pre (mostly useless unless you need to import)

```
StringJoin["C:\\Users\\George\\Documents\\SVD DNA stuff\\CombinedPCV1CjkSingularValues",
 "\\C", ToString[j], ToString[k], "SingValsofSVDnum", ToString[12], ".txt" ]
```

```
C:\Users\George\Documents\SVD DNA
  stuff\CombinedPCV1CjkSingularValues\C16SingValsofSVDnum12.txt
```

```
j = 1;
k = 4;
Import[
 StringJoin["C:\\Users\\George\\Documents\\SVD DNA stuff\\CombinedPCV1CjkSingularValues",
  "\\C", ToString[j], ToString[k], "SingValsofSVDnum", ToString[12], ".txt" ]]
```

```
1.8926580267875477 1.880158606106111
```

```
(* j=1;
k=4;
Do[
 Print[
  StringJoin[
   "C:\\Users\\George\\Documents\\SVD DNA stuff\\CombinedPCV1CjkSingularValues",
   "\\C",ToString[j],ToString[k],"SingValsofSVDnum", ToString[i],".txt" ]
 ]
 , {i,2,12}] *)
```

```
ToExpression[ StringJoin["C", ToString[j], ToString[k], "SingValsofSVDnum", ToString[i]] ]
```

```
C14SingValsofSVDnumi
```

```
j = 1;
k = 4;
Do[
 Print[
  Import[
   StringJoin[
    "C:\\Users\\George\\Documents\\SVD DNA stuff\\CombinedPCV1CjkSingularValues",
    "\\C", ToString[j], ToString[k], "SingValsofSVDnum", ToString[i], ".txt" ]
  ]
 ]
 , {i, 2, 12}]
```

```
14.088511395429673 8.659684435111325 0.6884254831603384 0.25335404988111376
```

```
3.753056995535095 2.939176569608536 0.8116832525012424 0.3931996611139725
  0.3363253894505036 0.17407797436561276 0.09447782741128295 2.127481861119625e-14
```

```
1.8887155133555702 1.369818414857094 1.033851499279152 0.6936424704838116
  0.5964940122138949 0.5004187449126801 0.43074794236316216 0.4250843295469037
  0.40651553037871174 0.3818367528865757 0.371445660356083 0.294736366366904
  1.4559132639847626e-07 6.414973828507162e-09 3.691804872295697e-15 7.096805390430533e-16
```

1.3598839969053642 0.9711184371937192 0.7777679965290155 0.7632786824711363
0.7038786661184481 0.6786012544873826 0.6592852290634107 0.6503351963288498
0.6262395882658844 0.6026740739398949 0.5921385688064863 0.5663815632342895
0.5107100723124782 0.49305351156419047 0.46199610438621513 0.4106834024731658
0.39052656005050024 0.3022209377333509 0.20787521025700628 0.00038336576388255724
6.575621536026981e-06 6.3364220966309715e-06 1.5215247691746793e-06 1.877428021823059e-08
1.5925790410126033e-08 7.564564902667875e-09 5.651540559389096e-09 2.0861817426979678e-15
1.2343047431629253e-15 7.453580380599379e-16 6.659805531424212e-16 5.306222464957937e-16

1.1744493633375808 0.9293041643670019 0.9187401205902033 0.8420911389456074 0.8197414707774113
0.8090491900609434 0.7969645948075248 0.7859893869440656 0.7757628086960344 0.7435180844984334
0.7222446754763403 0.7017337240659306 0.6427520095854777 0.6065585497483447 0.5903762505071088
0.576582154179682 0.540149816397642 0.46544572011215485 0.4630794233124105 0.4362819045293155
0.41547748345042046 0.4084763898407047 0.3898843471518465 0.3580591143281068
0.3117460990049348 0.27513202388051017 0.12986860672053332 0.008579445090084084
0.0017937283151359435 0.0016079559716831858 0.0015646679583888863 0.0014597478419606908
0.0007656241058937776 0.0006073170149410816 9.62934468188221e-05 8.555219321131326e-05
7.980192018477778e-05 7.392945045708053e-05 6.391493440741226e-05 5.168913836202479e-05
4.8296081368643966e-05 4.3218234468675214e-05 2.1914589327061188e-05 2.9077158809376258e-08
2.4843285894579995e-08 2.3362357756494352e-08 1.6804635989013854e-08 1.3994757184072316e-08
1.2872178509943047e-08 1.1953842708211409e-08 8.526387369027765e-09 5.521389688758958e-09
3.6791857149469802e-09 3.0622957449979313e-15 7.995953683058509e-16 5.031400995762606e-16
3.137731485796441e-16 2.7169002933161633e-16 2.083746720320685e-16 1.8080466680893906e-16
1.5929531903293389e-16 1.295060040690328e-16 1.1483558501014967e-16 1.0757906142358877e-16

