به نام خدا
محمدمهدی صفرمحمدلو
95440296

من در قسمت ب هم نام مهدی و هم نام محمد مهدی رو تست کردم و با توجه به این
که فامیل من صفرمحمدلو است و محمد رو شامل میشود
مشاهده شد که DWT با استفاده از ویژگی ، مقادیر اون رنج نسبتن بزرگتری رو
شامل میشوند
الگوریتم HMM حساسیت بالاتری در قسمت ویژگی ها داشته

https://github.com/mahdisml/DTWHMM

A :
DWT :

[0	5.820266013437163	6.597825587623788	6.518071160211548	5.724020685027426	6.715865516723625	6.522297288465097	6.648182973144685	6.324045204768481	6.114447938900412	7.801669669656803]
[0	0	4.475514158856299	5.541601461626328	4.643540346882560	4.610646920506156	4.823412160179373	4.922460892202366	5.285715921293899	5.023844462734473	6.584779329925936
[0	0	0.000000000000000	4.482577597321892	3.671212674526373	4.371892297869522	5.268201236259188	5.819591672618230	4.581304741978101	3.809854548162889	7.053883051020648]
[0	0	0.000000000000000	0.000000000000000	4.314221757812447	4.356342451309047	4.871172086127672	3.999954064220673	5.757974223881319	4.729738690499289	6.032527408510759]
[0	0	0.000000000000000	0.000000000000000	0.000000000000000	4.292828963489683	4.961165728696642	5.313714972933212	5.229660142648754	5.903857037797934	6.004099977560145]
[0	0	0.000000000000000	0.000000000000000	0.000000000000000	0.000000000000000	4.854696263581218	4.985369758146589	5.046081878596396	3.759536374749132	6.018321592924167]
[0	0	0.000000000000000	0.000000000000000	0.000000000000000	0.000000000000000	0.000000000000000	6.780770137566605	6.102926428123510	4.465775722849912	6.366162207676325]
[0	0	0.000000000000000	0.000000000000000	0.000000000000000	0.000000000000000	0.000000000000000	0.000000000000000	6.489275487418581	4.430942543855508	5.61237773896346]
[0	0	0.000000000000000	0.000000000000000	0.000000000000000	0.000000000000000	0.000000000000000	0.000000000000000	0.000000000000000	4.940690658941094	5.341624540479643]
[0	0	0.000000000000000	0.000000000000000	0.000000000000000	0.000000000000000	0.000000000000000	0.000000000000000	0.000000000000000	0.000000000000000	6.49138360840243]
[0	0	0.000000000000000	0.000000000000000	0.000000000000000	0.000000000000000	0.000000000000000	0.000000000000000	0.000000000000000	0.000000000000000	0]

: DWT with properties

[0	275.4918256548699	393.26130771497265	427.22383949370123	378.172574484488	367.78819851600565	393.2763723877724	448.247993160272	365.88446074235253	360.15625326754525	373.7492563875858]
[0	0	411.8464854732156	381.64219218492508	388.86514180898666	372.19308726117015	381.09316104464233	432.26516514644027	332.78509403858334	320.87775838072412	447.1489828452468]
[0	0	0.0000000000000	154.60488306172192	101.83191944658756	146.49365060403943	199.38530086725950	206.08932169526815	463.76828019972891	458.32883692416362	212.9474380016327]
[0	0	0.0000000000000	0.00000000000000	114.72769160009921	164.00131257437170	150.05496153607965	195.94141204841435	431.18658426683396	428.54254065616988	205.0411797631532]
[0	0	0.0000000000000	0.00000000000000	0.00000000000000	114.20030667260289	142.12502165324986	196.56867813318968	401.56458582635969	425.42200139001943	177.6073815897107]
[0	0	0.0000000000000	0.00000000000000	0.00000000000000	0.00000000000000	112.31340407766402	164.82114470750093	375.07054760400206	400.04401032882743	234.82097028568387]
[0	0	0.0000000000000	0.00000000000000	0.00000000000000	0.00000000000000	0.00000000000000	193.77448040433228	390.54207886289805	408.52999082743190	231.0928332414478]
[0	0	0.0000000000000	0.00000000000000	0.00000000000000	0.00000000000000	0.00000000000000	0.00000000000000	451.07566717732698	474.13684356003068	239.801574613899]
[0	0	0.0000000000000	0.00000000000000	0.00000000000000	0.00000000000000	0.00000000000000	0.00000000000000	0.00000000000000	346.58732170681469	467.2465660730377]
[0	0	0.0000000000000	0.00000000000000	0.00000000000000	0.00000000000000	0.00000000000000	0.00000000000000	0.00000000000000	0.00000000000000	524.7776146472897]
[0	0	0.0000000000000	0.00000000000000	0.00000000000000	0.00000000000000	0.00000000000000	0.00000000000000	0.00000000000000	0.00000000000000	0]

