

Self-Organizing Maps

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Outline

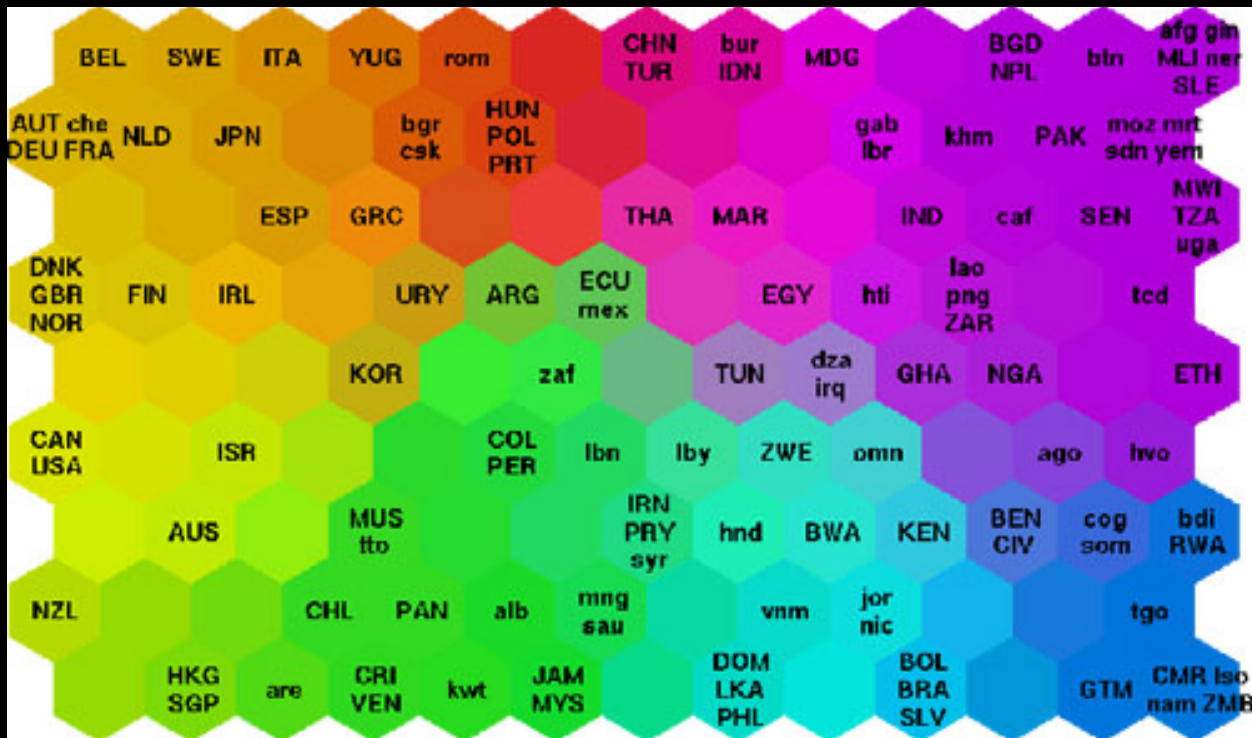
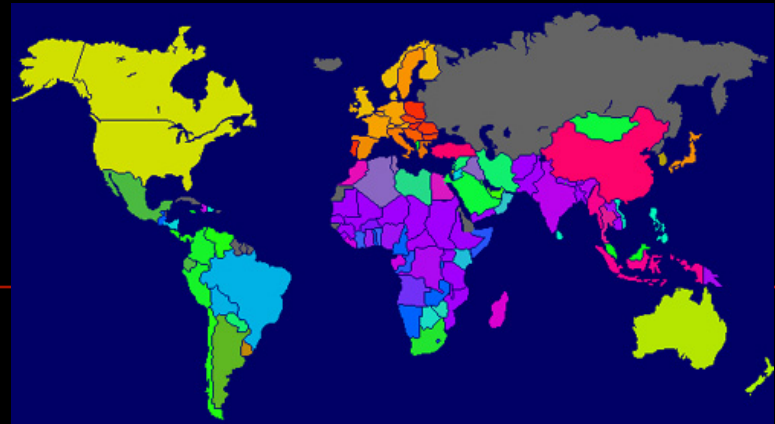
- Define Self-Organizing Maps (SOM)
- Quick Example
- Explain SOM
- An example of SOM using MGP dataset
- Questions

Define

- A Self-Organizing Map (SOM) is a way to visually represent multi-dimensional data in an usually 2-D or 3-D manner
- Similar data is grouped together.
- Unsupervised algorithm
- Continuously learning and adapting.