1.2658384408646828 1.1509118893194286 1.0983741467124628 1.0079309976094408 0.948550784918791
0.9341754481874428 0.9220839910459332 0.9048650824673393 0.8951938665487292 0.8888235015195626
0.7687830220368554 0.7228895755240888 0.6929152728995406 0.6648432428860265 0.6420221037528936
0.623423536146668 0.6031123596810911 0.577183804131472 0.5513277595250606 0.5280284395445121
0.5243322050604079 0.49751108147626505 0.45478271983274543 0.4380232119165392
0.43495537695329484 0.387596584693923 0.3875079561800164 0.37540791910883736
0.3442923076243814 0.3323530458916579 0.31259152816023633 0.2921186924031766
0.2796038022309513 0.26499955877695974 0.23573595556061908 0.21231876364219177
0.20386591353235545 0.17914111958430118 0.15177930074153856 0.13234076305925277
0.10189033077670923 0.06542019027971667 0.050554472044981175 0.02650322706758053
0.02440072909662459 0.023151147936729947 0.0215266894731874 0.019333923340398806
0.018832176002486205 0.01597396423285484 0.013552735948049342 0.01136196767088698
0.009185030233438727 0.006780254552763283 0.005843484725464627 0.005532307118491932
0.004533121330385443 0.0036169485465811202 0.003183487905611653 0.0031223387623326025
0.0028469680216972387 0.0021730751613514747 0.0012278764073286835 0.0008746522128033403

1.3669536128592743 1.3454771168546937 1.2533782850291415 1.2224697632099917 1.1626361968805028
1.1033162520283166 1.08850048849956 1.071416695002445 0.9849327208032196 0.9537064294312538
0.8989847523595451 0.8870864511618427 0.8808586165181339 0.8505263013144791 0.8220251425645217
0.7866831073260784 0.7761320597901318 0.7393764118205804 0.7138728429773336
0.6859804055138465 0.6555941551683542 0.636933601736595 0.6228207170351926 0.5734738929857257
0.5561098850796637 0.5476509993639426 0.4882638794815287 0.46622687038716254
0.45392958912797554 0.4267980338365026 0.345745215400175 0.3241093134112046

