

ORIGINAL ARTICLE

Task-related handwriting and drawing features for early detection of Alzheimer’s disease: A pilot study

Supplementary File

Table S1. Univariate results for all graphomotor features and tasks

Category	Task	Feature	F (df)	p-value	$\eta^2 p$	AD mean±SD	HC mean±SD
Ductus	1	N _{up}	1.244 (1.34)	0.273	0.035	12.370±1.455	10.193±1.021
		N _{down}	1.058 (1.34)	0.311	0.030	13.182±1.452	11.178±1.019
		N _{idle}	12.091 (1.34)	0.001	0.262	14.890±2.201	4.622±1.545
	2	N _{up}	0.393 (1.35)	0.535	0.011	25.832±2.973	23.334±2.087
		N _{down}	0.226 (1.35)	0.638	0.006	26.203±3.009	24.286±2.112
		N _{idle}	11.627 (1.35)	0.002	0.249	16.241±2.348	5.505±1.648
	3	N _{up}	0.177 (1.35)	0.677	0.005	70.705±3.582	68.685±2.515
		N _{down}	0.032 (1.35)	0.858	0.001	70.403±3.597	69.535±2.525
		N _{idle}	2.331 (1.35)	0.136	0.062	43.801±16.748	9.511±11.756
	4	N _{up}	0.829 (1.35)	0.369	0.023	3.519±1.121	2.149±0.787
		N _{down}	0.762 (1.35)	0.389	0.021	4.387±1.097	3.103±0.770
		N _{idle}	3.372 (1.35)	0.075	0.088	2.549±0.786	0.613±0.552
	5	N _{up}	11.495 (1.35)	0.002	0.247	3.074±0.545	0.598±0.382
		N _{down}	11.495 (1.35)	0.002	0.247	4.074±0.545	1.598±0.382
		N _{idle}	7.181 (1.35)	0.011	0.170	1.925±0.480	0.202±0.337
	6	N _{up}	0.230 (1.35)	0.634	0.007	22.189±3.957	24.734±2.778
		N _{down}	0.235 (1.35)	0.631	0.007	22.883±4.030	25.505±2.829
		N _{idle}	7.597 (1.35)	0.009	0.178	16.350±2.615	6.684±1.836
	7	N _{up}	4.237 (1.35)	0.047	0.108	63.050±6.100	46.212±4.282
		N _{down}	3.957 (1.35)	0.050	0.102	63.629±6.186	47.128±4.342
		N _{idle}	5.430 (1.35)	0.026	0.134	17.090±2.963	7.830±2.080
Time	1	T _{up}	6.880 (1.35)	0.013	0.164	21,820.942±3,106.290	10,894.513±2,180.492
		T _{down}	5.503 (1.35)	0.025	0.136	17,132.331±2,126.358	10,443.255±1,492.619
		T _{idle}	6.527 (1.35)	0.015	0.157	19,021.266±4,492.789	3,628.291±3,153.760
		Total	13.832 (1.35)	0.001	0.283	57,976.077±6,618.315	24,966.757±4,645.794
	2	T _{up}	15.714 (1.35)	0.000	0.310	36,364.274±3,690.602	16,744.447± 2,590.656
		T _{down}	7.112 (1.35)	0.012	0.169	24,180.190±2,769.910	14,273.774±1,944.367
		T _{idle}	11.534 (1.35)	0.002	0.248	12,366.581±2,192.672	2,380.035±1,539.168
		Total	20.558 (1.35)	0.000	0.370	72,917.563±6,499.348	33,398.245±4,562.284
	3	T _{up}	17.302 (1.35)	0.000	0.331	78,945.333±8,599.585	30,975.333±6,036.568
		T _{down}	12.929 (1.35)	0.001	0.270	37,686.454±3,296.460	21,791.026±2,313.984
		T _{idle}	5.849 (1.35)	0.021	0.143	32,822.920±6,340.780	12,257.445±4,450.976
		Total	16.966 (1.35)	0.000	0.326	149,465.100±15,286.424	65,025.264±10,730.463

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Table S1. (Continued)