Quick Example

■ World Poverty Levels

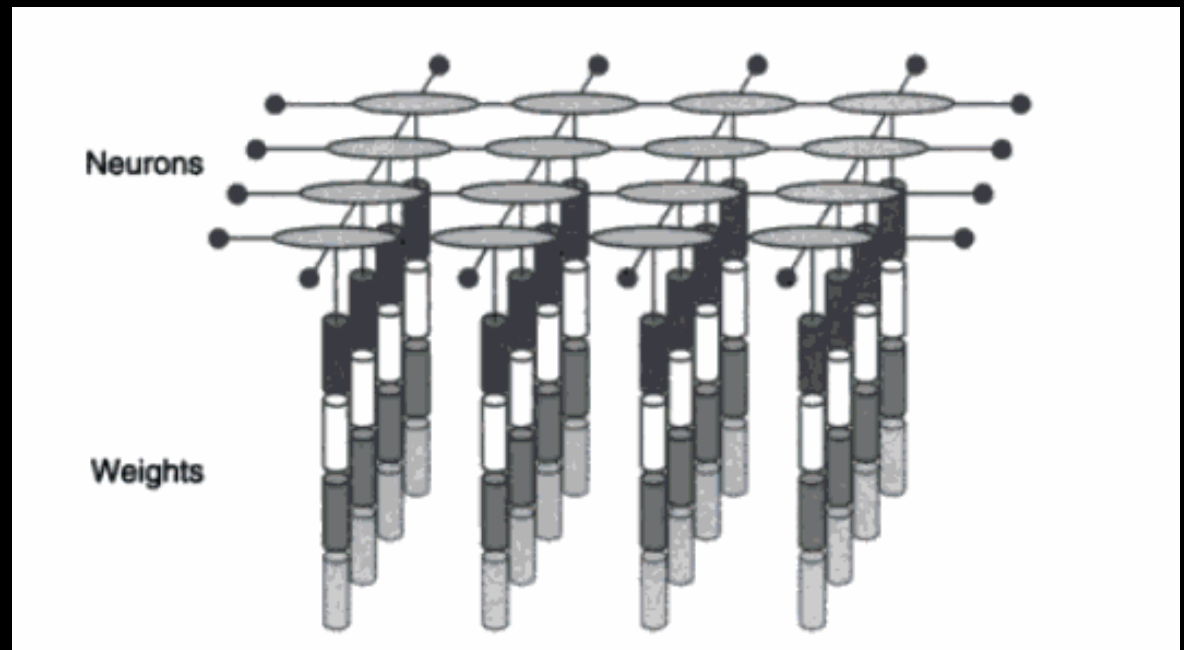


Source: <http://www.ai-junkie.com/ann/som/som5.html>

Randomized Map Generation

- Randomized weights are assigned to each neuron

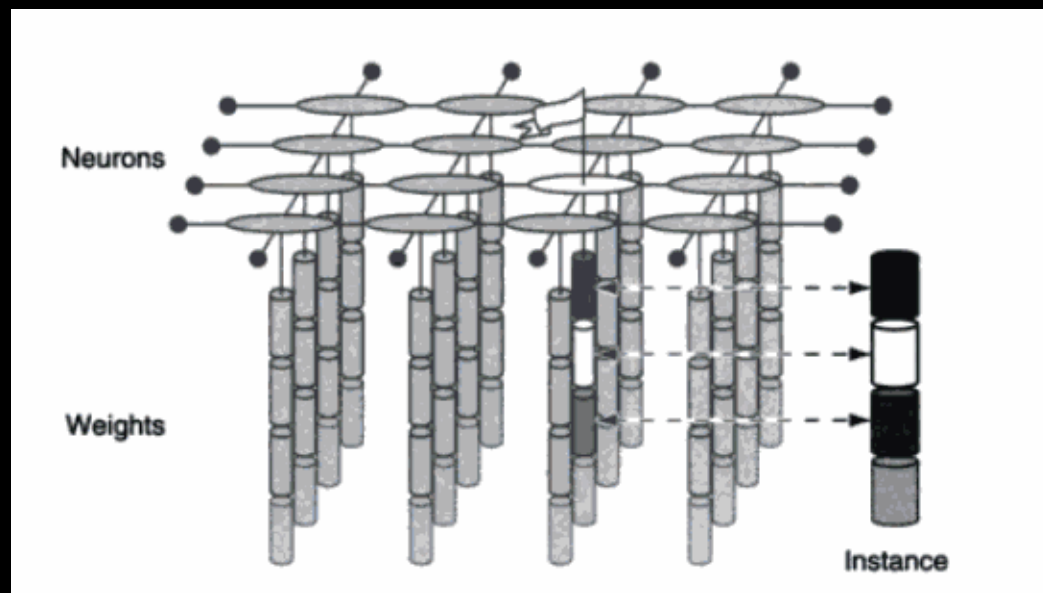
of weights
per neuron =
of attributes



Training the Map

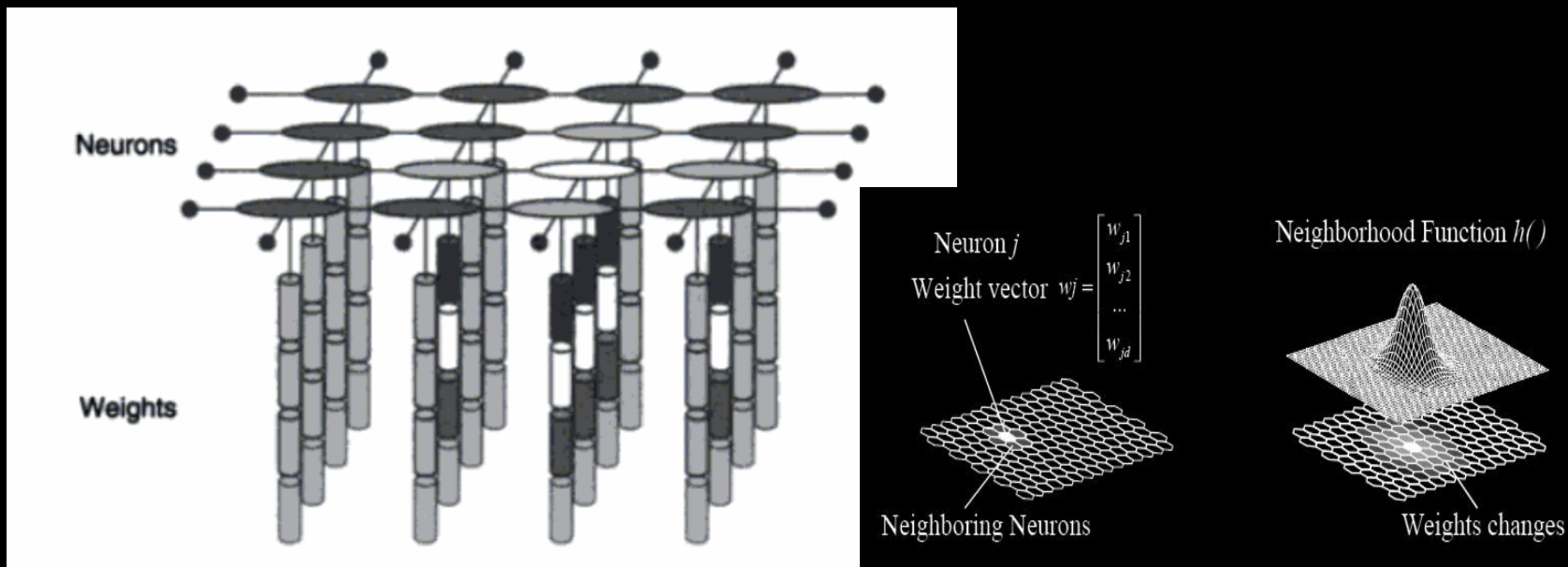
- SOM instance recognition
- Use Euclidean distance to match
 - This gives a measurement of how similar the two sets of data are to each other.

$$\sqrt{(p_1 - q_1)^2 + (p_2 - q_2)^2 + \dots + (p_n - q_n)^2} = \sqrt{\sum_{i=1}^n (p_i - q_i)^2}$$



Altering Neurons Weights

- Both the Best Match Neuron and its surrounding neighbors weights are altered



Example with MPG dataset

- MPG of 398 cars from 1970-1982
- 6 Additional Attributes
 - Number of cylinders
 - Displacement
 - Horsepower
 - Weight
 - Acceleration
 - Model year

mpg	cylinder	displacement	horsepower	weight	acceleration	model year	origin	car name
19	3	70	97	2330	13.5	72	3	mazda rx2 coupe
18	3	70	90	2124	13.5	73	3	mazda rx3
21.5	3	80	110	2720	13.5	77	3	mazda rx-4
23.7	3	70	100	2420	12.5	80	3	mazda rx-7 gs
24	4	113	95	2372	15	70	3	toyota corona mark ii
27	4	97	88	2130	14.5	70	3	datson pl510