1.56005657965681 1.4620932629105676 1.428191404422225 1.4095489644327936
1.379388264107785 1.332179267391429 1.28514296108315 1.2803146818750397
1.253789270156118 1.2188284600425283 1.1913343674884815 1.1290517842301182
1.1095861200032542 1.0715611979848187 1.001173292872265 0.9961763486535692

```
1.6888213684181959 1.6635031058613887 1.6233849283083945 1.6061688577663709
  1.5802734332236599 1.5551199435998002 1.4989912873345148 1.4530182250467631

1.8172031503754376 1.8072538204575401 1.7731090974416042 1.719584722203624

1.8926580267875477 1.880158606106111
```

```
j = 1;
k = 4;
Do[
 ToExpression[
   StringJoin["C", ToString[j], ToString[k], "SingValsofSVDnum", ToString[i]] ] =
  Import[
   StringJoin[
    "C:\\Users\\George\\Documents\\SVD DNA stuff\\CombinedPCV1CjkSingularValues",
    "\\C", ToString[j], ToString[k], "SingValsofSVDnum", ToString[i], ".txt" ]
  ]
 , {i, 2, 12}]
```

```
14. (10^-4) // N
14.10^(-4) // N
```

```
0.0014

0.0000253002
```

```
Digi
```

```
j = 1;
k = 4;
Import[
 StringJoin["C:\\Users\\George\\Documents\\SVD DNA stuff\\CombinedPCV1CjkSingularValues",
  "\\C", ToString[j], ToString[k], "SingValsofSVDnum", ToString[5], ".txt" ]]
StringReplace[Import[StringJoin[
   "C:\\Users\\George\\Documents\\SVD DNA stuff\\CombinedPCV1CjkSingularValues", "\\C",
   ToString[j], ToString[k], "SingValsofSVDnum", ToString[5], ".txt" ]], {"e" → "(10^",
  StringJoin["-", DigitCharacter] → StringJoin["(", "-", DigitCharacter, ")"]} ]
```

```
{1.3598839969053642, 0.9711184371937192, 0.7777679965290155, 0.7632786824711363,
  0.7038786661184481, 0.6786012544873826, 0.6592852290634107, 0.6503351963288498,
  0.6262395882658844, 0.6026740739398949, 0.5921385688064863, 0.5663815632342895,
  0.5107100723124782, 0.49305351156419047, 0.46199610438621513, 0.4106834024731658,
  0.39052656005050024, 0.3022209377333509, 0.20787521025700628, 0.00038336576388255724,
  6.575621536026981e-06, 6.3364220966309715e-06, 1.5215247691746793e-06,
  1.877428021823059e-08, 1.5925790410126033e-08, 7.564564902667875e-09,
  5.651540559389096e-09, 2.0861817426979678e-15, 1.2343047431629253e-15,
  7.453580380599379e-16, 6.659805531424212e-16, 5.306222464957937e-16}
```

```
{1.3598839969053642, 0.9711184371937192, 0.7777679965290155, 0.7632786824711363,
   0.7038786661184481, 0.6786012544873826, 0.6592852290634107, 0.6503351963288498,
   0.6262395882658844, 0.6026740739398949, 0.5921385688064863, 0.5663815632342895,
   0.5107100723124782, 0.49305351156419047, 0.46199610438621513,
   0.4106834024731658, 0.39052656005050024, 0.3022209377333509,
   0.20787521025700628, 0.00038336576388255724, 6.575621536026981(10^ ~~
 (- <> DigitCharacter <> ) ~~ 6, 6.3364220966309715(10^ ~~
 (- <> DigitCharacter <> ) ~~
 6, 1.5215247691746793(10^ ~~
 (- <> DigitCharacter <> ) ~~
 6, 1.877428021823059(10^ ~~
 (- <> DigitCharacter <> ) ~~
 8, 1.5925790410126033(10^ ~~
 (- <> DigitCharacter <> ) ~~ 8, 7.564564902667875(10^ ~~
 (- <> DigitCharacter <> ) ~~ 9, 5.651540559389096(10^ ~~
 (- <> DigitCharacter <> ) ~~ 9, 2.0861817426979678(10^ ~~
 (- <> DigitCharacter <> ) ~~ 5, 1.2343047431629253(10^ ~~
 (- <> DigitCharacter <> ) ~~ 5, 7.453580380599379(10^ ~~
 (- <> DigitCharacter <> ) ~~ 6, 6.659805531424212(10^ ~~
 (- <> DigitCharacter <> ) ~~ 6, 5.306222464957937(10^ ~~
 (- <> DigitCharacter <> ) ~~ 6}
```

```
StringReplace[Import[StringJoin[
   "C:\\Users\\George\\Documents\\SVD DNA stuff\\CombinedPCV1CjkSingularValues", "\\C",
   ToString[j], ToString[k], "SingValsofSVDnum", ToString[5], ".txt" ]], {"e" → "(10^("} ]
```

```
{1.3598839969053642, 0.9711184371937192, 0.7777679965290155, 0.7632786824711363,
  0.7038786661184481, 0.6786012544873826, 0.6592852290634107, 0.6503351963288498,
  0.6262395882658844, 0.6026740739398949, 0.5921385688064863, 0.5663815632342895,
  0.5107100723124782, 0.49305351156419047, 0.46199610438621513, 0.4106834024731658,
  0.39052656005050024, 0.3022209377333509, 0.20787521025700628, 0.00038336576388255724,
  6.575621536026981(10^(-06, 6.3364220966309715(10^(-06, 1.5215247691746793(10^(-06,
  1.877428021823059(10^(-08, 1.5925790410126033(10^(-08, 7.564564902667875(10^(-09,
  5.651540559389096(10^(-09, 2.0861817426979678(10^(-15, 1.2343047431629253(10^(-15,
  7.453580380599379(10^(-16, 6.659805531424212(10^(-16, 5.306222464957937(10^(-16}
```

```
C14SingValsofSVDnum5 =
 ToExpression["{1.3598839969053642, 0.9711184371937192, 0.7777679965290155,
    0.7632786824711363, 0.7038786661184481, 0.6786012544873826, 0.6592852290634107,
    0.6503351963288498, 0.6262395882658844, 0.6026740739398949, 0.5921385688064863,
    0.5663815632342895, 0.5107100723124782, 0.49305351156419047,
    0.46199610438621513, 0.4106834024731658, 0.39052656005050024,
    0.3022209377333509, 0.20787521025700628, 0.00038336576388255724,
    6.575621536026981(10^(-06)), 6.3364220966309715(10^(-06)),
    1.5215247691746793(10^(-06)), 1.877428021823059(10^(-08)),
    1.5925790410126033(10^(-08)), 7.564564902667875(10^(-09)),
    5.651540559389096(10^(-09)), 2.0861817426979678(10^(-15)),
    1.2343047431629253(10^(-15)), 7.453580380599379(10^(-16)),
    6.659805531424212(10^(-16)), 5.306222464957937(10^(-16))}" ]
```

