

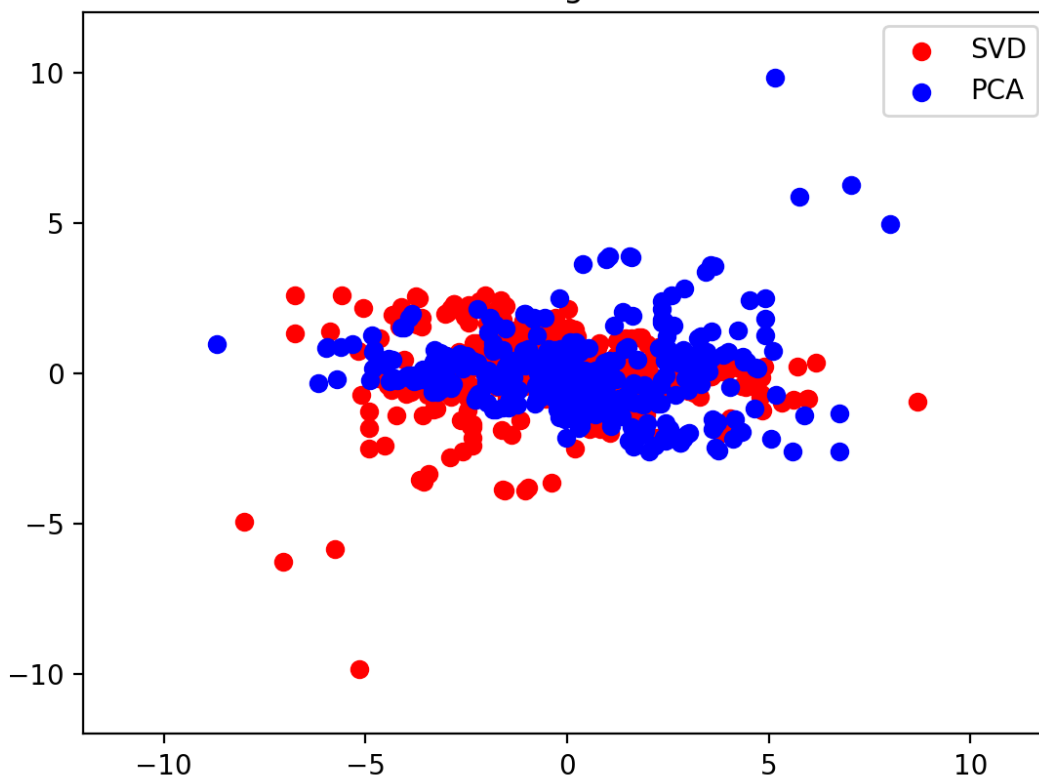
Brandon Luong

2. They are not the same. PCA and SVD are orthogonal to each other. The eigenvalues are flipped, PCA is $[x, -y]$ and SVD is $[-x, y]$. They both still pick Dealer Price and Retail Price to be the columns with the highest variance.

```
checking if PCA pc are orthogonal: -0.0
checking if SVD pc are orthogonal: 0.0
```

PCA		SVD
0.2637504434, 0.4685086975		-0.2637504434, -0.4685086975
0.2623186388, 0.4701465851		-0.2623186388, -0.4701465851
0.347080492, -0.0153471865		-0.347080492, 0.0153471865
0.3341887576, 0.0780320109		-0.3341887576, -0.0780320109
0.3186022585, 0.2922134761		-0.3186022585, -0.2922134761
-0.3104817267, -0.0033659358		0.3104817267, 0.0033659358
-0.3065886386, -0.0109644601		0.3065886386, 0.0109644601
0.3363293669, -0.1674635715		-0.3363293669, 0.1674635715
0.2662100336, -0.418177107		-0.2662100336, 0.418177107
0.2567901877, -0.4084113807		-0.2567901877, 0.4084113807
0.2960545914, -0.3128913502		-0.2960545914, 0.3128913502