Category	Task	Feature	F (df)	p-value	$\eta^2 p$	AD mean±SD	HC mean±SD	
Pressure	4	T _{up}	3.384 (1.35)	0.074	0.088	3,538.561±950.305	1,194.206±667.077	
		T _{down}	2.798 (1.35)	0.103	0.074	8,674.121±1,536.095	5,228.092±1,078.278	
		T _{idle}	1.837 (1.35)	0.184	0.050	891.990±282.022	379.406±197.968	
		Total	4.080 (1.35)	0.051	0.104	13,106.610±2,327.651	6,801.659±1,633.919	
	5	T _{up}	13.549 (1.35)	0.001	0.279	3,226.461±596.140	283.742±418.467	
		T _{down}	3.086 (1.35)	0.088	0.081	7,084.935±1,143.181	4,391.676±802.468	
		T _{idle}	4.909 (1.35)	0.033	0.123	888.350±259.278	117.964±182.003	
		Total	10.893 (1.35)	0.002	0.237	11,199.746±1,447.436	4,793.382±1,016.043	
	6	T _{up}	0.950 (1.35)	0.337	0.026	33,093.272±6,957.697	24,001.168±4,884.027	
		T _{down}	1.432 (1.35)	0.240	0.039	18,877.471±3,062.481	13,963.256±2,149.740	
		T _{idle}	7.756 (1.35)	0.009	0.181	18,528.158±3,799.641	4,337.071±2,667.197	
		Total	3.193 (1.35)	0.083	0.084	70,505.331±11,769.931	42,302.054±8,262.025	
	7	T _{up}	11.746 (1.35)	0.002	0.251	42,545.297±5,243.194	18,446.794±3,680.514	
		T _{down}	3.858 (1.35)	0.057	0.099	25,582±2,339.599	19,419.406±1,642.306	
		T _{idle}	6.197 (1.35)	0.018	0.150	13,352.760±2,628.629	4,577.254±1,845.194	
		Total	12.131 (1.35)	0.001	0.257	81,485.894±8,358.319	42,445.139±5,867.208	
	1	P _{min}	P _{min}	0.442 (1.35)	0.510	0.012	37.687±20.128	19.735±14.129
			P _{max}	0.181 (1.35)	0.673	0.005	17,988.3375±1,594.000	18,896.990±1,118.924
			P _{avg}	1.509 (1.35)	0.228	0.041	10,453.519±1,197.323	12,425.718±840.473
			P _{sd}	0.048 (1.35)	0.827	0.001	3,935.569±404.331	4,054.978±283.824
			P ₁₀	0.955 (1.35)	0.335	0.027	5,185.352±995.152	6,489.763±698.557
			P ₉₀	0.733 (1.35)	0.398	0.021	15,057.642±1,540.476	16,825.920±1,081.353
		2	P _{min}	0.094 (1.35)	0.761	0.003	1.582±0.752	1.274±0.528
			P _{max}	1.148 (1.35)	0.291	0.032	16,481.637±1,558.519	18,720.883±1,094.019
			P _{avg}	0.864 (1.35)	0.359	0.024	9,364.617±1,071.212	10,699.664±751.948
			P _{sd}	1.254 (1.35)	0.270	0.035	3,550.394±341.908	4,063.923±240.006
			P ₁₀	0.389 (1.35)	0.537	0.011	4,129.886±683.855	4,702.144±480.039
			P ₉₀	1.256 (1.35)	0.270	0.035	13,429.691±1,429.788	15,578.333±1,003.655
3	P _{min}	0.094 (1.35)	0.761	0.003	2.204±1.554	1.566±1.091		
	P _{max}	0.076 (1.35)	0.785	0.002	17,255.840±1,765.392	17,906.849±1,239.235		
	P _{avg}	1.581 (1.35)	0.217	0.043	8,389.719±1,192.395	10,400.189±837.014		
	P _{sd}	1.106 (1.35)	0.300	0.031	3,168.085±338.008	3,644.721±237.268		
	P ₁₀	1.101 (1.35)	0.301	0.030	3,849.841±805.209	4,982.649±565.225		
	P ₉₀	1.281 (1.35)	0.265	0.035	12,076.039±1,521.639	14,385.418±1,068.131		
4	P _{min}	0.068 (1.35)	0.796	0.002	178.769±115.048	218.969±80.759		
	P _{max}	0.003 (1.35)	0.956	0.000	12,884.674±1,713.047	12,757.183±1,202.491		
	P _{avg}	0.061 (1.35)	0.807	0.002	8,673.995±1,430.306	8,201.138±1,004.018		
	P _{sd}	0.790 (1.35)	0.380	0.022	2,887.351±328.606	2,495.665±230.668		
	P ₁₀	0.097 (1.35)	0.757	0.003	4,537.094±1,234.272	5,052.547±866.410		
	P ₉₀	0.047 (1.35)	0.829	0.001	11,724.118±1,641.775	11,245.934±1,152.461		
5	P _{min}	2.466 (1.35)	0.125	0.066	270.846±211.023	715.286±148.130		
	P _{max}	0.383 (1.35)	0.540	0.011	16,760.131±1,777.750	18,236.327±1,247.910		
	P _{avg}	2.056 (1.35)	0.160	0.055	11,970.849±1,234.980	14,345.520±866.907		

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Table S1. (Continued)