$$\{1.35988, 0.971118, 0.777768, 0.763279, 0.703879, 0.678601, 0.659285, 0.650335,\ 0.62624, 0.602674, 0.592139, 0.566382, 0.51071, 0.493054, 0.461996, 0.410683,\ 0.390527, 0.302221, 0.207875, 0.000383366, 6.57562\times10^{-6}, 6.33642\times10^{-6},\ 1.52152\times10^{-6}, 1.87743\times10^{-8}, 1.59258\times10^{-8}, 7.56456\times10^{-9}, 5.65154\times10^{-9},\ 2.08618\times10^{-15}, 1.2343\times10^{-15}, 7.45358\times10^{-16}, 6.65981\times10^{-16}, 5.30622\times10^{-16}\}$$

```
Length[C14SingValsofSVDnum5]
```

```
32
```

```
Table[{iter, C14SingValsofSVDnum5[[iter]]}, {iter, 1, Length[C14SingValsofSVDnum5]}]
```

$$\{\{1, 1.35988\}, \{2, 0.971118\}, \{3, 0.777768\}, \{4, 0.763279\}, \{5, 0.703879\},\ \{6, 0.678601\}, \{7, 0.659285\}, \{8, 0.650335\}, \{9, 0.62624\}, \{10, 0.602674\},\ \{11, 0.592139\}, \{12, 0.566382\}, \{13, 0.51071\}, \{14, 0.493054\}, \{15, 0.461996\},\ \{16, 0.410683\}, \{17, 0.390527\}, \{18, 0.302221\}, \{19, 0.207875\}, \{20, 0.000383366\},\ \{21, 6.57562\times10^{-6}\}, \{22, 6.33642\times10^{-6}\}, \{23, 1.52152\times10^{-6}\}, \{24, 1.87743\times10^{-8}\},\ \{25, 1.59258\times10^{-8}\}, \{26, 7.56456\times10^{-9}\}, \{27, 5.65154\times10^{-9}\}, \{28, 2.08618\times10^{-15}\},\ \{29, 1.2343\times10^{-15}\}, \{30, 7.45358\times10^{-16}\}, \{31, 6.65981\times10^{-16}\}, \{32, 5.30622\times10^{-16}\}\}$$

Plots of Singular Values of Combined PCV1 Samples Cjk

C15

C15 samples

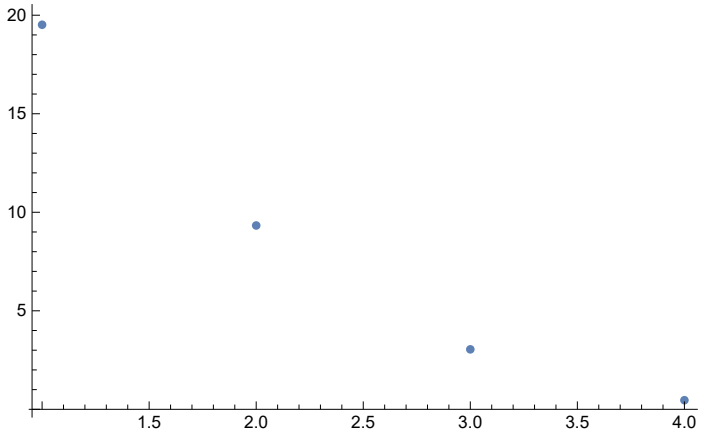
C15 sample plots

```
j = 1;
k = 5;
Do[
 NumberSVD = numSVD;
 CjkSample = ToExpression[StringJoin["C1", ToString[k], "num", ToString[NumberSVD]]];
 Print[
   Style[StringJoin["For C", ToString[j], ToString[k], "the singular values of the ",
     ToString[NumberSVD], "-th SVD are:"], Black, Bold, 18] ]
  Print[Table[{iter, CjkSample[[iter]]}, {iter, 1, Length[CjkSample]}]]
  Print["Plot of singular values: ( i-th Sing Val vs. i) "]
  Print[ListPlot[Table[{iter, CjkSample[[iter]]}, {iter, 1, Length[CjkSample]}]]]
  Print["LogPlot of singular values:  ( Log[i-th Sing Val] vs. i) "]
  Print[ListLogPlot[Table[{iter, CjkSample[[iter]]}, {iter, 1, Length[CjkSample]}]]]
 , {numSVD, 2, 12}]
```

