70.748	42.107	71.048	
CKSNAP	77.778	76.51	79.054	76.51	77.551	55.579	77.782	SVM
CKSNAP+SCPSDNC	80.808	77.852	83.784	77.852	80.277	61.737	80.818	
SCPSDNC	67.677	71.141	64.189	71.141	68.831	35.419	67.665	
CKSNAP	78.451	75.839	81.081	75.839	77.931	56.992	78.46	LDA
CKSNAP+SCPSDNC	77.104	75.839	78.378	75.839	76.871	54.232	77.109	

SCPSDNC	52.525	53.691	51.351	53.691	53.156	5.044	52.521	
CKSNAP	59.596	59.732	59.459	59.732	59.732	19.191	59.596	LR
CKSNAP+SCPSDNC	59.933	59.732	60.135	59.732	59.933	19.867	59.933	
SCPSDNC	67.34	69.128	65.541	69.128	67.987	34.692	67.334	
CKSNAP	65.657	61.745	69.595	61.745	64.336	31.434	65.67	RF
CKSNAP+SCPSDNC	66.33	64.43	68.243	64.43	65.753	32.695	66.336	
	Stage 3 (C4-2B)							
Type	Accuracy	Sensitivity	Specificity	Recall	F1	MCC	AUC-ROC	
LR-ensemble	80.81	80.54	81.08	80.54	80.81	61.62	80.81	
RF-ensemble	78.11	82.55	73.65	82.55	79.1	56.43	78.1	
SVM-ensmble	79.46	78.52	80.41	78.52	79.32	58.94	79.46	
LR-ensemble (based on LDA and SVM)	81.48	80.54	82.43	80.54	81.36	62.98	81.48	

Table S2: Performance values in terms of diverse evaluation measures across stage 1, 2 and 3 over Muscle dataset.

5000	Stage 1 and 2 (Muscle)							
Type	Accuracy	Sensitivity	Specificity	Recall	F1	MCC	AUC-ROC	
SCPSDNC	72.92	68.389	77.449	68.389	71.63	46.028	72.919	
CKSNAP	78.173	76.159	80.185	76.159	77.72	56.39	78.172	
CKSNAP+SCPSDNC	78.261	75.453	81.068	75.453	77.629	56.61	78.26	SVM
SCPSDNC	70.889	72.583	69.197	72.583	71.37	41.803	70.89	
CKSNAP	76.385	75.894	76.876	75.894	76.264	52.772	76.385	
CKSNAP+SCPSDNC	77.444	76.512	78.376	76.512	77.228	54.898	77.444	LDA

SCPSDNC	63.187	56.203	70.168	56.203	60.418	26.632	63.185	
CKSNAP	71.507	66.623	76.39	66.623	70.039	43.22	71.506	
CKSNAP+SCPSDNC	71.64	67.02	76.258	67.02	70.262	43.464	71.639	LR
SCPSDNC-RF	70.404	66.932	73.875	66.932	69.335	40.905	70.403	
CKSNAP-RF	71.22	66.358	76.081	66.358	69.745	42.641	71.219	RF
CKSNAP+SCPSDNC-RF	72.324	67.02	77.626	67.02	70.769	44.899	72.323	
	Stage 3 (Muscle)							
Type	Accuracy	Sensitivity	Specificity	Recall	F1	MCC	AUC-ROC	
LR-ensemble	78.19	77.31	79.08	77.31	78	56.4	78.19	
RF-ensemble	78.42	78.54	78.29	78.54	78.44	56.83	78.42	
SVM-ensemble	77.89	77.66	78.11	77.66	77.83	55.77	77.89	
SVM-ensemble (based on LR and SVM)	78.66	78.85	78.46	78.85	78.7	57.32	78.66	

Table S3: Performance values in terms of diverse evaluation measures across stage 1, 2 and 3 over Ovary-Primary dataset.