Except from the
MPG dataset

Results

Engine
Cylinder

four	four	four	four	four	four	four	four	six	four
four	four	four	four	four	four	four	four	four	
four	four	four	four	four	four	four	six	six	four
four	four	four	four	four	six	six	six	six	
four	four	four	four		six	six	six	six	six
four	six	four	four	six	six	six	six	six	six
six	six	six	six	six	six		six	eight	
six	six	six	eight	eight		eight	eight	eight	eight
six		eight	eight	eight	eight	eight	eight	eight	eight
six	eight		eight	eight	eight	eight	eight	eight	eight

MPG

32.9628	33.2888	31.7869	29.7918	26.9988	26.383	25.4452	24.6602	23.7732	23.7234
33.0396	32.6871	31.8868	29.5936	27.221	26.5273	25.8115	24.3248	23.7872	23.7921
31.6163	31.5387	30.9045	28.5568	26.9452	26.0855	25.4026	23.3301	22.5925	22.28
29.8089	29.0995	28.7621	27.4954	26.0419	23.9521	22.0069	20.1769	20.6464	21.1586
27.5018	27.2857	26.885	25.9961	24.0982	21.1901	19.9712	18.9852	18.8026	18.6502
25.3411	24.8184	24.7337	23.6526	22.0235	19.8092	19.163	18.4085	17.8179	17.6668
23.1231	23.0709	22.0421	21.3571	20.0601	18.8283	17.7687	16.8402	16.2326	15.8909
21.6328	20.3491	19.4387	18.1258	17.7282	17.0366	16.0144	15.3983	14.7323	14.3153
20.7006	19.6309	18.1489	17.3097	16.7036	15.9836	15.3729	14.7381	13.9966	13.344
20.3263	19.6362	17.6545	16.9477	16.3911	15.7828	15.0531	14.358	13.5202	13.0157

Results

Engine
Cylinder

four	four	four	four	four	four	four	four	six	four
four	four	four	four	four	four	four	four	four	
four	four	four	four	four	four	four	six	six	four
four	four	four	four	four	six	six	six	six	
four	four	four	four		six	six	six	six	six
four	six	four	four	six	six	six	six	six	six
six	six	six	six	six	six		six	eight	
six	six	six	eight	eight		eight	eight	eight	eight
six		eight	eight	eight	eight	eight	eight	eight	eight
six	eight		eight	eight	eight	eight	eight	eight	eight

Horsepower

63.8126	64.4762	69.0544	76.385	84.741	90.1339	94.3355	97.6642	98.211	95.3236
65.2841	68.1123	70.8001	77.5152	86.1945	91.341	94.2283	96.9577	96.1082	92.1097
71.9559	72.5228	75.6384	81.4593	88.478	92.0273	94.8642	97.0093	95.1532	91.3767
78.6681	79.8092	81.27	83.9632	89.9935	93.7759	97.4489	98.8648	96.3595	93.4091
82.3111	84.2055	87.2114	89.9745	92.4131	96.8931	99.5093	99.7705	102.86	103.566
89.5717	90.3766	92.5089	92.833	96.786	100.773	103.909	106.873	110.519	111.969
93.7635	94.8121	99.0331	101.057	107.921	112.417	118.955	123.114	126.322	130.065
99.6583	104.006	112.636	122.388	127.583	131.375	138.715	145.574	149.835	153.848
108.963	113.131	126.901	137.947	145.482	149.636	155.895	163.676	167.043	169.032
112.408	118.14	133.754	143.392	148.879	153.101	166.457	173.652	177.962	175.465

Results

Engine
Cylinder

four	four	four	four	four	four	four	four	six	four
four	four	four	four	four	four	four	four	four	
four	four	four	four	four	four	four	six	six	four
four	four	four	four	four	six	six	six	six	
four	four	four	four		six	six	six	six	six
four	six	four	four	six	six	six	six	six	six
six	six	six	six	six	six		six	eight	
six	six	six	eight	eight		eight	eight	eight	eight
six		eight	eight	eight	eight	eight	eight	eight	eight
six	eight		eight	eight	eight	eight	eight	eight	eight