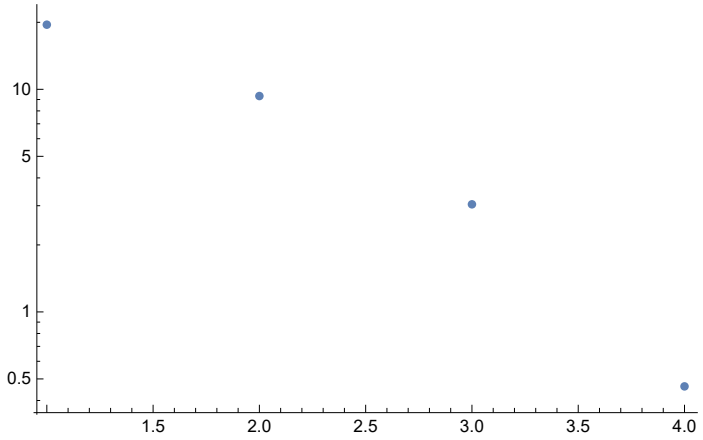
For C15the singular values of the 2-th SVD are:

```
{{1, 19.5162}, {2, 9.3293}, {3, 3.04362}, {4, 0.462841}}
```

Plot of singular values: (i-th Sing Val vs. i)



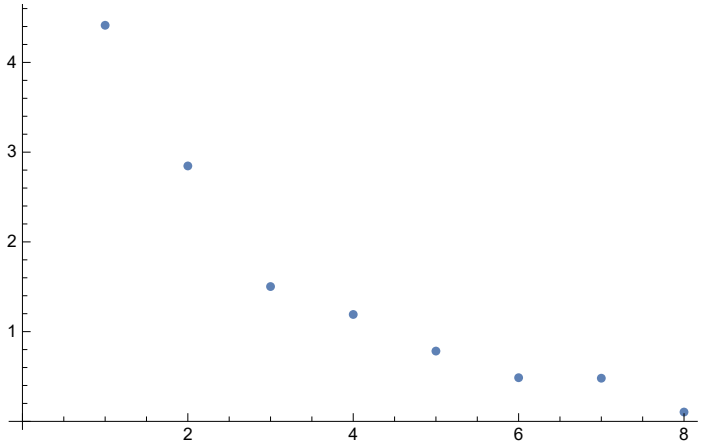
LogPlot of singular values: (Log[i-th Sing Val] vs. i)



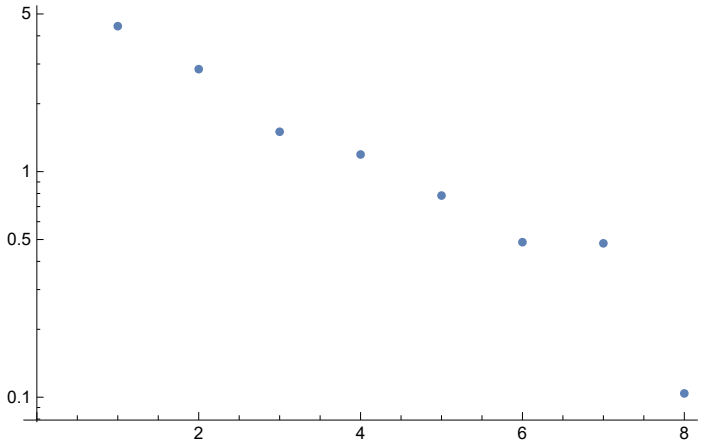
For C15the singular values of the 3-th SVD are:

```
{{1, 4.41379}, {2, 2.84634}, {3, 1.5024}, {4, 1.19121},
 {5, 0.783333}, {6, 0.486658}, {7, 0.480983}, {8, 0.103956}}
```

Plot of singular values: (i-th Sing Val vs. i)



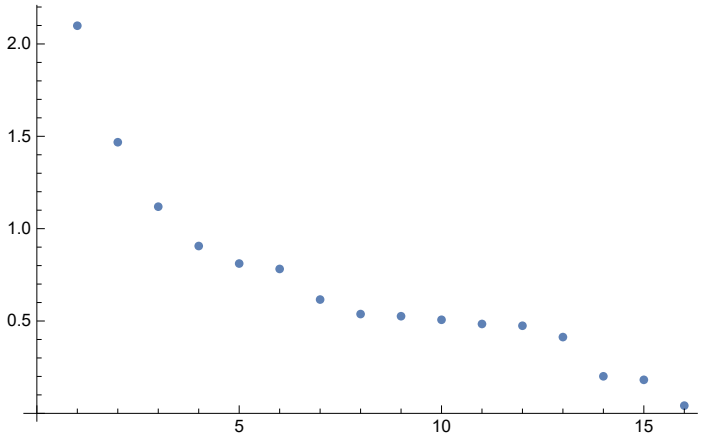
LogPlot of singular values: (Log[i-th Sing Val] vs. i)



