Dataset with electrical impedance measurements in samples of freshly excised tissue from the

106 instances
10 attributes: 9 features+1class attribute

Six classes of freshly excised tissue were studied using electrical impedance measurements:

		# of cases
Car	Carcinoma	21
Fad	Fibro-adenoma	15
Mas	Mastopathy	18
Gla	Glandular	16
Con	Connective	14
Adi	Adipose	22
		106

Impedance measurements were made at the frequencies: 15.625, 31.25, 62.5, 125, 250, 500, 1000 K
These measurements plotted in the (real, -imaginary) plane constitute
the impedance spectrum from where the features below are computed.

9 features:

I0	Impedivity (ohm) at zero frequency
PA500	phase angle at 500 KHz
HFS	high-frequency slope of phase angle
DA	impedance distance between spectral ends
AREA	area under spectrum
A/DA	area normalized by DA
MAX IP	maximum of the spectrum
DR	distance between I0 and real part of the maximum frequency point
P	length of the spectral curve

References: J. Jossinet (1996) Variability of impedivity in normal and pathological breast tissue. Med. &
JE Silva, JP Marques de Sá, J Jossinet (2000) Classification of Breast Tissue by Electrical

breast

Hz

Biol. Eng. & Comput, 34: 346-350.
Impedance Spectroscopy. Med & Bio Eng & Computing, 38:26-30.

Case #	Class	I0	PA500	HFS	DA	Area	A/DA	Max IP	DR
1	car	524,79407	0,1874484	0,0321141	228,80023	6843,5985	29,910803	60,20488	220,73721
2	car	330	0,2268928	0,26529	121,1542	3163,2395	26,109202	69,717361	99,084964
3	car	551,87929	0,2324779	0,06353	264,80494	11888,392	44,894903	77,793297	253,7853
4	car	380	0,2408554	0,286234	137,64011	5402,1712	39,248524	88,758446	105,19857
5	car	362,83127	0,2007129	0,2443461	124,91256	3290,4624	26,342127	69,389389	103,86655
6	car	389,87298	0,1500983	0,0977384	118,62581	2475,5571	20,86862	49,757149	107,68616
7	car	290,45514	0,1441642	0,053058	74,635067	1189,5452	15,938154	35,703331	65,541324
8	car	275,67739	0,153938	0,1877974	91,527893	1756,2348	19,187974	39,305183	82,658682
9	car	470	0,2131047	0,2254965	184,59006	8185,3608	44,343455	84,482483	164,12251
10	car	423	0,2195624	0,2617994	172,37124	6108,1063	35,435762	79,056351	153,1729
11	car	410	0,3178245	0,2974041	255,81518	10622,547	41,524303	67,523209	246,74283
12	car	500	0,2272419	0,0509636	219,2955	9819,4496	44,77725	76,8685	207,26664
13	car	438,78016	0,2124066	0,0607375	120,9016	4879,4956	40,359232	80,791779	89,943786
14	car	366,94238	0,2801253	0,2520255	172,74555	7064,8159	40,897237	75,604324	155,32228
15	car	485,66881	0,2302089	0,1340413	253,8937	8135,9684	32,044783	64,855446	245,47053
16	car	390	0,3583161	0,2038545	245,6861	10055,837	40,929612	70,324783	236,49017
17	car	269,49595	0,2075196	0,0383972	80,411085	1963,6052	24,419584	44,740154	66,838309
18	car	300	0,1900664	0,1668535	97,10813	3039,5613	31,300791	51,353973	82,418192
19	car	325	0,2246239	0,2869321	229,21586	5705,3321	24,890651	35,602715	227,26479
