¿Por qué Álgebra Lineal?

“La Matrix está por todas partes.
Nos rodea. Incluso ahora, en esta misma habitación.”
-Morfeo-



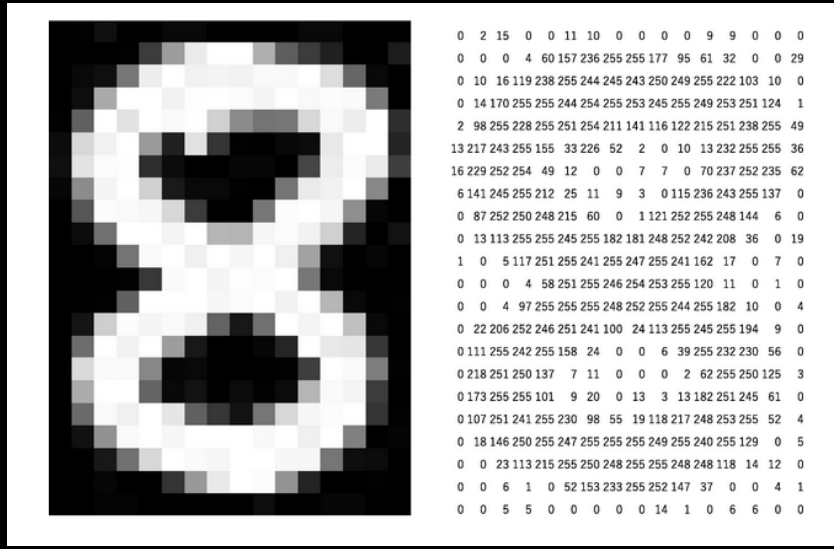




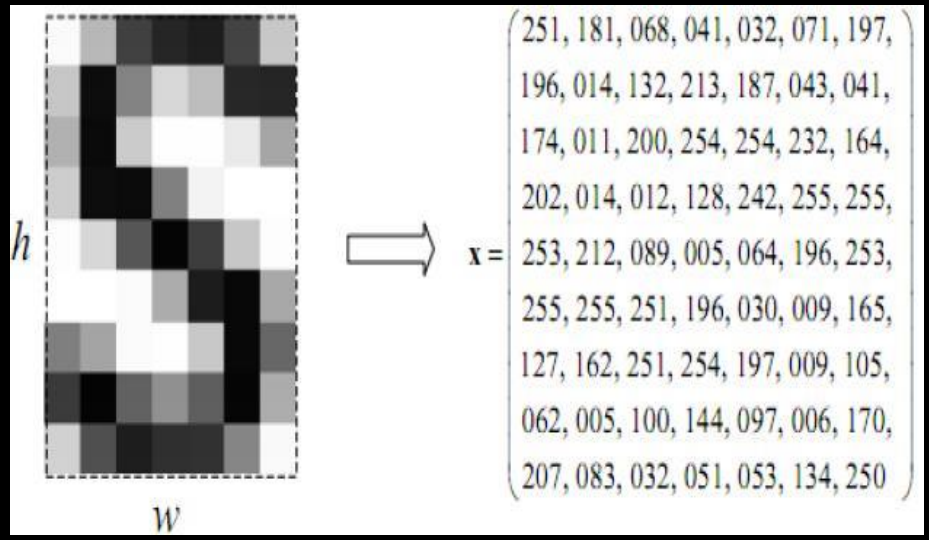


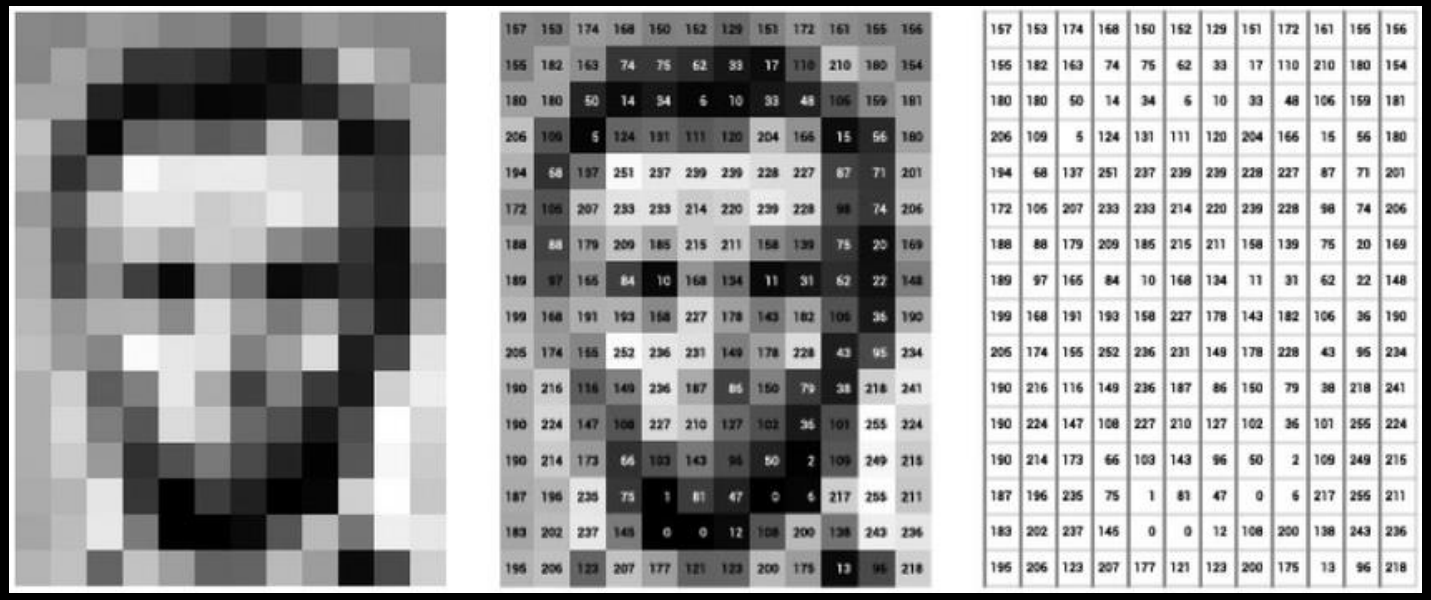



Algebra Lineal en Data Science



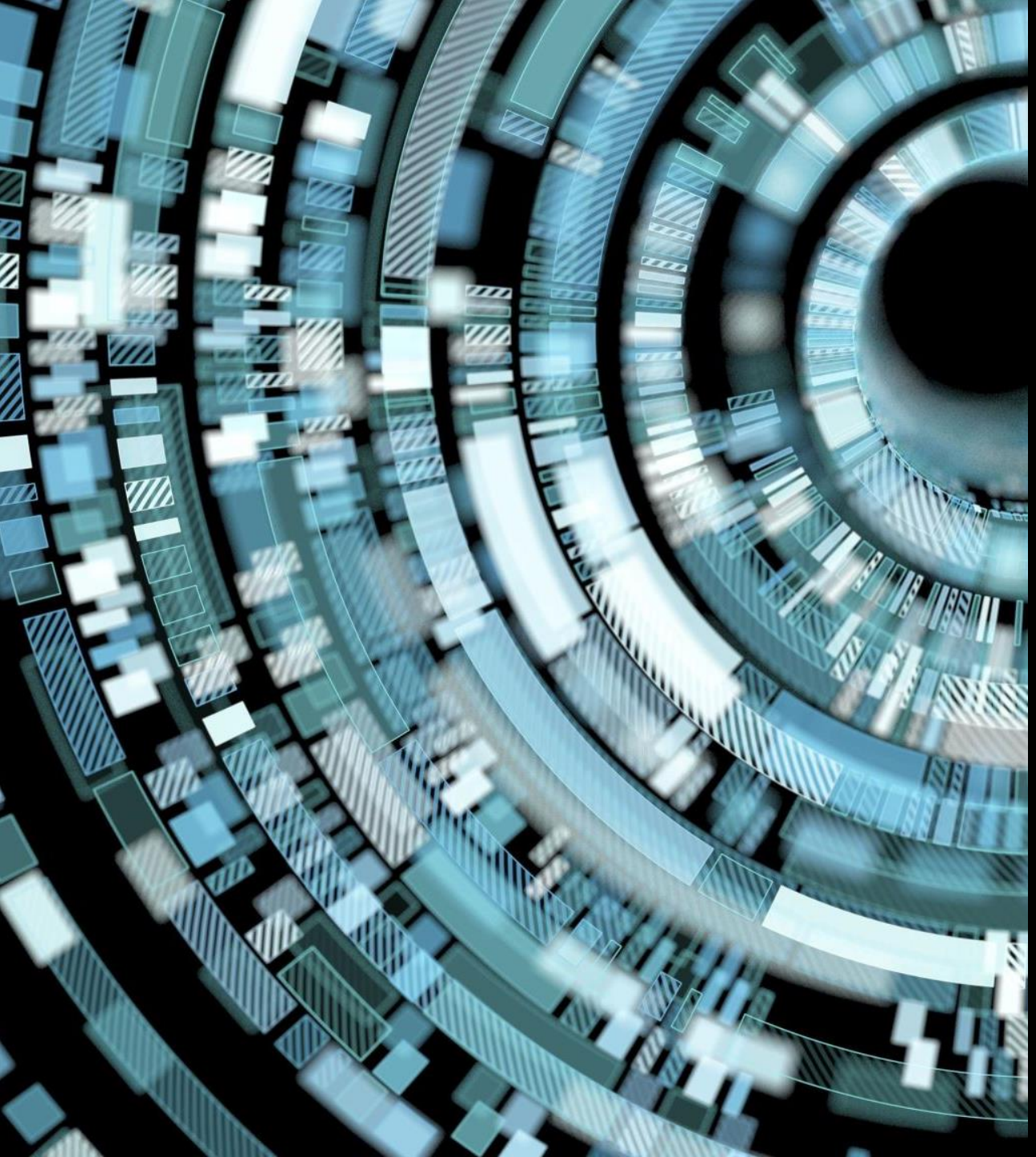
0	2	15	0	0	11	10	0	0	0	0	9	9	0	0	0
0	0	0	4	60	157	236	255	255	177	95	61	32	0	0	29
0	10	16	119	238	255	244	245	243	250	249	255	222	103	10	0
0	14	170	255	255	244	254	255	253	245	255	249	253	251	124	1
2	98	255	228	255	251	254	211	141	116	122	215	251	238	255	49
13	217	243	255	155	33	226	52	2	0	10	13	232	255	255	36
16	229	252	254	49	12	0	0	7	7	0	70	237	252	235	62
6	141	245	255	212	25	11	9	3	0	115	236	243	255	137	0
0	87	252	250	248	215	60	0	1	121	252	255	248	144	6	0
0	13	113	255	255	245	255	182	181	248	252	242	208	36	0	19
1	0	5	117	251	255	241	255	247	255	241	162	17	0	7	0
0	0	0	4	58	251	255	246	254	253	255	120	11	0	1	0
0	0	4	97	255	255	255	248	252	255	244	255	182	10	0	4
0	22	206	252	246	251	241	100	24	113	255	245	255	194	9	0
0	111	255	242	255	158	24	0	0	6	39	255	232	230	56	0
0	218	251	250	137	7	11	0	0	0	2	62	255	250	125	3
0	173	255	255	101	9	20	0	13	3	13	182	251	245	61	0
0	107	251	241	255	230	98	55	19	118	217	248	253	255	52	4
0	18	146	250	255	247	255	255	255	249	255	240	255	129	0	5
0	0	23	113	215	255	250	248	255	255	248	248	118	14	12	0
0	0	6	1	0	52	153	233	255	252	147	37	0	0	4	1
0	0	5	5	0	0	0	0	0	14	1	0	6	6	0	0