: HMM

[0	57.9470198675498	63.67221070724449	57.9470198675498	35.45567038658115	57.9470198675498	57.9470198675498	74.01844843897854	52.76726584673597	57.9470198675498	88.0095876275191]
[0	0	5.725190839694694	0.000000000000000	22.491349480968648	0.000000000000000	0.000000000000000	16.071428571428736	110.71428571428577	0.000000000000000	145.95660749506888]
[0	0	0.000000000000000	5.725190839694694	28.216540320663341	5.725190839694694	5.725190839694694	10.346237731734043	116.43947655398046	5.725190839694694	151.68179833476358]
[0	0	0.000000000000000	0.000000000000000	22.491349480968648	0.000000000000000	0.000000000000000	16.071428571428736	110.71428571428577	0.000000000000000	145.95660749506888]
[0	0	0.000000000000000	0.000000000000000	0.000000000000000	22.491349480968648	22.491349480968648	38.562778052397384	88.22293623331711	22.491349480968648	123.46525801410024]
[0	0	0.000000000000000	0.000000000000000	0.000000000000000	0.000000000000000	0.000000000000000	16.071428571428736	110.71428571428577	0.000000000000000	145.95660749506888]
[0	0	0.000000000000000	0.000000000000000	0.000000000000000	0.000000000000000	0.000000000000000	16.071428571428736	110.71428571428577	0.000000000000000	145.95660749506888]
[0	0	0.000000000000000	0.000000000000000	0.000000000000000	0.000000000000000	0.000000000000000	0.000000000000000	126.78571428571450	16.071428571428736	162.02803606649763]
[0	0	0.000000000000000	0.000000000000000	0.000000000000000	0.000000000000000	0.000000000000000	0.000000000000000	0.00000000000000	110.714285714285765	35.24232178078313]
[0	0	0.000000000000000	0.000000000000000	0.000000000000000	0.000000000000000	0.000000000000000	0.000000000000000	0.000000000000000	0.000000000000000	145.95660749506888]
[0	0	0.000000000000000	0.000000000000000	0.000000000000000	0.000000000000000	0.000000000000000	0.000000000000000	0.000000000000000	0.000000000000000	0]