SVD and PCA Using Normalized Data



PCA	II	SVD
1.5674430636, -0.4472724582	II	-1.5674430636, 0.4472724582
1.6356483399, -0.3397319469	II	-1.6356483399, 0.3397319469
1.9066185788, -0.4111386039	II	-1.9066185788, 0.4111386039
1.5901986477, 3.862579372	II	-1.5901986477, -3.862579372
-2.6547635333, 0.6544513335	II	2.6547635333, -0.6544513335
0.4412425473, 0.0811070504	II	-0.4412425473, -0.0811070504
-1.5381110973, 0.0283394434	II	1.5381110973, -0.0283394434
-2.0364083375, -0.0619046098	II	2.0364083375, 0.0619046098
-1.5339429783, 0.2322042074	II	1.5339429783, -0.2322042074
0.1509915682, 0.8018690073	II	-0.1509915682, -0.8018690073
-0.4100932632, 0.4709363607	II	0.4100932632, -0.4709363607
-0.0226164654, 0.5258027755	II	0.0226164654, -0.5258027755
0.0228169406, 0.5685083463	II	-0.0228169406, -0.5685083463
0.5221142681, 0.847423195	II	-0.5221142681, -0.847423195
0.9057821502, 0.2531061251	II	-0.9057821502, -0.2531061251
0.3472865469, -0.1138695036	II	-0.3472865469, 0.1138695036
0.9143886432, -0.0180059778	II	-0.9143886432, 0.0180059778
0.8087162784, -0.0378180128	II	-0.8087162784, 0.0378180128
2.4996408188, 0.7937269531	II	-2.4996408188, -0.7937269531
4.3834405911, 0.3932657715	II	-4.3834405911, -0.3932657715
2.3576130438, 1.7820899045	II	-2.3576130438, -1.7820899045
2.391094615, 1.7626644215	II	-2.391094615, -1.7626644215
4.9143021816, 2.4923783185	II	-4.9143021816, -2.4923783185
-1.9641266413, 1.3607825359	II	1.9641266413, -1.3607825359
-1.7827214655, 1.6097134844	II	1.7827214655, -1.6097134844
-0.5642397602, 1.8437583742	II	0.5642397602, -1.8437583742
-1.0329412865, 0.2424709697	II	1.0329412865, -0.2424709697
-0.9625518, 0.3264677672	II	0.9625518, -0.3264677672
-0.4288061087, 0.5884081644	II	0.4288061087, -0.5884081644
-0.7027323085, 0.2729643372	II	0.7027323085, -0.2729643372
-0.5153103636, 0.3673537396	II	0.5153103636, -0.3673537396
-0.4711635052, 0.7935746403	II	0.4711635052, -0.7935746403
0.0693272831, 1.0368374632	II	-0.0693272831, -1.0368374632
-0.5112751123, 0.7220038154	II	0.5112751123, -0.7220038154
-0.3155999935, 0.7603590572	II	0.3155999935, -0.7603590572
0.3944948228, -0.5048945221	II	-0.3944948228, 0.5048945221
0.7386390268, -0.1181527087	II	-0.7386390268, 0.1181527087
2.8880205357, 0.7869098263	II	-2.8880205357, -0.7869098263
3.9982220961, 0.6923059597	II	-3.9982220961, -0.6923059597
4.4517716674, 0.3814809823	II	-4.4517716674, -0.3814809823
1.1586810444, 1.5773765097	II	-1.1586810444, -1.5773765097
1.6123718844, 1.8932200471	II	-1.6123718844, -1.8932200471
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3.4701199756, 0.722935891	II	-3.4701199756, -0.722935891
-1.5128949559, 1.4722683208	II	1.5128949559, -1.4722683208
-1.0462434222, 1.9584098339	II	1.0462434222, -1.9584098339
-0.2321943504, -1.2178510927	II	0.2321943504, 1.2178510927

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0.0611243689, -0.3076034132 || -0.0611243689, 0.3076034132
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3. In our case:

	PC1	PC2
1.	[-725.18054467	-341.57979887]
2.	[-721.24380473	-342.77394816]
3.	[-954.29610266	11.1893096]
4.	[-918.85034246	-56.8914915]
5.	[-875.99533986	-213.04667542]
6.	[853.66797782	2.45403269]
7.	[842.96395113	7.99395638]
8.	[-924.73593721	122.09415405]
9.	[-731.94317561	304.88409895]
10.	[-706.04335572	297.76411411]
11.	[-814.00064035	228.12247676]]

The first column representing PC1 has a higher variance for each feature. Therefore all features contributed the most to PC1, and only a small amount to PC2.

It also confirmed when you check the eigen_value/eigensum:

1,	0.65
2,	0.82
3,	0.89
4,	0.93
5,	0.95
6,	0.97
7,	0.97
8,	0.98
9,	0.99
10,	0.99
11,	1.0

Shows that even with only 1 column we are able retain 65% of our original data. From here we can see that:

Feature 1: is strongly negatively correlated to PC1 and PC2
Feature 2: is strongly negatively correlated to PC1 and PC2
Feature 3: is strongly negatively correlated to PC1 and a minimal positive correlation to PC2
Feature 4: is strongly negatively correlated to PC1 and slightly negative correlated PC2
Feature 5: is strongly negatively correlated to PC1 and negative correlated PC2
Feature 6: is strongly positively correlated to PC1 and a minimal positive correlation to PC2
Feature 7: is strongly positively correlated to PC1 and a minimal positive correlation to PC2
Feature 8: is strongly negatively correlated to PC1 and a positive correlation to PC2
Feature 9: is strongly negatively correlated to PC1 and a positive correlation to PC2
Feature 10: is strongly negatively correlated to PC1 and a positive correlation to PC2
Feature 11: is strongly negatively correlated to PC1 and a positive correlation to PC2

Please view output and image if you need more information. I Printed everything