157	153	174	168	150	152	129	151	172	161	155	156
155	182	163	74	75	62	33	17	110	210	180	154
180	180	50	14	34	6	10	33	48	106	159	181
206	109	5	124	131	111	120	204	166	15	56	180
194	68	137	251	237	239	239	228	227	87	71	201
172	105	207	233	233	214	220	239	228	98	74	206
188	88	179	209	185	215	211	158	139	75	20	169
189	97	165	84	10	168	134	11	31	62	22	148
199	168	191	193	158	227	178	143	182	106	36	190
205	174	155	252	236	231	149	178	228	43	95	234
190	216	116	149	236	187	86	150	79	38	218	241
190	224	147	108	227	210	127	102	36	101	255	224
190	214	173	66	103	143	96	50	2	109	249	215
187	196	235	75	1	81	47	0	6	217	255	211
183	202	237	145	0	0	12	108	200	138	243	236
195	206	123	207	177	121	123	200	175	13	96	218

157	153	174	168	150	152	129	151	172	161	155	156
155	182	163	74	75	62	33	17	110	210	180	154
180	180	50	14	34	6	10	33	48	106	159	181
206	109	5	124	131	111	120	204	166	15	56	180
194	68	137	251	237	239	239	228	227	87	71	201
172	105	207	233	233	214	220	239	228	98	74	206
188	88	179	209	185	215	211	158	139	75	20	169
189	97	165	84	10	168	134	11	31	62	22	148
199	168	191	193	158	227	178	143	182	106	36	190
205	174	155	252	236	231	149	178	228	43	95	234
190	216	116	149	236	187	86	150	79	38	218	241
190	224	147	108	227	210	127	102	36	101	255	224
190	214	173	66	103	143	96	50	2	109	249	215
187	196	235	75	1	81	47	0	6	217	255	211
183	202	237	145	0	0	12	108	200	138	243	236
195	206	123	207	177	121	123	200	175	13	96	218



Algebra Lineal en Data Science

- Regresión Lineal
- Deep Learning
- Computer Vision
- Estadística Multivariable
- Natural Language Processing

