Singular Value Decomposition

- Algorithm for factoring a matrix of multivariate data
- Creates a 2 new eigenvector matrices
- Diagonal matrix of scalar values
- Separates column vectors and row vectors
- Scales them with singular values
- Ranks them in order of decreasing importance

4	4	5
4	5	5
3	3	2
4	5	4
4	4	4
3	5	4
4	4	3
2	4	4
5	5	5

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0.35	0.09	-0.64
0.38	0.19	-0.10
0.22	-0.40	0.28
0.36	-0.08	0.33
0.33	-0.18	-0.20
0.33	0.33	0.48
0.30	-0.44	0.23
0.28	0.64	0.10
0.41	-0.22	-0.25

*

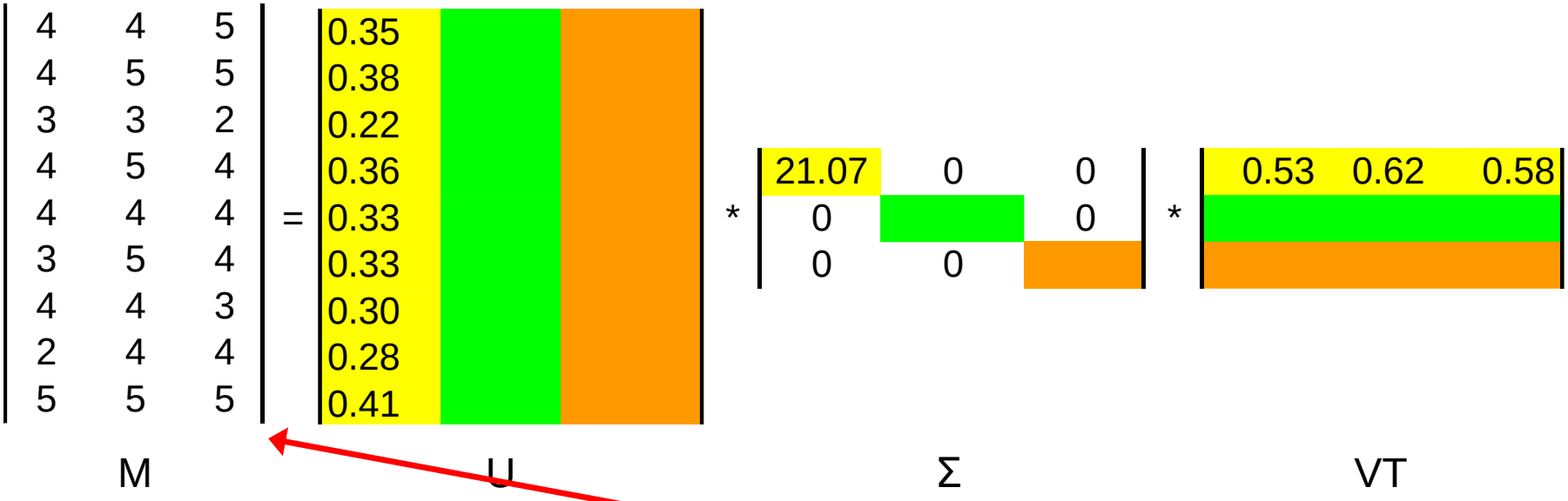
21.07	0	0
0	2.01	0
0	0	1.42

*

0.53	0.62	0.58
-0.82	0.20	0.53
-0.21	0.76	-0.62

M matrix U matrix Σ matrix VT matrix

How does SVD work?



Factor Matrix, M, into Column Vectors, U, Singular Values, Σ, and Row Vectors, VT

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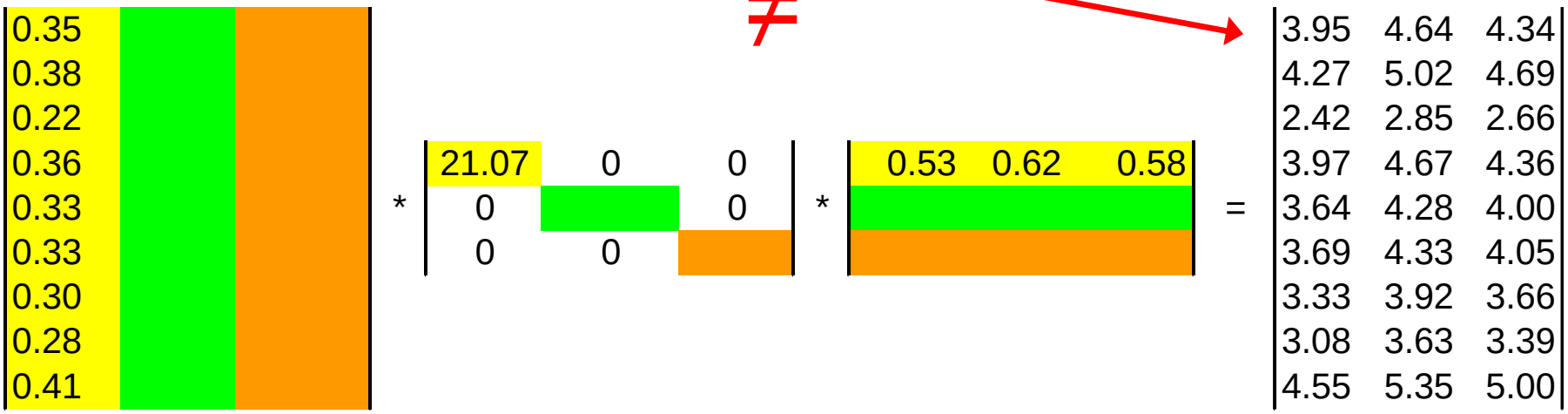