2000	Stage 1 and 2 (Ovary-Primary)							
Type	Accuracy	Sensitivity	Specificity	Recall	F1	MCC	AUC-ROC	
SCPSDNC	70.139	69.444	70.833	69.444	69.93	40.282	70.139	
CKSNAP	73.611	70.833	76.389	70.833	72.857	47.295	73.611	SVM
CKSNAP+SCPSDNC	75	75	75	75	75	50	75	
SCPSDNC	64.583	68.056	61.111	68.056	65.772	29.237	64.583	

CKSNAP	70.139	73.611	66.667	73.611	71.141	40.375	70.139	LDA
CKSNAP+SCPSEDNC	68.75	68.056	69.444	68.056	68.531	37.504	68.75	
SCPSEDNC	54.861	52.778	56.944	52.778	53.901	9.731	54.861	
CKSNAP	56.25	52.778	59.722	52.778	54.676	12.53	56.25	LR
CKSNAP+SCPSEDNC	54.861	51.389	58.333	51.389	53.237	9.746	54.861	
SCPSEDNC	62.5	61.111	63.889	61.111	61.972	25.01	62.5	
CKSNAP	61.111	55.556	66.667	55.556	58.824	22.361	61.111	RF
CKSNAP+SCPSEDNC	63.194	62.5	63.889	62.5	62.937	26.391	63.194	
Stage 3 (Ovary-Primary)								
Type	Accuracy	Sensitivity	Specificity	Recall	F1	MCC	AUC-ROC	
LR-ensemble	70.83	70.83	70.83	70.83	70.83	41.67	70.83	
RF-ensemble	76.39	65.28	87.5	65.28	73.44	54.13	76.39	
SVM-ensemble	74.31	68.06	80.56	68.06	72.59	49	74.31	
RF-ensemble (based on LDA and SVM)	75.69	66.67	84.72	66.67	73.28	52.25	75.69	

Table S4: Performance values in terms of diverse evaluation measures across stage 1, 2 and 3 over Plasma dataset.

4000	Stage 1 and 2 (Plasma)							
Type	Accuracy	Sensitivity	Specificity	Recall	F1	MCC	AUC-ROC	
SCPSEDNC	66.967	61.322	72.613	61.322	64.995	34.153	66.968	
CKSNAP	75.357	73.133	77.582	73.133	74.8	50.765	75.357	SVM
CKSNAP+SCPSEDNC	76.237	73.993	78.482	73.993	75.695	52.528	76.237	
SCPSEDNC	63.818	64.607	63.028	64.607	64.106	27.639	63.818	
CKSNAP	73.675	72.781	74.57	72.781	73.441	47.358	73.675	LDA

CKSNAP+SCPSDNC	75.474	73.68	77.269	73.68	75.03	50.982	75.475	
SCPSDNC	58.811	51.74	65.884	51.74	55.682	17.803	58.812	
CKSNAP	69.978	65.898	74.061	65.898	68.705	40.092	69.979	LR
CKSNAP+SCPSDNC	69.881	65.819	73.944	65.819	68.61	39.895	69.881	
SCPSDNC	63.739	61.126	66.354	61.126	62.771	27.518	63.74	
CKSNAP	67.866	63.316	72.418	63.316	66.339	35.883	67.867	RF
CKSNAP+SCPSDNC	69.333	64.294	74.374	64.294	67.71	38.866	69.334	
Stage 3 (Plasma)								
Type	Accuracy	Sensitivity	Specificity	Recall	F1	MCC	AUC-ROC	
LR-ensemble	75.42	74.19	76.64	74.19	75.11	50.85	75.42	
RF-ensemble	76.16	75.05	77.27	75.05	75.89	52.33	76.16	
SVM-ensemble	75.24	73.33	77.15	73.33	74.76	50.52	75.24	
RF-ensemble (based on SVM-LR)	76.3	74.58	78.01	74.58	75.89	52.62	76.3	

Table S5: Performance values in terms of diverse evaluation measures across stage 1, 2 and 3 over FaDu dataset.