Algebra Lineal en Data Science

PageRank = Linear Algebra

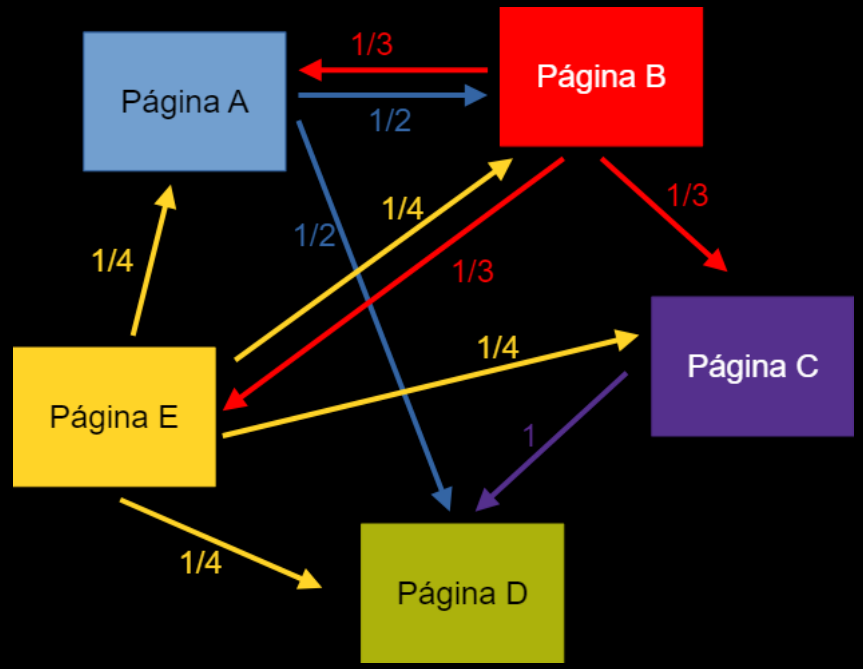
THE $25,000,000,000* EIGENVECTOR
THE LINEAR ALGEBRA BEHIND GOOGLE

KURT BRYAN† AND TANYA LEISE‡

Abstract. Google's success derives in large part from its PageRank algorithm, which ranks the importance of webpages according to an eigenvector of a weighted link matrix. Analysis of the PageRank formula provides a wonderful applied topic for a linear algebra course. Instructors may assign this article as a project to more advanced students, or spend one or two lectures presenting the material with assigned homework from the exercises. This material also complements the discussion of Markov chains in matrix algebra. Maple and Mathematica files supporting this material can be found at www.rose-hulman.edu/~bryan.

Key words. linear algebra, PageRank, eigenvector, stochastic matrix

AMS subject classifications. 15-01, 15A18, 15A51



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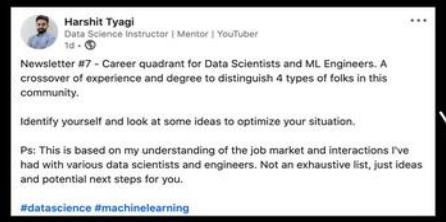
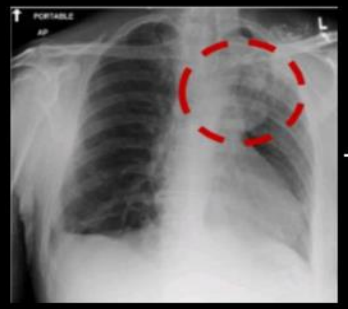
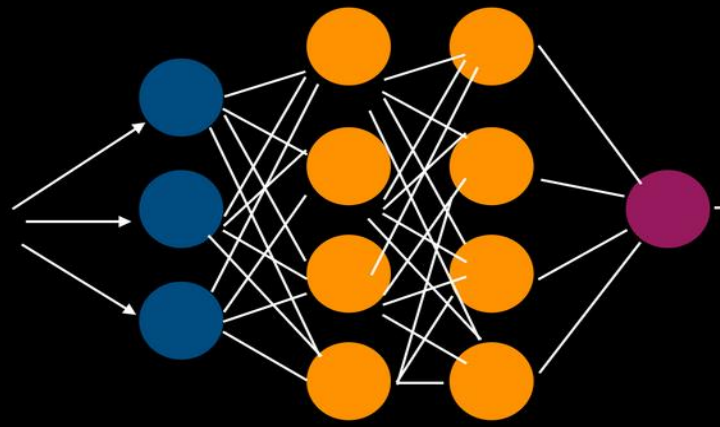




[[12, 213, 44, 15],
[20, 113, 39, 10],
[13, 117, 45, 13],
[25, 120, 49, 14],
…,
…,
]

Tensor



[[0.98, 0.45, 0.44, 0.95],
[0.23, 0.13, 0.39, 0.89],
[0.13, 0.77, 0.55, 0.23],
[0.25, 0.20, 0.49, 0.14],
…,
…,
]

Tensor

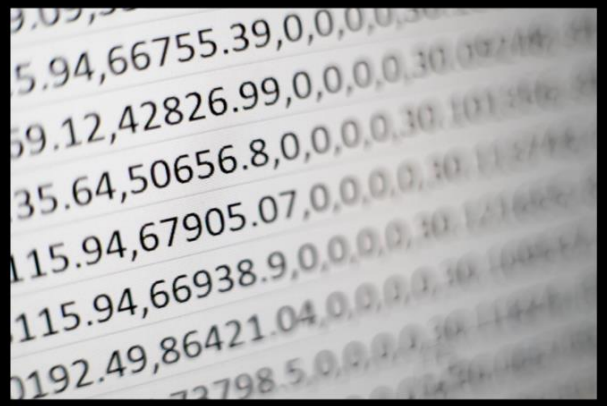
Attend the session!