: HMM with properties

0	105.26315789473672	421.05263157894734	263.157894736842	315.7894736842104	105.26315789473695	0.0	157.89473684210532	192.98245614035082	52.63157894736836	315.7894736842104
[0	0	315.78947368421063	157.89473684210532	210.52631578947367	210.52631578947367	105.26315789473672	263.15789473684202	87.71929824561408	52.63157894736836	210.52631578947367]
[0	0	0.00000000000000	157.89473684210532	105.26315789473695	526.31578947368428	421.05263157894734	578.94736842105260	228.07017543859652	368.42105263157896	105.26315789473695]
[0	0	0.00000000000000	0.00000000000000	52.63157894736836	368.42105263157896	263.15789473684202	421.05263157894734	70.17543859649122	210.52631578947367	52.63157894736836]
[0	0	0.00000000000000	0.00000000000000	0.00000000000000	421.05263157894734	315.78947368421041	473.68421052631572	122.80701754385959	263.15789473684202	0.0]
[0	0	0.00000000000000	0.00000000000000	0.00000000000000	0.00000000000000	105.26315789473695	52.63157894736836	298.24561403508778	157.89473684210532	421.05263157894734]
[0	0	0.00000000000000	0.00000000000000	0.00000000000000	0.00000000000000	0.00000000000000	157.89473684210532	192.98245614035082	52.63157894736836	315.7894736842104]
[0	0	0.00000000000000	0.00000000000000	0.00000000000000	0.00000000000000	0.00000000000000	0.00000000000000	350.87719298245611	210.52631578947367	473.6842105263157]
[0	0	0.00000000000000	0.00000000000000	0.00000000000000	0.00000000000000	0.00000000000000	0.00000000000000	0.00000000000000	140.35087719298244	122.80701754385959]
[0	0	0.00000000000000	0.00000000000000	0.00000000000000	0.00000000000000	0.00000000000000	0.00000000000000	0.00000000000000	0.00000000000000	263.157894736842]
[0	0	0.00000000000000	0.00000000000000	0.00000000000000	0.00000000000000	0.00000000000000	0.00000000000000	0.00000000000000	0.00000000000000	0]

: B

: Mahdi
: DWT

[8.041015797598448	7.476985611461714	6.902769874399382]
[8.69317308635459	6.0287534853116540	5.148867172016139]
[10.385457197160918	7.4270447192251368	5.41742265884352]
[8.897948879686737	6.7904351020442846	5.199756147512744]
[9.258370495790587	6.0893105723289409	5.327726795343551]
[9.396815609770329	6.1249825954960215	5.609932566924272]
[8.979642596529402	6.0962361951685580	5.390835236891462]
[8.779412928448892	7.1112857233447357	5.820843045780293]
[9.54667770330525	7.75405060927791475	5.999625787935656]
[9.324378306602739	6.4009819317325309	5.697610702998645]
[10.544300718257546	7.99347259959783464	6.17022695007563]

: DWT with properties

[500.7841798008885	516.4101240567397	451.8023859576788]
[470.82767111063004	395.78495269361883	455.328482657671]
[504.7716949954629	444.08170186635107	454.20087143033743]
[457.29646574147046	398.90276463236660	422.85145021788776]
[441.063577093184	402.38427341636270	419.753195412457]
[422.7776876874268	378.69718409422785	400.43171413615346]
[408.50845652632415	362.93638395983726	394.06653442420065]
[381.9845840074122	356.42437131889164	377.06106535717845]
[566.7809604937211	559.42005901224911	523.1585342222825]
[652.12567050918	610.48096511396579	634.3502437232528]
[391.71620919555426	368.51741091627628	356.6244387254119]

: HMM

[340.6901181222288	21.04016573749723	16.004415011037665]
[398.63713798977864	36.906854130052565	41.94260485651213]
[404.3623288294733	42.632044969747263	47.667795696206824]
[398.63713798977864	36.906854130052565	41.94260485651213]
[376.14578850880997	14.415504649083921	19.451255375543486]
[398.63713798977864	36.906854130052565	41.94260485651213]
[398.63713798977864	36.906854130052565	41.94260485651213]
[414.70856656120736	52.978282701481305	58.01403342794087]
[287.92285227549286	73.807431584233200	68.77168085777363]
[398.63713798977864	36.906854130052565	41.94260485651213]
[252.68053049470973	109.049753365016329	104.01400263855676]

: HMM with properties

[894.736842105263	473.6842105263157	736.8421052631577]
[789.4736842105264	368.42105263157896	631.578947368421]
[473.6842105263157	52.63157894736836	315.7894736842104]
[631.578947368421	210.52631578947367	473.6842105263157]
[578.9473684210526	157.89473684210532	421.05263157894734]
[1000.0	578.94736842105260	842.1052631578947]
[894.736842105263	473.68421052631572	736.8421052631577]
[1052.6315789473683	631.57894736842104	894.736842105263]
[701.7543859649122	280.70175438596488	543.8596491228069]
[842.1052631578947	421.05263157894734	684.2105263157894]
[578.9473684210526	157.89473684210532	421.05263157894734]