20	car	294,47485	0,206647	0,4677482	194,87104	5541,2561	28,435504	36,765797	191,80489
21	car	500	0,1926843	0,1947787	144,68858	3055,013	21,114403	96,56337	107,7511
22	fad	211	0,0539307	0,0942478	30,753443	151,98458	4,9420345	14,268374	27,243124
23	fad	196,85671	0,0200713	0,0907571	28,593126	82,058889	2,8698817	7,9687834	27,661516
24	fad	245	0,1890192	0,0816814	62,902955	1235,9834	19,649051	42,152016	46,690355
25	fad	352,65645	0,1219985	0,0907571	68,527846	1066,1578	15,558024	43,691925	52,792817
26	fad	243,29398	0,039968	0,0670206	68,544778	383,92845	5,6011335	9,9913483	67,816656
27	fad	259,88515	0,0706858	0,0069813	58,243807	465,08727	7,9851797	17,506838	56,340241
28	fad	250	0,0680678	-0,0153589	57,172431	652,90135	11,419863	17,776981	55,79127
29	fad	200	0,0376991	0,1172861	42,316675	220,81091	5,218059	10,675764	40,947882
30	fad	355	0,0640536	0,0844739	89,558463	1033,8542	11,543903	27,562662	86,576561
31	fad	272	0,0914553	0,0048869	63,78938	718,94631	11,270627	20,085556	60,690729
32	fad	341,62001	0,0919789	0,074002	85,043029	1370,8381	16,119347	29,028969	79,935197
33	fad	160,32245	0,1769764	0,1633628	37,217124	341,88146	9,1861333	30,889164	20,75991
34	fad	301,3044	0,1097812	0,0356047	64,6162	942,77319	14,590353	29,045677	57,72003
35	fad	155	0,1727876	0,1186824	38,940168	415,1116	10,660242	25,836502	29,134376
36	fad	144	0,1206023	0,0460767	19,64767	70,426239	3,5844576	18,131014	7,5694931
37	mas	178	0,1708677	0,2129302	41,542167	489,44052	11,781776	35,747795	21,162393
38	mas	195	0,1391027	0,2052507	37,462196	328,38405	8,7657449	35,023827	13,29465
39	mas	435,09317	0,076969	0,1612684	123,59754	1342,2776	10,860068	37,384724	117,80804
40	mas	250	0,0471239	0,0139626	70,90704	224,14579	3,1611218	9,1021757	70,3204
41	mas	339,50855	0,0453786	0,0300197	88,629809	331,08039	3,7355422	19,825581	87,62118
42	mas	236	0,1246165	0,2017601	48,45113	236,88011	4,8890524	36,006622	32,41967
43	mas	481,46715	0,0785398	0,016057	79,059162	1154,3382	14,600942	33,929131	71,408439
44	mas	252	0,106116	0,0314159	38,54421	493,79042	12,811014	25,541145	28,86704
45	mas	172,5158	0,1272345	0,0383972	37,543673	192,21815	5,1198546	19,322081	32,189821
46	mas	121	0,1741839	0,0907571	24,43718	144,46651	5,9117505	22,02108	10,594708
47	mas	196,36486	0,1829105	0,1424189	54,58308	843,26253	15,449156	34,149414	42,580865
48	mas	370,39572	0,1047198	0	115,92325	1308,1204	11,284366	31,367031	112,7151
49	mas	260,27752	0,0790634	0,0328122	58,817611	277,25903	4,7138778	17,86867	56,037684
50	mas	544,65435	0,0637045	0,0020944	100,78808	1189,2902	11,79991	29,412222	96,58015
51	mas	310	0,1747075	0,1654572	98,509961	2741,032	27,824923	49,327862	85,27001
52	mas	274,9934	0,1471313	0,1375319	66,457943	1217,4157	18,318588	40,849678	52,421008
53	mas	281,32326	0,2323033	0,4377286	157,88418	5305,1232	33,60136	46,384335	150,91689