Atelactasis

Ok Google, set alarm for 5 AM.

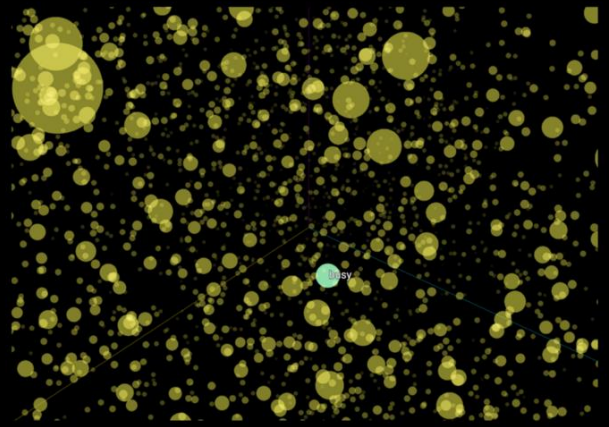
Algebra Lineal en Data Science

Más ejemplos



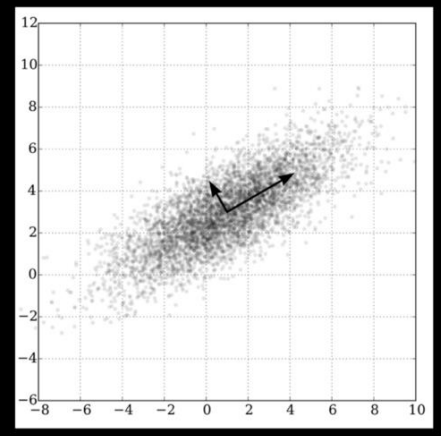
Data Representation

Using vectors, matrices and tensors to represent data.