: Mohammad Mahdi

: DWT

[7.900459256568865	7.956544238379138	9.20108527418256]
[6.551954126404212	6.0774647999390936	8.05040437612729]
[5.70540899580044	7.5438732049047985	7.387138994367035]
[6.792973224637535	6.5488721517667727	8.327475573664799]
[7.099989077505597	8.0607619788042939	7.223335751290392]
[6.650637389800522	6.1626580339875545	7.595510744985006]
[6.7006566298084635	7.1581043257644978	7.960725555060719]
[7.044506112896215	6.4908900108653143	8.562385478172075]
[5.901432121732796	6.7673357709181801	8.831747110677554]
[5.969033891351501	7.0610898376089608	8.043441512351137]
[6.225168587777262	7.6552011160511029	7.125751783716794]

: DWT with properties

[555.4125015048776	710.292480450822	504.7095903845038]
[531.3227091003209	660.1800144035369	509.1175196841359]
[618.3405852112919	653.8432075995952	505.337791480124]
[550.1928291711956	612.3555060476065	453.15270513668656]
[578.9283399712294	635.0130304638296	459.87579253315926]
[543.0369019862264	625.5691505577415	423.0297416485846]
[522.4782196879387	601.0144494622946	406.1591245699674]
[518.3445955049247	568.9853521417826	378.22944832220674]
[705.3197284871712	612.2385342856869	522.4925903277472]
[736.0571920608636	761.4719305930194	646.3942075658124]
[524.3535070363432	566.4159409794956	390.5615265443921]

: HMM

[363.4012947391918	262.05298013245005	107.05298013245024]
[421.3483146067416	319.99999999999983	165.00000000000003]
[427.0735054464363	325.72519083969451	170.72519083969473]
[421.3483146067416	319.99999999999983	165.00000000000003]
[398.85696512577294	297.50865051903122	142.5086505190314]
[421.3483146067416	319.99999999999983	165.00000000000003]
[421.3483146067416	319.99999999999983	165.00000000000003]
[437.41974317817034	336.07142857142856	181.07142857142878]
[310.63402889245583	209.28571428571408	54.28571428571427]
[421.3483146067416	319.99999999999983	165.00000000000003]
[275.3917071116727	174.04339250493095	19.043392504931145]

: HMM with properties

[736.8421052631577	421.05263157894734	789.4736842105264]
[631.578947368421	315.78947368421063	684.2105263157896]
[315.7894736842104	0.00000000000000	368.42105263157896]
[473.6842105263157	157.89473684210532	526.3157894736843]
[421.05263157894734	105.26315789473695	473.68421052631595]
[842.1052631578947	526.31578947368428	894.7368421052632]
[736.8421052631577	421.05263157894734	789.4736842105264]
[894.736842105263	578.94736842105260	947.3684210526317]
[543.8596491228069	228.07017543859652	596.4912280701756]
[684.2105263157894	368.42105263157896	736.8421052631579]
[421.05263157894734	105.26315789473695	473.68421052631595]