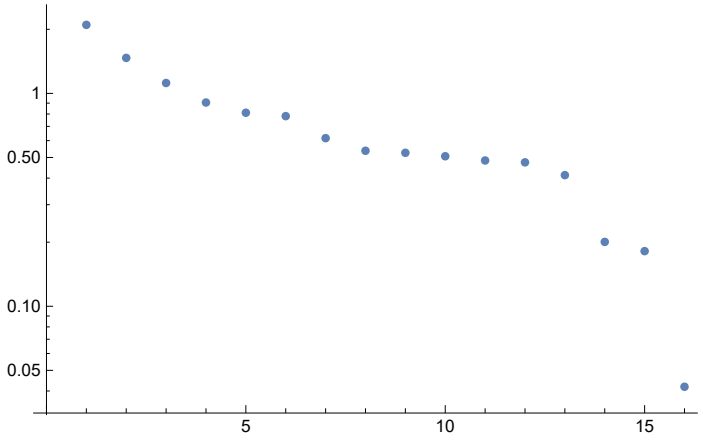
For C15the singular values of the 4-th SVD are:

{{1, 2.09875}, {2, 1.46795}, {3, 1.11901}, {4, 0.906}, {5, 0.811133}, {6, 0.781885},
 {7, 0.616154}, {8, 0.53763}, {9, 0.525909}, {10, 0.506673}, {11, 0.483992},
 {12, 0.474355}, {13, 0.412971}, {14, 0.200626}, {15, 0.181545}, {16, 0.0418654}}

Plot of singular values: (i-th Sing Val vs. i)



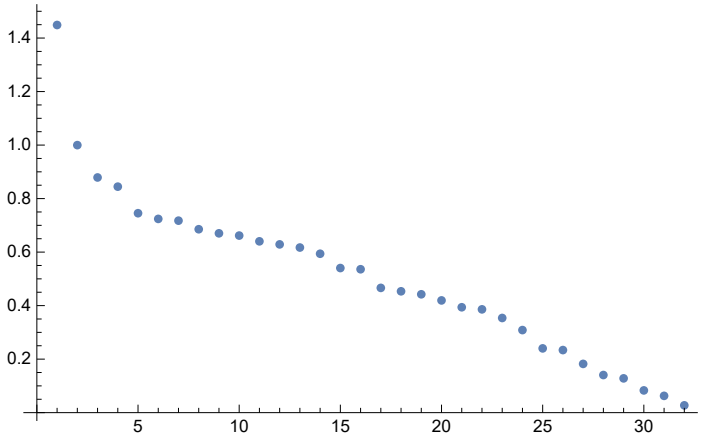
LogPlot of singular values: (Log[i-th Sing Val] vs. i)



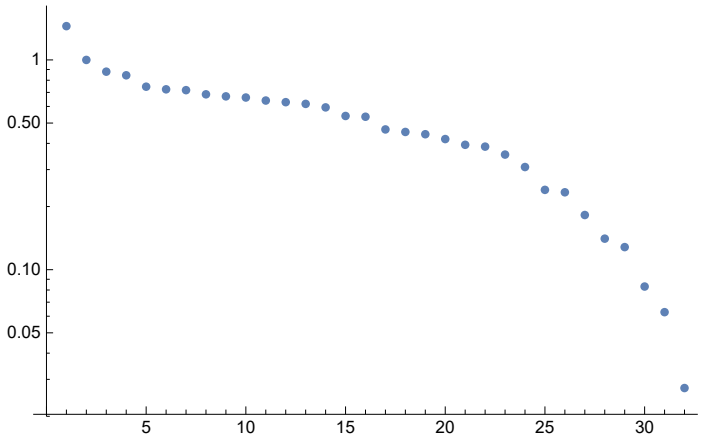
For C15the singular values of the 5-th SVD are:

{{1, 1.44878}, {2, 0.999821}, {3, 0.878915}, {4, 0.844606}, {5, 0.745324}, {6, 0.724091},
 {7, 0.717511}, {8, 0.68543}, {9, 0.670186}, {10, 0.661778}, {11, 0.640252}, {12, 0.628827},
 {13, 0.617072}, {14, 0.593861}, {15, 0.540417}, {16, 0.535917}, {17, 0.466239},
 {18, 0.453476}, {19, 0.442307}, {20, 0.419428}, {21, 0.393839}, {22, 0.386034},
 {23, 0.35377}, {24, 0.308565}, {25, 0.240146}, {26, 0.233848}, {27, 0.182221},
 {28, 0.140576}, {29, 0.128114}, {30, 0.0831022}, {31, 0.0627318}, {32, 0.0272756}}