3000	Stage 1 and 2 (FaDu)							
Type	Accuracy	Sensitivity	Specificity	Recall	F1	MCC	AUC-ROC	
SCPSDNC	68.088	66.59	69.585	66.59	67.602	36.191	68.088	
CKSNAP	75.115	72.35	77.88	72.35	74.408	50.307	75.115	SVM
CKSNAP+SCPSDNC	74.654	71.429	77.88	71.429	73.81	49.412	74.654	
SCPSDNC	69.124	70.046	68.203	70.046	69.406	38.255	69.124	
CKSNAP	73.502	72.581	74.424	72.581	73.256	47.013	73.502	LDA
CKSNAP+SCPSDNC	74.424	72.35	76.498	72.35	73.882	48.89	74.424	
SCPSDNC	60.714	52.535	68.894	52.535	57.215	21.721	60.714	

CKSNAP	70.622	65.668	75.576	65.668	69.091	41.448	70.622	LR
CKSNAP+SCPSDNC	69.816	64.977	74.654	64.977	68.281	39.818	69.816	
SCPSDNC-RF	61.175	61.29	61.06	61.29	61.22	22.35	61.175	
CKSNAP-RF	65.092	61.521	68.664	61.521	63.799	30.262	65.092	RF
CKSNAP+SCPSDNC-RF	67.281	63.825	70.737	63.825	66.11	34.645	67.281	
	Stage 3 (FaDu)							
Type	Accuracy	Sensitivity	Specificity	Recall	F1	MCC	AUC-ROC	
LR-ensemble	74.31	71.66	76.96	71.66	73.61	48.69	74.31	
RF-ensemble	74.31	71.89	76.73	71.89	73.67	48.67	74.31	
SVM-ensemble	73.5	70.74	76.27	70.74	72.75	47.08	73.5	
RF-ensemble (based on LDA and LR)	75.23	70.74	79.72	70.74	74.07	50.67	75.23	

Table S6: Performance values in terms of diverse evaluation measures across stage 1, 2 and 3 over OVCAR8 dataset.

3000	Stage 1 and 2 (OVCAR8)							
Type	Accuracy	Sensitivity	Specificity	Recall	F1	MCC	AUC-ROC	
SCPSDNC	89.241	84.81	93.671	84.81	88.742	78.791	89.241	
CKSNAP	91.139	91.139	92.405	91.139	91.72	83.551	91.139	SVM
CKSNAP+SCPSDNC	91.139	89.873	92.405	89.873	91.026	82.305	91.139	
SCPSDNC	85.443	86.076	84.81	86.076	85.535	70.892	85.443	
CKSNAP	89.873	88.608	91.139	88.608	89.744	79.772	89.873	LDA
CKSNAP+SCPSDNC	87.975	87.342	88.608	87.342	87.898	75.955	87.975	
SCPSDNC	50	97.468	2.532	97.468	66.094	0	50	
CKSNAP	86.076	89.873	82.278	89.873	86.585	72.361	86.076	LR
CKSNAP+SCPSDNC	86.076	88.608	83.544	88.608	86.42	72.245	86.076	

SCPSDNC-RF	82.278	77.215	87.342	77.215	81.333	64.891	82.278	RF
CKSNAP-RF	84.177	88.608	79.747	88.608	84.848	68.624	84.177	
CKSNAP+SCPSDNC-RF	89.873	91.139	88.608	91.139	90	79.772	89.873	
Stage 3 (OVCAR8)								
Type	Accuracy	Sensitivity	Specificity	Recall	F1	MCC	AUC-ROC	
LR-ensemble	89.87	89.87	89.87	89.87	89.87	79.75	89.87	
RF-ensemble	91.77	91.14	92.41	91.14	91.72	83.55	91.77	
SVM-ensemble	88.61	87.34	89.87	87.34	88.46	77.24	88.61	
RF-ensemble (based on LR and SVM)	93.04	94.94	91.14	94.94	93.17	86.14	93.04	

Table S7: Performance values in terms of diverse evaluation measures across stage 1, 2 and 3 over Placenta dataset.

3000	Stage 1 and 2 (Placenta)							
Type	Accuracy	Sensitivity	Specificity	Recall	F1	MCC	AUC-ROC	
SCPSDNC	63.025	61.345	64.706	61.345	62.393	26.065	63.025	
CKSNAP	76.891	75.63	78.151	75.63	76.596	53.799	76.891	SVM
CKSNAP+SCPSDNC	76.471	73.109	79.832	73.109	75.652	53.061	76.471	
SCPSDNC	62.605	62.185	63.025	62.185	62.447	25.211	62.605	
CKSNAP	71.008	73.95	68.067	73.95	71.837	42.09	71.008	LDA
CKSNAP+SCPSDNC	72.269	73.95	70.588	73.95	72.727	44.563	72.269	
SCPSDNC	55.882	89.076	22.689	89.076	66.877	15.731	55.882	
CKSNAP	63.866	61.345	66.387	61.345	62.931	27.766	63.866	LR
CKSNAP+SCPSDNC	63.445	62.185	64.706	62.185	62.979	26.899	63.445	
SCPSDNC-RF	60.504	62.185	58.824	62.185	61.157	21.02	60.504	RF
CKSNAP-RF	55.882	52.101	59.664	52.101	54.148	11.798	55.882	
CKSNAP+SCPSDNC-RF	64.286	63.866	64.706	63.866	64.135	28.572	64.286	