: C
: DWT

[6.600336663071175	5.276146550290832	6.300242363394773	6.628197424663085	4.636066798955653	5.64280655970731	4.8162354479429155	5.509265791671169	5.425233421258326	6.217499877335285	6.079614923191002]
[5.562590726426265	5.1788356959231123	6.160987891560239	5.1591253526586343	3.9165912708323276	4.5549203447774289	4.8438742487307991	4.604114497623073	4.8990802943422977	4.9937166658208980	4.955233860934527]
[3.582805445116037	4.1386252570706574	4.175643970932583	5.7408310995102738	4.1650872226470028	5.6930556123346605	3.1498930952680553	4.944835590921343	4.8857221580502710	3.1345906506554684	4.28457067578654]
[4.344257412357365	4.9549591744371355	5.084487166504459	5.1399100928210828	3.7266970206528640	4.7257871405064407	4.2280266068211745	4.027301298493512	3.9680149521395833	4.8157850180796231	4.858638882496052]
[6.454628000673438	6.1467704600690922	4.399919921858327	5.8845063338194450	5.3787527338481596	5.7613988010772346	4.7610506550610694	5.043553299746236	5.2656434569098565	4.3458707500249147	5.064012673239631]
[4.356074887614795	4.4156772690562320	5.246536274170921	4.8350757633284047	3.9635411894164463	4.0485431874877804	4.7293354522488471	4.244995421729527	4.5748418550233509	4.1077977270938391	4.431104370947196]
[4.878166215446754	5.2504885616842785	4.907835765960272	6.9611774951401912	4.6775773125307296	4.0225134559717617	5.0954978024778370	4.516840850190647	4.9968516070746318	4.4134755651728028	4.8843764565501715]
[5.277139088781496	4.9240378094959851	4.965902347213159	5.1850133838920556	4.5072989198165487	4.8364720973528392	4.9903816417020721	4.489673459247115	5.5952982519488614	6.3539977491413993	5.323359098858873]
[5.954511255298712	5.9241870762480175	5.706490162373939	7.8189398247650388	6.1735730518830678	5.8164458366744611	5.6871178823474224	5.139174882790940	4.4831473459876179	5.6191912149570271	6.5475766871541055]
[3.8956992781922963	4.5208290469172425	5.543670564379681	5.5487957024142815	3.9603688177867298	4.9345161390966723	4.1635443461580621	5.397592629217797	4.8864323537568453	4.6431970124285726	4.519472567181765]
[6.443945801423979	5.5118949288917065	6.039461612278956	6.8054862497092472	5.9438642857903687	5.4792608147091642	6.0295581301514289	5.673707811740314	5.7710522649945233	6.2453101749260895	5.560640611796771]

: DWT with properties

[370.02320728474297	326.9457878933754	451.38208412961103	515.2237144841347	344.1903647372965	518.9498741661664	501.71587916021235	435.5384362244513	639.2754130179528	564.6348814817611	515.5973036193755]
[443.72916681319475	263.50417865812778	467.62841799482703	436.65042924508452	299.17136933840811	456.37037954479456	469.15897930413485	439.09859747136943	540.68283078074455	509.36658159177750	408.86349653825164]
[343.7084871456027	446.58506337553263	262.36989976093173	300.44539753720164	436.26023654080927	433.68788821250200	389.53073287382722	245.89599587698467	506.89747106283903	389.70305503997952	336.1092111878097]
[311.74758091010153	450.63547004386783	276.92526047118008	275.69520853646100	407.84627591818571	368.44103909842670	320.21254015527666	215.77041572076268	482.03374982066453	366.16503777727485	323.2993594426662]
[297.0087712109089	421.43970102071762	247.55957009270787	292.45611668005586	386.06076304428279	380.47856296598911	351.56927207484841	205.81490941951051	466.12972419336438	358.30551506672055	307.9683456234634]
[339.202002633363	408.11027198657393	263.10629671066999	237.35141986608505	371.71327229402959	351.68341863155365	301.13867532089353	250.91286335815676	440.89256050810218	320.42260192241520	298.8231784030795]
[356.70021721720695	406.21548534370959	282.42038263566792	255.41415564529598	347.97563885524869	310.74426405690610	280.23804694972932	235.40745671512559	450.51791437715292	333.33196775522083	304.68251424096525]
[405.29235020652413	531.16379868611693	225.13243016228080	173.79303498566151	443.43444753997028	315.43343777582049	280.52713160589337	267.74886392871849	520.06312287226319	274.50970819219947	246.52924143522978]
[524.1392572587356	365.38007581327111	552.89023520890623	528.79583552386612	453.40642351191491	524.06936654914171	553.59863124135882	544.95364916836843	533.17919457796961	607.25046045146883	592.5439255880192]
[499.72247198340483	434.80710774776526	536.98625146714039	516.31607366842218	432.82368577760644	603.13073390023783	554.28127480414696	520.15552107663825	614.32567985937931	611.40170063660480	531.4878266323358]
[275.5291111320257	420.58988966047764	218.75161522254348	321.50786718353629	410.57042641378939	349.56922173500061	363.98549944907427	191.05867840046994	549.56606265157461	388.91056790668517	354.2567900530994]