Plot of singular values: (i-th Sing Val vs. i)



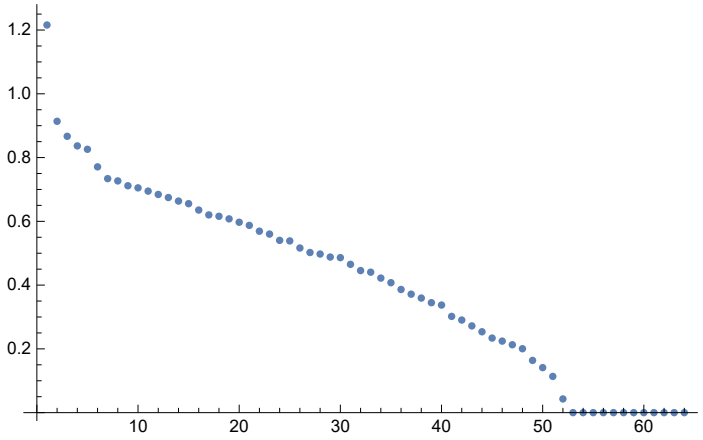
LogPlot of singular values: (Log[i-th Sing Val] vs. i)



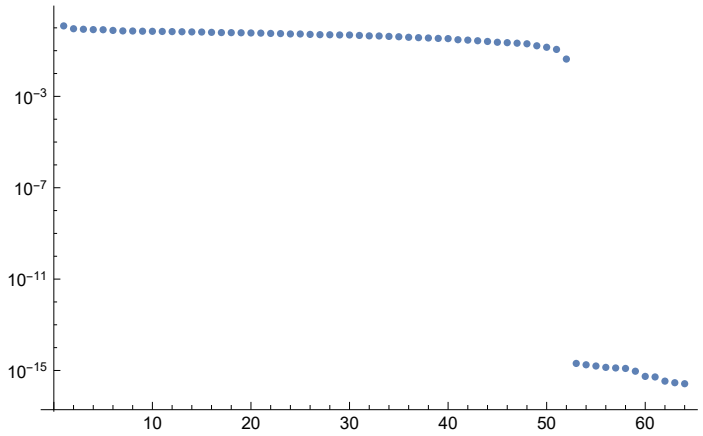
For C15the singular values of the 6-th SVD are:

{{1, 1.21579}, {2, 0.913756}, {3, 0.866722}, {4, 0.836654}, {5, 0.825978}, {6, 0.77094},
{7, 0.733928}, {8, 0.72679}, {9, 0.711622}, {10, 0.705037}, {11, 0.69478}, {12, 0.684302},
{13, 0.674681}, {14, 0.6636}, {15, 0.655434}, {16, 0.635407}, {17, 0.620153}, {18, 0.615878},
{19, 0.607773}, {20, 0.597123}, {21, 0.587287}, {22, 0.569102}, {23, 0.560051}, {24, 0.540359},
{25, 0.538591}, {26, 0.516354}, {27, 0.502229}, {28, 0.497387}, {29, 0.488007}, {30, 0.486135},
{31, 0.465111}, {32, 0.445574}, {33, 0.440538}, {34, 0.422029}, {35, 0.407576}, {36, 0.386258},
{37, 0.371565}, {38, 0.359347}, {39, 0.344801}, {40, 0.337458}, {41, 0.301868},
{42, 0.290407}, {43, 0.272064}, {44, 0.253634}, {45, 0.23389}, {46, 0.224393}, {47, 0.212959},
{48, 0.200455}, {49, 0.163831}, {50, 0.141207}, {51, 0.113635}, {52, 0.0429809},
{53, 2.03525×10^{-15}}, {54, 1.77318×10^{-15}}, {55, 1.56793×10^{-15}}, {56, 1.36706×10^{-15}},
{57, 1.28781×10^{-15}}, {58, 1.22775×10^{-15}}, {59, 9.27641×10^{-16}}, {60, 5.50818×10^{-16}},
{61, 5.2058×10^{-16}}, {62, 3.41372×10^{-16}}, {63, 2.91076×10^{-16}}, {64, 2.63132×10^{-16}}}

Plot of singular values: (i-th Sing Val vs. i)