	Stage 3 (Placenta)							
Type	Accuracy	Sensitivity	Specificity	Recall	F1	MCC	AUC-ROC	
LR-ensemble	74.79	75.63	73.95	75.63	75	49.59	74.79	
RF-ensemble	76.47	78.15	74.79	78.15	76.86	52.97	76.47	
SVM-ensemble	78.15	80.67	75.63	80.67	78.69	56.37	78.15	
LR-ensemble-(based on LDA and SVM)	78.15	78.99	77.31	78.99	78.33	56.31	78.15	

Table S8: Performance values in terms of diverse evaluation measures across stage 1, 2 and 3 over Urine dataset.

2000	Stage 1 and 2 (Urine)							
Type	Accuracy	Sensitivity	Specificity	Recall	F1	MCC	AUC-ROC	
SCPSDNC	71.311	67.76	74.863	67.76	70.255	42.731	71.311	
CKSNAP	75.683	75.41	75.956	75.41	75.616	51.367	75.683	SVM
CKSNAP+SCPSDNC	77.322	75.41	79.235	75.41	76.88	54.685	77.322	
SCPSDNC	72.131	78.142	66.12	78.142	73.711	44.586	72.131	
CKSNAP	71.585	69.945	73.224	69.945	71.111	43.193	71.585	LDA
CKSNAP+SCPSDNC	73.224	72.678	73.77	72.678	73.077	46.451	73.224	
SCPSDNC	54.918	53.552	56.284	53.552	54.294	9.84	54.918	
CKSNAP	58.47	55.738	61.202	55.738	57.303	16.965	58.47	LR
CKSNAP+SCPSDNC	58.197	55.738	60.656	55.738	57.143	16.413	58.197	
SCPSDNC	63.934	61.202	66.667	61.202	62.921	27.911	63.934	
CKSNAP	61.202	55.191	67.213	55.191	58.721	22.568	61.202	RF
CKSNAP+SCPSDNC	68.579	63.934	73.224	63.934	67.049	37.32	68.579	
	Stage 3 (Urine)							
Type	Accuracy	Sensitivity	Specificity	Recall	F1	MCC	AUC-ROC	
LR-ensemble	76.78	78.14	75.41	78.14	77.09	53.57	76.78	

RF-ensemble	76.78	75.41	78.14	75.41	76.45	53.57	76.78	
SVM-ensemble	77.41	75.96	78.7	75.96	77.01	54.68	77.41	
RF-ensemble (based on LDA and SVM)	77.4	75.96	78.71	75.96	77.1	54.67	77.4	

Table S9: Performance values in terms of diverse evaluation measures across stage 1, 2 and 3 over AT dataset.

2000	Stage 1 and 2 (AT)							
Type	Accuracy	Sensitivity	Specificity	Recall	F1	MCC	AUC-ROC	
SCPSDNC	66	60	72	60	63.83	32.233	66	
CKSNAP	81	80	82	80	80.808	62.012	81	SVM
CKSNAP+SCPSDNC	79	76	82	76	78.351	58.105	79	
SCPSDNC	66	68	64	68	66.667	32.026	66	
CKSNAP	61	60	62	60	60.606	22.004	61	LDA
CKSNAP+SCPSDNC	69	68	70	68	68.687	38.008	69	
SCPSDNC	50	100	0	100	66.667	0	50	
CKSNAP	52	94	10	94	66.197	7.372	52	LR
CKSNAP+SCPSDNC	51	90	12	90	64.748	3.196	51	
SCPSDNC-RF	58	64	52	64	60.377	16.116	58	
CKSNAP-RF	57	64	50	64	59.813	14.139	57	RF
CKSNAP+SCPSDNC-RF	62	72	52	72	65.455	24.495	62	
Stage 3 (AT)								
Type	Accuracy	Sensitivity	Specificity	Recall	F1	MCC	AUC-ROC	
LR-ensemble	70	68	72	68	69.39	40.03	70	
RF-ensemble	73	80	66	80	74.77	46.46	73	
SVM-ensemble	72	74	70	74	72.55	44.04	72	
LR-ensemble (based on SVM and LR)	81	80	82	80	80.81	62.01	81	