: HMM

[11.8215586129371	43.68637396185137	1.2245777655861545	50.83160608664849	70.44701986754998	57.9470198675498	6.424771623990022	2.5898770104069158	35.76001511319183	57.9470198675498	18.040822077738827]
[46.1254612546127	101.633393829401172	59.17159763313595	108.7786259541982901	12.5000000000001776	0.000000000000	51.52224824355977	55.35714285714288	22.18700475435797514	0.000000000000	75.98784194528862]
[51.85065209430739	107.358584669095876	64.89678847283065	114.5038167938929803	6.7748091603054639	5.725190839694694	57.24743908325447	61.08233369683758	27.91219559405266892	5.725190839694694	81.71303278498331]
[46.1254612546127	101.633393829401172	59.17159763313595	108.7786259541982901	12.5000000000001776	0.000000000000	51.52224824355977	55.35714285714288	22.18700475435797514	0.000000000000	75.98784194528862]
[23.63411177364405	79.142044348432535	36.68024815216731	86.2872764732296389	34.9913494809688217	22.491349480968648	29.03089876259113	32.86579337617424	0.30434472661067247	22.491349480968648	53.49649246431998]
[46.1254612546127	101.633393829401172	59.17159763313595	108.7786259541982901	12.5000000000001776	0.000000000000	51.52224824355977	55.35714285714288	22.18700475435797514	0.000000000000	75.98784194528862]
[46.1254612546127	101.633393829401172	59.17159763313595	108.7786259541982901	12.5000000000001776	0.000000000000	51.52224824355977	55.35714285714288	22.18700475435797514	0.000000000000	75.98784194528862]
[62.196889826041435	117.704822400829912	75.24302620456469	124.8500545256270300	3.5714285714285587	16.071428571428736	67.59367681498851	71.42857142857162	38.25843332578671152	16.071428571428736	92.05927051671736]
[64.58882445967306	9.080891884884590	51.54268808114981	1.9356597600874714	123.2142857142859498	110.714285714285765	59.19203747072599	55.35714285714288	88.52728095992779345	110.714285714285765	34.72644376899714]
[46.1254612546127	101.633393829401172	59.17159763313595	108.7786259541982901	12.5000000000001776	0.000000000000	51.52224824355977	55.35714285714288	22.18700475435797514	0.000000000000	75.98784194528862]
[99.83114624045619	44.323213665667716	86.78500986193293	37.1779815408705971	158.4566074950690791	145.956607495068880	94.43435925150911	90.59946463792600	123.76960274071092272	145.956607495068880	69.96876554978027]