Weight

1898.21	1947.55	2081.16	2247.34	2449.66	2599.8	2739.3	2851.03	2927.8	2975.71
1936.6	2016.26	2113.87	2269.9	2492.16	2624.81	2734.03	2880.06	2999.64	3062.88
2085.08	2113.95	2182.96	2336.4	2541.93	2664.89	2774.43	2969.26	3133.05	3208.87
2178.48	2203.99	2273.77	2408.27	2608.48	2829.55	3030.91	3219.43	3305.99	3317.4
2258.63	2288.49	2388.72	2537.54	2764.57	3098.99	3273.71	3397.86	3485.07	3526.87
2406.31	2432.34	2533.69	2739.63	2965.21	3246.25	3393.15	3538.48	3641.69	3691.12
2593.92	2631.85	2777.56	2953.94	3161.09	3428.13	3666.46	3822.77	3903	3952.33
2762.55	2846.34	3024.54	3241.64	3419.86	3650.98	3956.62	4079.97	4180.04	4272.49
2936.04	3004.87	3192.11	3448.73	3608.54	3815.7	4053.38	4217.85	4395.2	4520.37
3010.41	3083.01	3286.61	3508.47	3669.76	3816.32	4087.11	4298.91	4528.86	4620.85

Results

Engine
Cylinder

four	four	four	four	four	four	four	four	six	four
four	four	four	four	four	four	four	four	four	
four	four	four	four	four	four	four	six	six	four
four	four	four	four	four	six	six	six	six	
four	four	four	four		six	six	six	six	six
four	six	four	four	six	six	six	six	six	six
six	six	six	six	six	six		six	eight	
six	six	six	eight	eight		eight	eight	eight	eight
six		eight	eight	eight	eight	eight	eight	eight	eight
six	eight		eight	eight	eight	eight	eight	eight	eight

Acceleration

17.0188	17.2378	17.2086	16.7837	16.405	16.0181	16.0776	16.0152	16.3802	17.0838
16.9811	16.8572	16.9727	16.5525	16.3642	15.8376	15.9272	16.1094	16.9466	17.9662
16.4673	16.4124	16.341	16.2302	16.147	15.9117	15.7492	16.166	17.4496	18.4218
15.8002	15.7211	15.6854	15.9693	15.891	15.8632	15.95	16.3955	17.4823	18.2557
15.7486	15.5368	15.3377	15.6293	15.8121	16.3578	16.7331	17.0708	17.1533	17.2403
15.1264	15.3393	15.1495	15.6108	15.8968	16.6121	16.7135	16.9066	16.8403	16.8208
15.1909	15.0138	14.9411	15.2196	15.4331	15.966	15.9989	15.9397	15.7341	15.5012
14.9007	14.6124	14.0134	13.578	13.7691	14.2041	14.2777	14.0967	14.1201	13.9509
14.9377	14.6163	13.3611	12.5413	12.3126	12.599	12.8657	12.9281	13.0108	13.2526
15.0484	14.4436	13.1005	12.3119	12.1227	12.342	12.0823	12.2845	12.5895	12.9457

Results

Engine
Cylinder

Year

four	four	four	four	four	four	four	four	six	four
four	four	four	four	four	four	four	four	four	
four	four	four	four	four	four	four	six	six	four
four	four	four	four	four	six	six	six	six	
four	four	four	four		six	six	six	six	six
four	six	four	four	six	six	six	six	six	six
six	six	six	six	six	six		six	eight	
six	six	six	eight	eight		eight	eight	eight	eight
six		eight	eight	eight	eight	eight	eight	eight	eight
six	eight		eight	eight	eight	eight	eight	eight	eight

77.1151	77.287	77.1994	76.6066	76.9629	77.8512	78.7003	78.3247	77.7726	77.3416
77.0112	77.2331	77.099	76.7382	77.099	77.9094	78.6302	78.4018	77.9008	77.5239
76.9726	77.0632	76.7496	76.8576	77.1081	77.9834	78.0741	77.972	77.5743	77.2094
76.1018	75.9832	76.4109	76.7504	77.2246	76.9436	76.613	76.6015	77.2816	77.078
75.7277	75.6515	76.4149	77.1066	77.5689	76.6961	76.6686	76.2418	76.7524	76.3937
75.1017	74.8764	75.7167	76.5159	77.1274	76.6594	76.4952	76.4046	76.4635	76.3083
74.7453	74.8037	74.8941	75.9253	76.3706	76.6621	76.4261	75.6082	75.1593	75.0077
74.385	74.2775	74.0109	73.7608	74.4983	75.7894	75.7434	74.8931	74.0926	73.8365
74.4857	74.4871	73.6419	73.7697	73.7091	74.7225	74.7911	74.02	73.3792	73.0538
74.4769	74.4928	73.5349	73.5271	73.47	74.1098	74.0987	73.5858	73.0097	72.8046

Review

- Define SOM
- Quick Example
- Explain SOM
- An example of SOM using MGP dataset
- Questions

References

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