Category	Task	Feature	F (df)	p-value	$\eta^2 p$	AD mean±SD	HC mean±SD	
Space and inclination	6	P _{sd}	1.059 (1.35)	0.310	0.029	3,354.418±438.424	2,749.320±307.756	
		P ₁₀	5.580 (1.35)	0.024	0.137	7,454.910±1,164.010	11,142.171±817.089	
		P ₉₀	0.360 (1.35)	0.552	0.010	15,617.762±1,645.502	16,942.573±1,155.077	
		P _{min}	0.813 (1.35)	0.373	0.023	110.193±64.379	32.332±45.192	
		P _{max}	0.313 (1.35)	0.579	0.009	18,379.619±1,602.413	19,582.093±1,124.831	
		P _{avg}	0.192 (1.35)	0.664	0.005	10,777.162±1,353.107	11,572.172±949.828	
	7	P _{sd}	0.848 (1.35)	0.363	0.024	3,833.069±315.941	4,223.231±221.778	
		P ₁₀	0.003 (1.35)	0.953	0.000	5,657.306±1,111.365	5,745.308±780.134	
		P ₉₀	0.639 (1.35)	0.429	0.018	15,247.577±1,613.702	16,977.557±1,132.755	
		P _{min}	0.139 (1.35)	0.712	0.004	107.987±125.371	45.327±88.005	
		P _{max}	0.127 (1.35)	0.724	0.004	19,180.214±1,572.147	19,930.960±1,103.585	
		P _{avg}	1.712 (1.35)	0.199	0.047	9,064.645±1,125.069	11,039.009±789.753	
	1	P _{sd}	0.339	0.564	0.010	3,318.636±261.918	3,523.097±183.856	
		P ₁₀	2.320 (1.35)	0.137	0.062	4,345.353±888.803	6,161.043±623.904	
		P ₉₀	1.347 (1.35)	0.254	0.037	12,789.104±1,336.608	14,869.822±938.246	
		S _{bb}	0.122 (1.35)	0.729	0.003	84,986.548±11,992.343	79,365.453±8,418.149	
		S _{avg}	0.001 (1.35)	0.970	0.000	2,632.880±321.143	2,971.067±225.430	
		S _{tot}	0.617 (1.35)	0.438	0.017	3,2376.343±4,396.068	32,599.888±3,085.866	
		L _{avg}	0.769 (1.35)	0.387	0.021	1.900±0.371	2.337±0.261	
		2	S _{bb}	1.702 (1.35)	0.201	0.046	69,974.497±10,664.445	51,317.242±7,486.018
			S _{avg}	0.495 (1.35)	0.486	0.014	1,956.212±177.011	2,123.241±124.254
			S _{tot}	0.009 (1.35)	0.927	0.000	49,238.664±5,092.694	49,868.708±3,574.870
			L _{avg}	0.363 (1.35)	0.551	0.010	4.791±0.835	5.465±0.586
		3	S _{bb}	2.057 (1.35)	0.160	0.056	272,396.793±55,286.231	378,740.076±38,808.742
	S _{avg}		0.661 (1.35)	0.422	0.019	1,536.644±105.809	1,652.000±74.274	
	S _{tot}		1.807 (1.35)	0.187	0.049	102,020.399±7,233.239	115,061.416±5,077.447	
	L _{avg}		0.056 (1.35)	0.814	0.002	3.600±0.536	3.429±0.376	
	4	S _{bb}	0.184 (1.35)	0.671	0.005	52,569.246±13,718.872	44,682.742±9,630.104	
		S _{avg}	5.758 (1.35)	0.022	0.141	2,153.640±524.643	465.321±368.278	
		S _{tot}	2.282 (1.35)	0.140	0.061	9,067.290±2,739.806	3,516.757±1,923.235	
		L _{avg}	0.027 (1.35)	0.870	0.001	1.162±0.085	1.144±0.060	
	5	S _{bb}	1.929 (1.35)	0.185	0.050	40,288.095±8,117.775	25,565.667±5,698.356	
		S _{avg}	8.582 (1.35)	0.006	0.197	1,580.109±403.003	293.579±282.892	
		S _{tot}	5.667 (1.35)	0.023	0.139	6,166.007±1,364.752	804.356±958.002	
		L _{avg}	0.003 (1.35)	0.956	0.000	1.156±0.074	1.150±0.052	
	6	S _{bb}	1.463 (1.35)	0.235	0.040	109,974.249±24,621.114	70,032.101±17,283.046	
		S _{avg}	0.020 (1.35)	0.888	0.001	1,574.079±267.118	1,523.236±187.506	
		S _{tot}	0.008 (1.35)	0.929	0.000	38,658.196±8,506.436	39,683.930±5,971.181	
		L _{avg}	0.288 (1.35)	0.595	0.008	2.064±0.254	2.247±0.178	
	7	S _{bb}	0.104 (1.35)	0.749	0.003	200,678.024±35,159.925	215,853.667±24,680.873	
		S _{avg}	3.256 (1.35)	0.080	0.085	903.180±142.348	1,247.659±99.923	
		S _{tot}	0.065 (1.35)	0.800	0.002	62,680.369±9,533.750	59,424.753±6,692.315	
L _{avg}		0.613	0.439	0.017	2.495±0.464	2.008±0.326		

Notes: Task 1: Pentagon; Task 2: House; Task 3: Word; Tasks 4 and 5: Circles; Task 6: Clock; Task 7: Sentence. Refer to Table 2 for a description of the features. Abbreviations: AD: Alzheimer's disease; df: Degree of freedom; HC: Healthy control; SD: Standard deviation.