54	mas	327	0,1410226	0,0844739	76,212868	1664,6741	21,842428	43,221691	62,771703
55	gla	470,51642	0,127409	0,0663225	150,22402	2657,9104	17,692978	47,560631	142,49647
56	gla	223	0,1240929	0,079587	33,096335	197,01254	5,9526996	30,454874	12,95639
57	gla	152	0,1658063	0,2275909	34,21955	94,354328	2,7573223	31,279278	13,877478
58	gla	303	0,0633555	0,0397935	22,567893	102,50031	4,5418644	21,830841	5,7205006
59	gla	250	0,0870919	0,0928515	29,63751	180,76124	6,0990698	26,142097	13,963263
60	gla	197	0,132645	0,074002	33,460653	409,64714	12,242652	26,992807	19,773813
61	gla	197	0,132645	0,074002	33,460653	409,64714	12,242652	26,992807	19,773813
62	gla	216,41326	0,1178097	0,0684169	53,5996	280,44549	5,232231	22,790535	48,512974
63	gla	178	0,1495747	0,0991347	40,290621	474,4047	11,774569	25,920828	30,845499
64	gla	185	0,1497492	0,0851721	39,891409	361,74798	9,0683179	26,860762	29,49278
65	gla	391	0,0581195	0,0111701	35,780061	265,14979	7,410546	22,131472	28,114244
66	gla	502	0,0652753	0,0279253	53,239433	834,27273	15,670203	33,331142	41,514722
67	gla	176	0,0898845	0,0767945	20,588524	79,705425	3,871352	18,226492	9,5750879
68	gla	145	0,1176352	0,1103048	21,218942	82,455562	3,8859412	20,303082	6,1667152
69	gla	124,12873	0,1319469	0,1089085	20,592633	78,342794	3,8044088	18,462399	9,1212056
70	gla	103	0,1581268	0,2918191	23,754811	78,258474	3,2944262	22,323603	8,120826
71	con	1724,0899	0,0527089	-0,020944	404,12621	3053,9669	7,5569632	71,427589	399,19424
72	con	1385,6647	0,0923279	0,0893609	202,48004	8785,0287	43,387134	143,09219	143,25778
73	con	1084,247	0,0734784	0	191,89795	2937,9715	15,310072	66,563629	179,98363
74	con	649,3694	0,1075123	0,0188496	207,11169	3344,4327	16,147967	50,54747	200,84871
75	con	1500	0,0565487	0,0502655	375,0966	4759,4545	12,68861	78,445976	366,80198
76	con	770	0,0416283	0,0024346	175,01968	346,09131	1,9774422	25,22233	173,19274
77	con	650	0,0410152	0,1452114	216,81133	427,53407	1,9719176	33,765163	214,16598
78	con	691,97203	0,0260054	0,0865683	190,67669	304,27072	1,5957415	23,975718	189,16333
79	con	1461,7503	0,0408407	0,0495674	391,84602	5574,0028	14,224982	57,23148	387,64399
80	con	1496,7361	0,1038471	0,0823795	640,27595	11071,998	17,29254	108,28692	631,05248
81	con	1111,8141	0,0987856	0,0712094	386,98709	7659,7421	19,793275	86,025124	377,3045
82	con	1270,6667	0,0788889	0,0656244	555,35232	3612,9683	6,505723	68,78167	551,07647
83	con	1647,9398	0,0809833	0,0865683	576,77038	11852,485	20,549747	111,43591	565,90291
84	con	1535,8507	0,0884882	0,0041888	637,34967	10814,05	16,967217	96,610397	632,16512
85	adi	2100	0,0619592	-0,0453786	390,48251	16640,724	42,615798	125,90041	380,6447
86	adi	1800	0,0342085	0,042586	301,06035	4406,1543	14,635452	67,625328	293,36692
87	adi	2100	0,1216494	0,3776893	450,55167	35671,606	79,173176	436,09964	113,19857
88	adi	1666,1488	0,0123918	0,0584515	72,93105	1402,2317	19,226813	51,854767	58,595763
89	adi	1700	0,0439823	0,1051268	120,65301	12331,103	102,20303	120,29732	-9,2576965
90	adi	1949,1182	0,0517983	0,0165007	170,33149	3212,0771	18,857799	101,45585	136,81933
91	adi	1850	0,0791492	0,0694702	253,62146	13113,203	51,70384	160,06546	196,7305
92	adi	2350	0,0815069	0,2715732	515,28948	27758,64	53,869992	289,56906	426,23116
93	adi	1800	0,0919789	0,2052507	362,86332	15021,554	41,397278	217,83397	290,20364
94	adi	1900	0,0544543	0,1137955	272,61803	7481,5935	27,443502	138,35927	234,8985
95	adi	1800	0,069115	0,1570796	385,5647	13831,725	35,87394	157,57001	351,89748
96	adi	1850	0,0733038	0,2254965	325,19154	8644,9842	26,584284	208,73997	249,35349
97	adi	1650	0,0476475	0,0432842	274,42618	5824,8952	21,225727	81,239571	262,12566
98	adi	2800	0,0830777	0,1843068	583,25926	31388,653	53,815953	298,58298	501,03849
99	adi	2329,8401	0,066148	0,3532546	377,25337	25369,04	67,246689	336,07516	171,38723
100	adi	2400	0,0841249	0,2206096	596,04196	37939,256	63,651988	261,34818	535,68941
101	adi	2000	0,0671952	0,1242674	330,27165	15381,098	46,571051	169,19798	283,63956
102	adi	2000	0,1069887	0,1054179	520,22265	40087,921	77,059161	204,09035	478,51722
103	adi	2600	0,2005383	0,2080432	1063,4414	174480,48	164,07154	418,68729	977,55237
104	adi	1600	0,0719076	-0,0663225	436,9436	12655,342	28,963331	103,7327	432,12975
105	adi	2300	0,0450295	0,1368338	185,44604	5086,2925	27,427344	178,69174	49,59329
106	adi	2600	0,0699877	0,0488692	745,47437	39845,774	53,450226	154,1226	729,3684

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