: HMM with properties

[605.263157894737	605.263157894737	105.26315789473695	105.26315789473695	605.263157894737	421.05263157894734	105.26315789473672	315.7894736842104	298.24561403508756	157.89473684210532	368.42105263157873]
[500.0000000000002	500.00000000000023	210.52631578947367	210.52631578947367	500.00000000000023	315.78947368421063	0.00000000000000	210.52631578947367	192.98245614035082	263.15789473684202	263.157894736842]
[184.2105263157896	184.21052631578959	526.31578947368428	526.31578947368428	184.21052631578959	0.00000000000000	315.78947368421063	105.26315789473695	122.8070175438598 1	578.94736842105260	52.63157894736858]
[342.1052631578949	342.10526315789491	368.42105263157896	368.42105263157896	342.10526315789491	157.89473684210532	157.89473684210532	52.63157894736836	35.08771929824550	421.05263157894734	105.26315789473672]
[289.4736842105265	289.47368421052653	421.05263157894734	421.05263157894734	289.47368421052653	105.26315789473695	210.52631578947367	0.00000000000000	17.54385964912286	473.68421052631572	52.63157894736836]
[710.5263157894739	710.52631578947387	0.00000000000000	0.00000000000000	710.52631578947387	526.31578947368428	210.52631578947367	421.05263157894734	403.50877192982449	52.63157894736836	473.6842105263157]
[605.263157894737	605.26315789473699	105.26315789473695	105.26315789473695	605.26315789473699	421.05263157894734	105.26315789473672	315.7894736842104 1	298.24561403508756	157.89473684210532	368.42105263157873]
[763.1578947368423	763.15789473684231	52.63157894736836	52.63157894736836	763.15789473684231	578.94736842105260	263.15789473684202	473.68421052631572	456.14035087719287	0.00000000000000	526.315789473684]
[412.28070175438614	412.28070175438614	298.24561403508778	298.24561403508778	412.28070175438614	228.07017543859652	87.71929824561408	122.80701754385959	105.26315789473672	350.87719298245611	175.43859649122794]
[552.6315789473686	552.63157894736855	157.89473684210532	157.89473684210532	552.63157894736855	368.42105263157896	52.63157894736836	263.15789473684202	245.61403508771917	210.52631578947367	315.7894736842104]
[289.4736842105265	289.47368421052653	421.05263157894734	421.05263157894734	289.47368421052653	105.26315789473695	210.52631578947367	0.00000000000000	17.54385964912286	473.68421052631572	52.63157894736836]

کد ها :

کد ها در گیتهاب موجود میباشد

https://github.com/mahdisml/DTWHMM

فایل MAIN

```python
from hmm import HMM
from dwt import DWT

dwt = DWT(False)
dwt2 = DWT(True)  # with properties


hmm = HMM(False)
hmm2 = HMM(True)  # with properties


# hmm learning data files address : Safarmohammadloo
hmml = []


for i in range(1, 70):
    hmml.append("./hmml/" + str(i) + ".wav")


hmm.learn(hmml)
hmm2.learn(hmml)


def compare(x, y):
    print("DWT :")
    temp = []
    for i in x:
        results = []
        for j in y:
            if (str(i) + str(j) not in temp) or (str(j) + str(i) not in temp):
                temp.append(str(i) + str(j))
                temp.append(str(j) + str(i))
                results.append(dwt.against(i, j))
            else:
                results.append(0)
    print(results)
```

```python
        print("DWT with properties :")
        temp = []
        for i in x:
            results = []
            for j in y:
                if (str(i) + str(j) not in temp) or (str(j) + str(i) not in temp):
                    temp.append(str(i) + str(j))
                    temp.append(str(j) + str(i))
                    results.append(dwt2.against(i, j))
                else:
                    results.append(0)
            print(results)

        print("HMM :")
        temp = []
        for i in x:
            results = []
            for j in y:
                if (str(i) + str(j) not in temp) or (str(j) + str(i) not in temp):
                    temp.append(str(i) + str(j))
                    temp.append(str(j) + str(i))
                    results.append(hmm.against(i, j))
                else:
                    results.append(0)
            print(results)

        print("HMM with properties :")
        temp = []
        for i in x:
            results = []
            for j in y:
                if (str(i) + str(j) not in temp) or (str(j) + str(i) not in temp):
                    temp.append(str(i) + str(j))
                    temp.append(str(j) + str(i))
                    results.append(hmm2.against(i, j))
                else:
                    results.append(0)
            print(results)
```

```python
# ----------------
# A
print("")
print("A :")

# last name files address : Safarmohammadloo
last_name = []

for i in range(1, 12):
    last_name.append("./l/" + str(i) + ".wav")

compare(last_name, last_name)

# ----------------
# B
print("")
print("B :")
```

```python
92      print("")
93      print("Mahdi :")
94
95      # first name files address : Mahdi
96      first_name = []
97
98      for i in range(1, 4):
99          first_name.append("./f/" + str(i) + ".wav")
100
101     compare(last_name, first_name)
102
103     print("")
104     print("Mohammad Mahdi :")
105
106     # first name 2 files address : Mohammad Mahdi
107     first_name2 = []
108
109     for i in range(1, 4):
110         first_name2.append("./fs/" + str(i) + ".wav")
```

```python
111
112    compare(last_name, first_name2)
113
114    # ---------------
115    # C
116    print("")
117    print("C :")
118
119    # last name files address other person : Safarmohammadloo
120    last_name2 = []
121
122    for i in range(1, 12):
123        last_name2.append("./ls/" + str(i) + ".wav")
124
125    compare(last_name, last_name2)
126
```