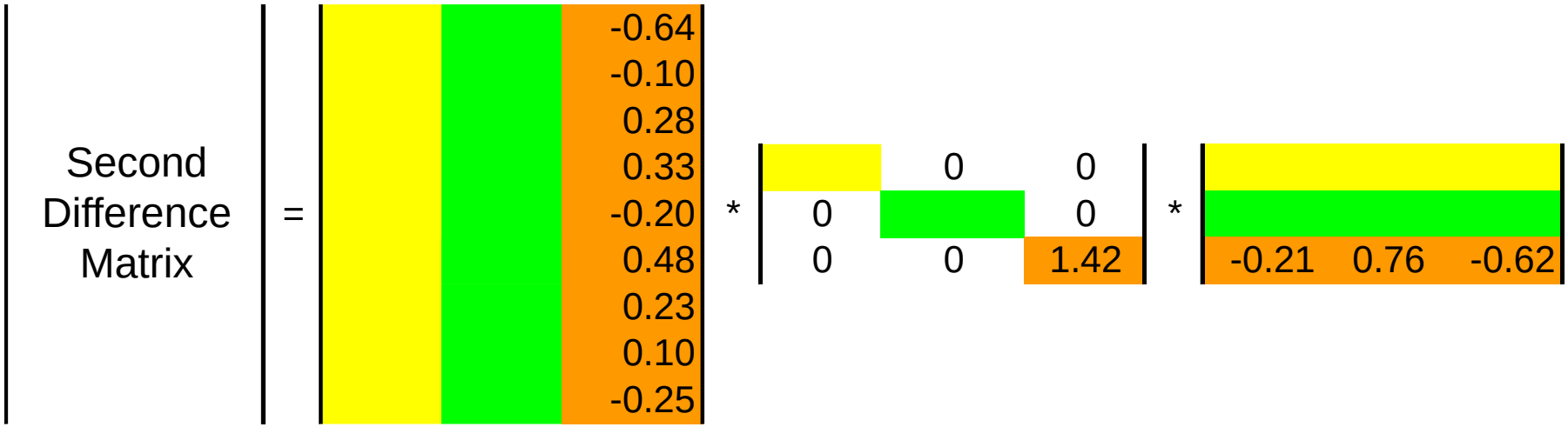
4	4	5		3.95	4.64	4.34		0.05	-0.64	0.66
4	5	5		4.27	5.02	4.69		-0.28	-0.02	0.31
3	3	2		2.42	2.85	2.66		0.58	0.15	-0.66
4	5	4		3.97	4.67	4.36		0.03	0.33	-0.36
4	4	4	-	3.64	4.28	4.00	=	0.36	-0.28	0.00
3	5	4		3.69	4.33	4.05		-0.69	0.67	-0.05
4	4	3		3.33	3.92	3.66		0.67	0.08	-0.66
2	4	4		3.08	3.63	3.39		-1.08	0.37	0.61
5	5	5		4.55	5.35	5.00		0.45	-0.35	0.00