5000	Stage 1 and 2 (Sperm)							
Type	Accuracy	Sensitivity	Specificity	Recall	F1	MCC	AUC-ROC	
SCPSEDNC	87.925	85.998	89.851	85.998	87.687	75.906	87.925	
CKSNAP	93.931	92.958	94.905	92.958	93.872	87.879	93.931	SVM
CKSNAP+SCPSEDNC	93.911	93.165	94.656	93.165	93.865	87.831	93.911	
SCPSEDNC	84.093	86.164	82.022	86.164	84.416	68.244	84.093	
CKSNAP	91.218	91.425	91.011	91.425	91.236	82.436	91.218	LDA
CKSNAP+SCPSEDNC	92.709	92.336	93.082	92.336	92.682	85.421	92.709	
SCPSEDNC	70.568	67.606	73.529	67.606	69.669	41.207	70.568	
CKSNAP	85.439	83.471	87.407	83.471	85.147	70.933	85.439	LR
CKSNAP+SCPSEDNC	85.128	83.513	86.744	83.513	84.884	70.294	85.128	
SCPSEDNC-RF	85.232	84.176	86.288	84.176	85.074	70.48	85.232	
CKSNAP-RF	87.697	83.886	91.508	83.886	87.209	75.614	87.697	RF
CKSNAP+SCPSEDNC-RF	88.401	84.424	92.378	84.424	87.921	77.046	88.401	
	Stage 3 (Sperm)							
Type	Accuracy	Sensitivity	Specificity	Recall	F1	MCC	AUC-ROC	
LR-ensemble	93.9	93.54	94.24	93.54	93.87	87.78	93.9	
RF-ensemble	93.83	93.37	94.28	93.37	93.8	87.66	93.83	
SVM-ensemble	93.77	93.5	94.03	93.5	93.75	87.53	93.77	

3000	Stage 1 and 2 (Yeast)
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Type	Accuracy	Sensitivity	Specificity	Recall	F1	MCC	AUC-ROC	
SCPSDNC	77.374	72.067	82.682	72.067	76.106	55.06	77.374	
CKSNAP	90.503	90.503	90.503	90.503	90.503	81.006	90.503	SVM
CKSNAP+SCPSDNC	90.503	89.385	91.62	89.385	90.395	81.026	90.503	
SCPSDNC	75.419	70.391	80.447	70.391	74.118	51.097	75.419	
CKSNAP	87.43	84.358	90.503	84.358	87.032	75.002	87.43	LDA
CKSNAP+SCPSDNC	85.754	82.682	88.827	82.682	85.303	71.644	85.754	
SCPSDNC	52.514	99.441	5.587	99.441	67.681	14.567	52.514	
CKSNAP	81.006	81.564	80.447	81.564	81.111	62.015	81.006	LR
CKSNAP+SCPSDNC	81.564	80.447	82.682	80.447	81.356	63.144	81.564	
SCPSDNC-RF	75.698	73.184	78.212	73.184	75.072	51.462	75.698	
CKSNAP-RF	85.754	82.682	88.827	82.682	85.303	71.644	85.754	RF
CKSNAP+SCPSDNC-RF	83.799	80.447	87.151	80.447	83.237	67.75	83.799	
	Stage 3 (Yeast)							
Type	Accuracy	Sensitivity	Specificity	Recall	F1	MCC	AUC-ROC	
LR ensemble	89.94	88.27	91.62	88.27	89.77	79.93	89.94	
RF ensemble	89.66	89.39	89.94	89.39	89.64	79.33	89.66	
SVM ensemble	89.66	88.27	91.06	88.27	89.52	79.36	89.66	
SVM ensemble (based on LDA and SVM)	90.22	89.39	91.06	89.39	90.14	80.46	90.22	