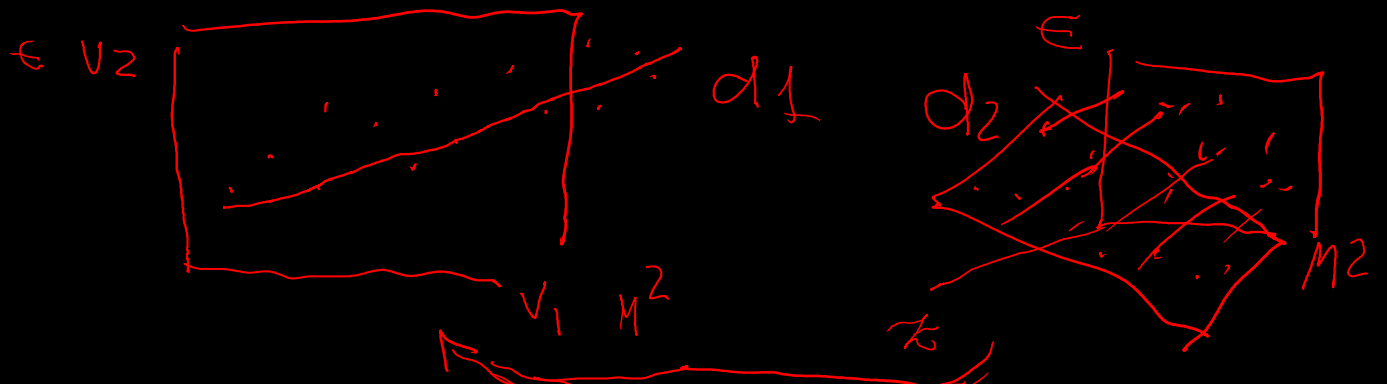
Word Embeddings

Embedding vectors to efficiently represent words for natural language problems

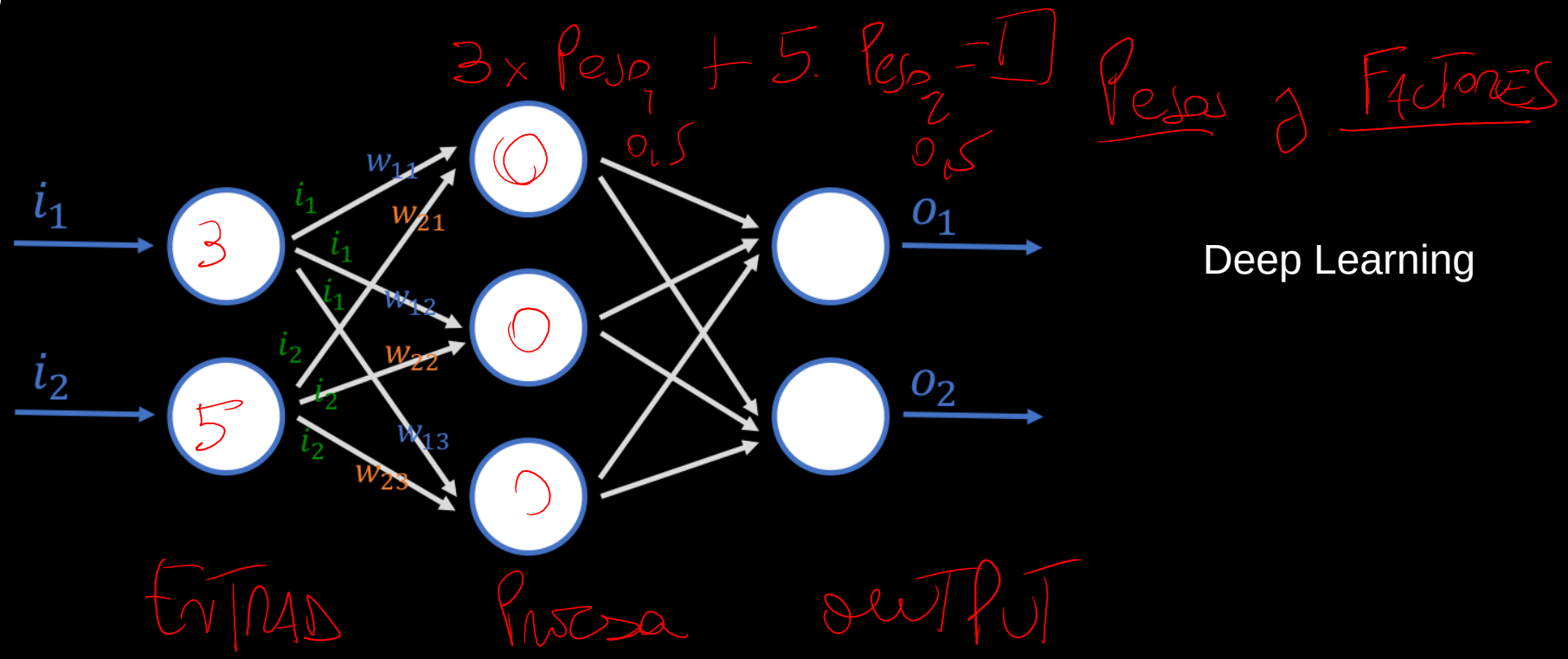


Dimensionality Reduction

Using eigenvectors and eigenvalues to deal with large-dimensional data.