کلاس DWT

```python
import numpy as np
from fastdtw import fastdtw
from scipy.spatial.distance import euclidean
import librosa


class DWT:

    def __init__(self, using_property):
        self.using_property = using_property
```

```python
def get_array(self, file):
    if not self.using_property:
        y, sr = librosa.load(file, sr=8000)
        return y
    else:
        y, sr = librosa.load(file)
        hop_length = 512
        y_harmonic, y_percussive = librosa.effects.hpss(y)
        tempo, beat_frames = librosa.beat.beat_track(y=y_percussive, sr=sr)
        mfcc = librosa.feature.mfcc(y=y, sr=sr, hop_length=hop_length, n_mfcc=13)
        mfcc_delta = librosa.feature.delta(mfcc)
        beat_mfcc_delta = librosa.util.sync(np.vstack([mfcc, mfcc_delta]), beat_frames)
        chromagram = librosa.feature.chroma_cqt(y=y_harmonic, sr=sr)
        beat_chroma = librosa.util.sync(chromagram, beat_frames, aggregate=np.median)
        beat_features = np.vstack([beat_chroma, beat_mfcc_delta])
        return beat_features.ravel()
```

```python
def against(self, file1, file2):
    if file1 != file2:
        x = self.get_array(file1)
        y = self.get_array(file2)
        distance, path = fastdtw(x, y, dist=euclidean)
    else:
        distance = 0
    return distance
```

كلاس HMM :

```python
import numpy as np
import librosa
from hmmlearn import hmm


class HMM:

    def __init__(self, using_property):
        self.using_property = using_property
```

```python
def get_array(self, file):

    if not self.using_property:
        y, sr = librosa.load(file, sr=8000)
        return y
    else:
        y, sr = librosa.load(file)
        hop_length = 512
        y_harmonic, y_percussive = librosa.effects.hpss(y)
        tempo, beat_frames = librosa.beat.beat_track(y=y_percussive, sr=sr)
        mfcc = librosa.feature.mfcc(y=y, sr=sr, hop_length=hop_length, n_mfcc=13)
        mfcc_delta = librosa.feature.delta(mfcc)
        beat_mfcc_delta = librosa.util.sync(np.vstack([mfcc, mfcc_delta]), beat_frames)
        chromagram = librosa.feature.chroma_cqt(y=y_harmonic, sr=sr)
        beat_chroma = librosa.util.sync(chromagram, beat_frames, aggregate=np.median)
        beat_features = np.vstack([beat_chroma, beat_mfcc_delta])
        return beat_features.ravel()
```

```python
def learn(self, files):
    x = []
    self.model = hmm.GaussianHMM(n_components=5, covariance_type="diag", n_iter=100)
    for m in files:
        n = self.get_array(m)
        n = n.reshape(-1, 1)
        x.append(n)
    for n in x:
        self.model.fit(n)


def against(self, file1, file2):
    if file1 != file2:
        x = self.get_array(file1)
        y = self.get_array(file2)
        xs = self.model.predict(x.reshape(-1, 1))
        ys = self.model.predict(y.reshape(-1, 1))
        distance = abs(np.average(xs) - np.average(ys))*1000
    else:
        distance = 0
    return distance
```