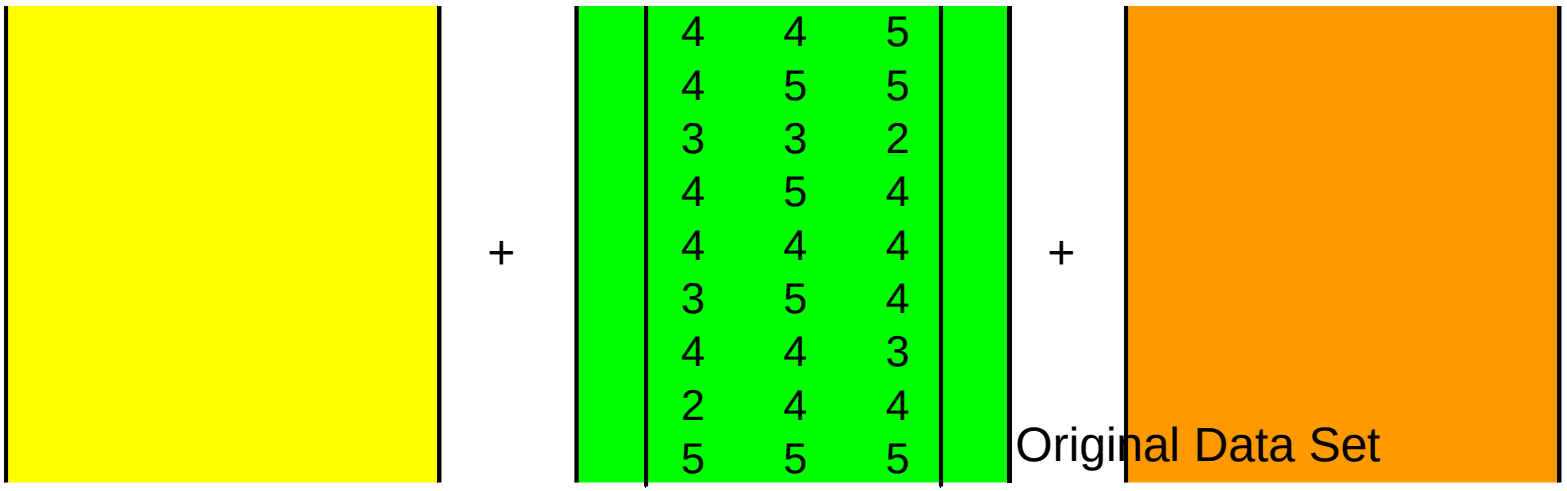
Difference Matrix

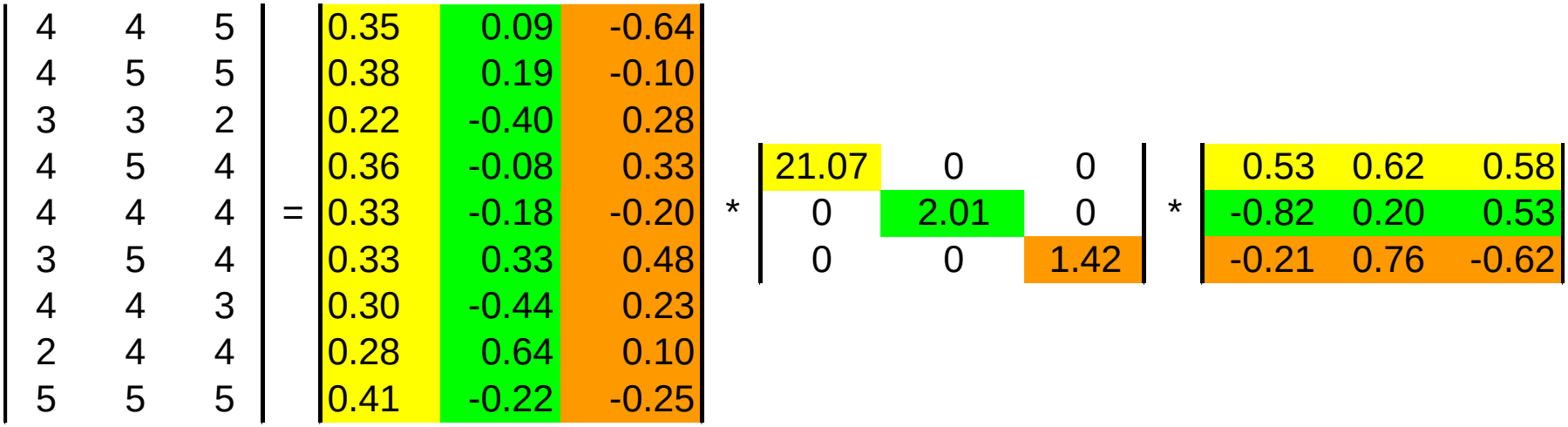
- Subtracts the factored matrix from the original matrix
- Creates a difference matrix
- Factors the difference matrix
- Obtain second column vector, singular value, and row vector

0.05	-0.64	0.66			0.09			0	0								
-0.28	-0.02	0.31			0.19												
0.58	0.15	-0.66			-0.40												
0.03	0.33	-0.36			-0.08												
0.36	-0.28	0.00	≠		-0.18		*	0	2.01	0	*	-0.82	0.20	0.53			
-0.69	0.67	-0.05			0.33												
0.67	0.08	-0.66			-0.44			0	0								
-1.08	0.37	0.61			0.64												
0.45	-0.35	0.00			-0.22												

- SVD subtracts the new factored matrix to create a second difference matrix
- The second difference matrix is factored into a third column vector and a third row vector with another singular value







Now this overall statement is true.