Algebra Lineal en Data Science



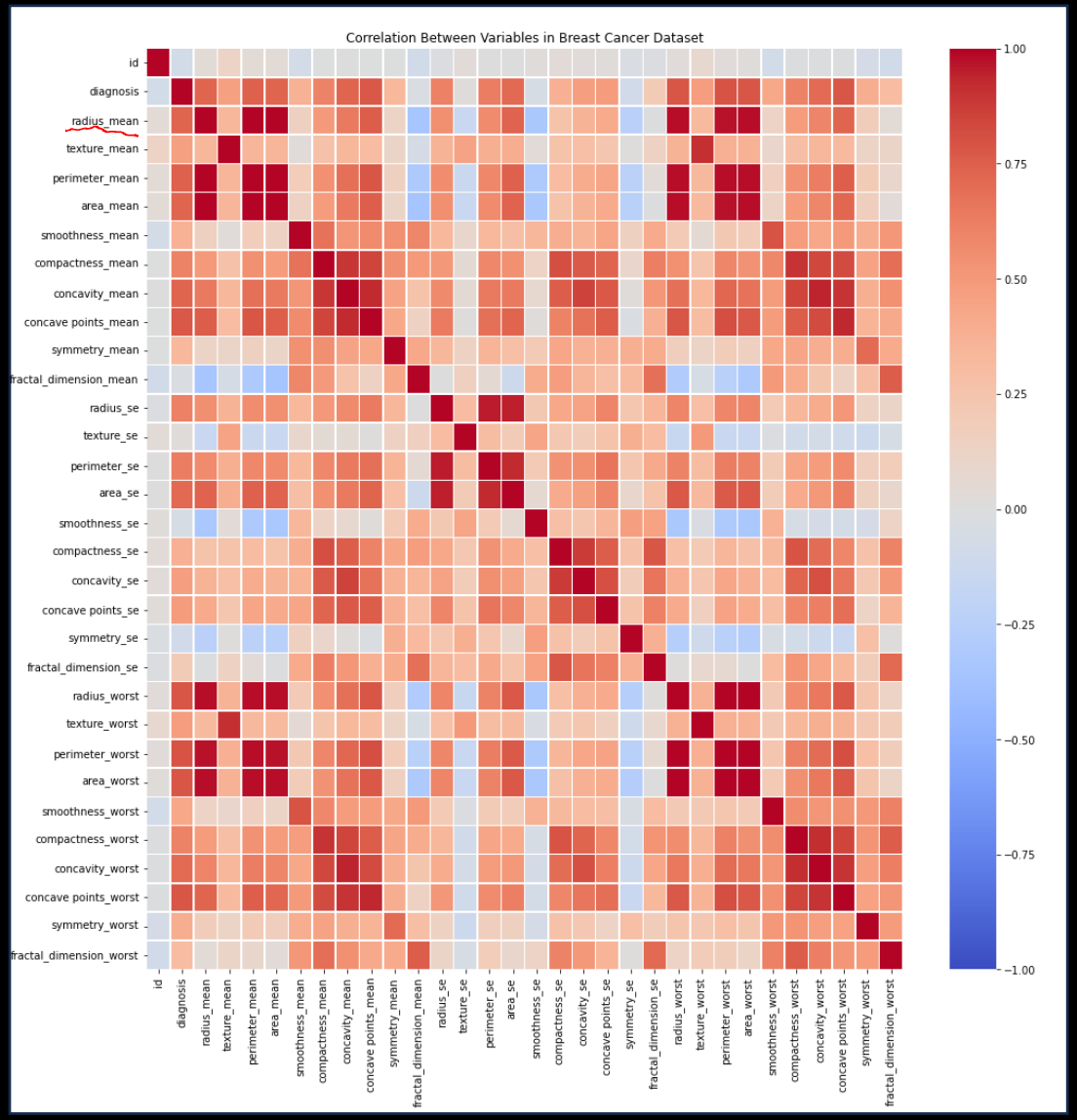
Deep Learning

Imagen

$$\begin{matrix} w_{11} & w_{21} \\ w_{12} & w_{22} \\ w_{13} & w_{23} \end{matrix} \quad \begin{matrix} i_1 \\ i_2 \end{matrix}$$

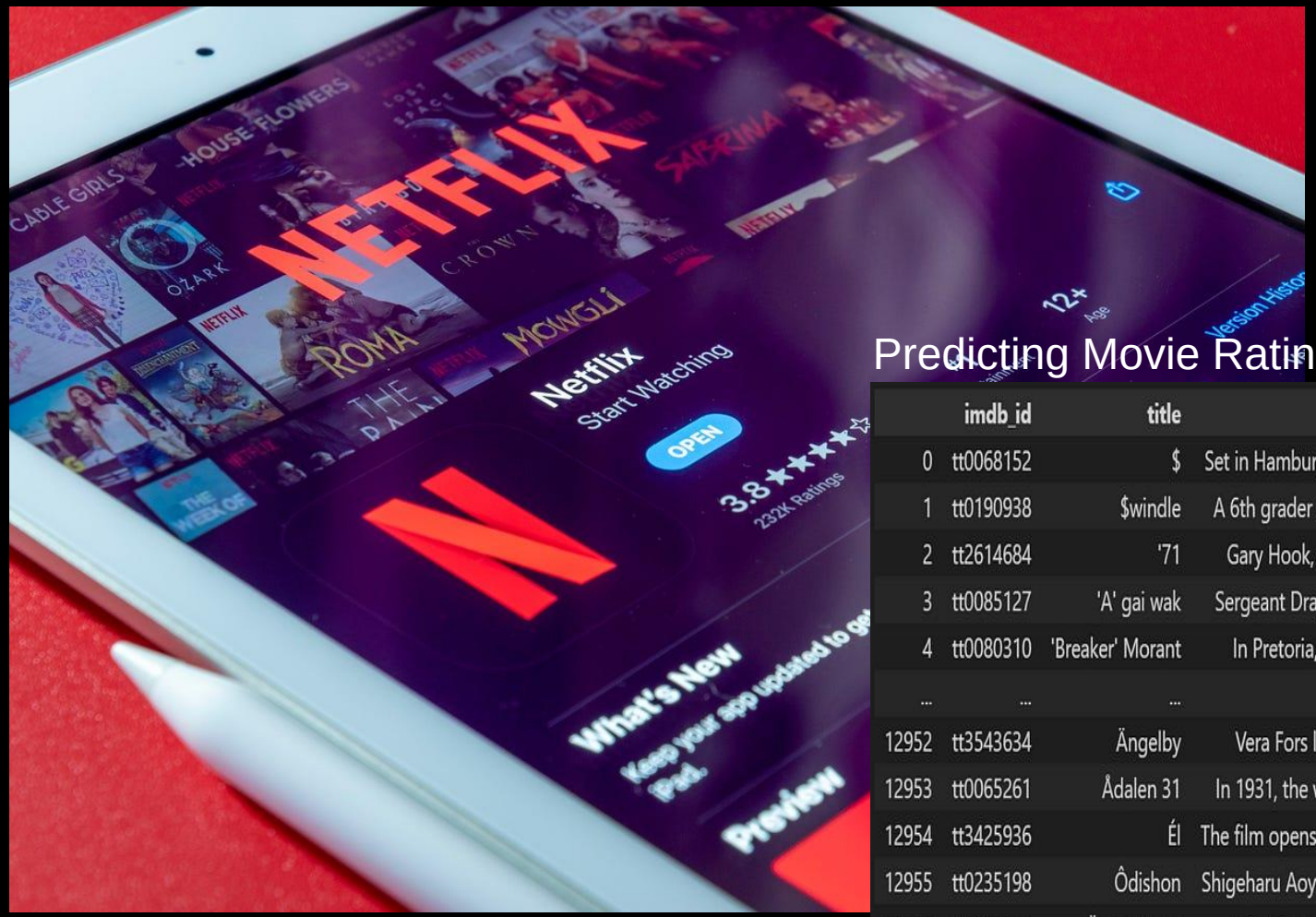
$$\begin{matrix} w_{11} & i_1 & w_{21} & i_2 \\ w_{12} & i_1 & w_{22} & i_2 \\ w_{13} & i_1 & w_{23} & i_2 \end{matrix}$$

Algebra Lineal en Data Science



Correlations Breast Cancer Dataset

Algebra Lineal en Data Science



Movie	Alice (1)	Bob (2)	Carol (3)	Dave (4)	Eve (5)
Love at last	5	5	0	0	?
Romance forever	5	?	?	0	?
Cute puppies of love	?	4	0	?	?
Nonstop car chases	0	0	5	4	?
Swords vs. karate	0	0	5	?	?

$$Y = \begin{bmatrix} 5 & 5 & 0 & 0 & ? \\ 5 & ? & ? & 0 & ? \\ ? & 4 & 0 & ? & ? \\ 0 & 0 & 5 & 4 & ? \\ 0 & 0 & 5 & 0 & ? \end{bmatrix}$$

$$\min_{\substack{x^{(1)},\dots,x^{(n_m)} \\ \theta^{(1)},\dots,\theta^{(n_u)}}} \frac{1}{2} \sum_{(i,j):r(i,j)=1} ((\theta^{(j)})^T x^{(i)} - y^{(i,j)})^2 + \frac{\lambda}{2} \sum_{i=1}^{n_m} \sum_{k=1}^{n} (x_k^{(i)})^2 + \frac{\lambda}{2} \sum_{j=1}^{n_u} \sum_{k=1}^{n} (\theta_k^{(j)})^2$$

$n=2$ $\quad \theta^{(5)} \in \mathbb{R}^2$ $\quad \theta^{(5)} = \begin{bmatrix} 0 \\ 0 \end{bmatrix}$

$$\frac{\lambda}{2}\left[(\theta_1^{(5)})^2 + (\theta_2^{(5)})^2\right]$$

$$(\theta^{(5)})^T x^{(i)} = 0$$

Predicting Movie Ratings

	imdb_id	title	plot_synopsis	tags	split	synopsis_source
0	tt0068152	$	Set in Hamburg, West Germany, several criminal...	murder	test	imdb
1	tt0190938	$windle	A 6th grader named Griffin Bing decides to gat...	flashback	train	wikipedia
2	tt2614684	'71	Gary Hook, a new recruit to the British Army, ...	suspenseful, neo noir, murder, violence	train	wikipedia
3	tt0085127	'A' gai wak	Sergeant Dragon Ma (Jackie Chan) is part of th...	cult, violence	train	wikipedia
4	tt0080310	'Breaker' Morant	In Pretoria, South Africa, in 1902, Major Char...	murder, anti war, violence, flashback, tragedy...	train	wikipedia
...	...	...	...	...	...	...
12952	tt3543634	Ängelby	Vera Fors lives an ordinary life with her husb...	paranormal, murder	train	wikipedia
12953	tt0065261	Ådalen 31	In 1931, the working-class family Andersson of...	romantic	val	wikipedia
12954	tt3425936	Él	The film opens during a foot washing ceremony ...	autobiographical	train	wikipedia
12955	tt0235198	Ôdishon	Shigeharu Aoyama (Ryo Ishibashi), a middle-age...	cruelty, murder, cult, violence, flashback, ps...	train	imdb
12956	tt1233381	Üç Maymun	A family is dislocated when small failings bec...	murder	train	wikipedia

12957 rows × 7 columns

Algebra Lineal : Vectores

Data Representation

Height	Age	Weight
170	24	70
165	45	65
190	28	102
180	34	83
182	30	79
178	67	85

$$\begin{bmatrix} 170 \\ 24 \\ 70 \end{bmatrix}$$