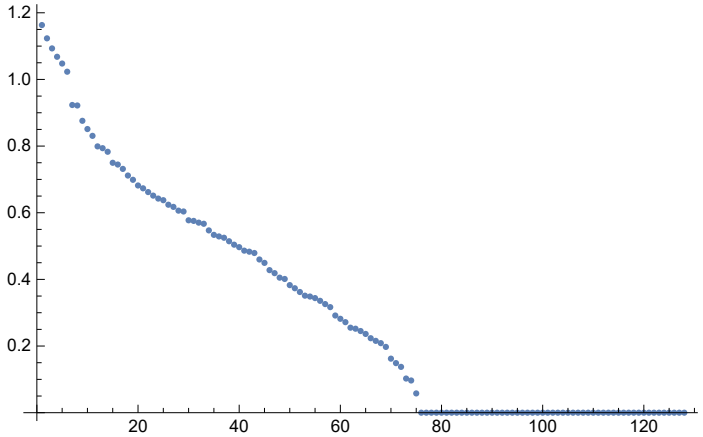
LogPlot of singular values: (Log[i-th Sing Val] vs. i)



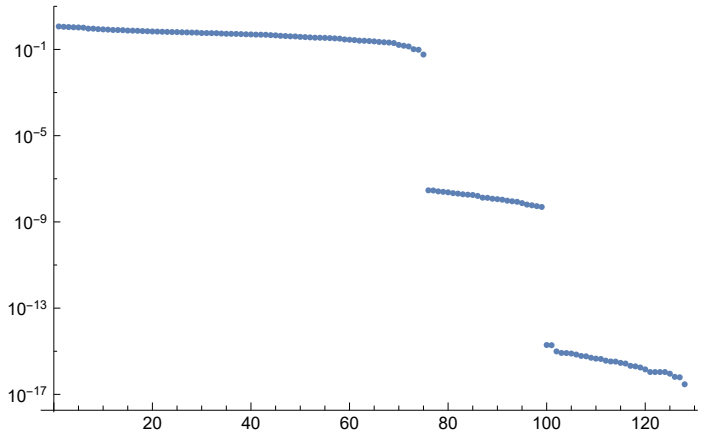
For C15the singular values of the 7-th SVD are:

$$\{\{1, 1.16317\}, \{2, 1.12328\}, \{3, 1.09309\}, \{4, 1.06797\}, \{5, 1.0477\}, \{6, 1.02315\}, \{7, 0.923275\},$$
$$\{8, 0.92185\}, \{9, 0.875853\}, \{10, 0.851136\}, \{11, 0.830719\}, \{12, 0.799096\}, \{13, 0.793703\},$$
$$\{14, 0.782952\}, \{15, 0.749878\}, \{16, 0.744599\}, \{17, 0.731539\}, \{18, 0.711617\}, \{19, 0.698824\},$$
$$\{20, 0.681784\}, \{21, 0.673266\}, \{22, 0.662019\}, \{23, 0.651364\}, \{24, 0.642517\}, \{25, 0.637629\},$$
$$\{26, 0.624068\}, \{27, 0.617548\}, \{28, 0.606272\}, \{29, 0.603759\}, \{30, 0.577308\}, \{31, 0.575464\},$$
$$\{32, 0.570294\}, \{33, 0.566901\}, \{34, 0.546964\}, \{35, 0.533608\}, \{36, 0.528901\}, \{37, 0.524946\},$$
$$\{38, 0.514471\}, \{39, 0.504152\}, \{40, 0.496699\}, \{41, 0.486237\}, \{42, 0.483125\}, \{43, 0.47918\},$$
$$\{44, 0.459724\}, \{45, 0.449543\}, \{46, 0.427773\}, \{47, 0.418727\}, \{48, 0.405208\}, \{49, 0.40126\},$$
$$\{50, 0.382803\}, \{51, 0.373419\}, \{52, 0.362135\}, \{53, 0.351147\}, \{54, 0.348537\}, \{55, 0.34387\},$$
$$\{56, 0.335667\}, \{57, 0.325903\}, \{58, 0.316768\}, \{59, 0.291608\}, \{60, 0.281758\}, \{61, 0.271658\},$$
$$\{62, 0.25509\}, \{63, 0.252023\}, \{64, 0.245044\}, \{65, 0.236297\}, \{66, 0.223484\}, \{67, 0.215565\},$$
$$\{68, 0.208668\}, \{69, 0.197408\}, \{70, 0.162153\}, \{71, 0.148729\}, \{72, 0.137489\}, \{73, 0.102485\},$$
$$\{74, 0.0966538\}, \{75, 0.0578362\}, \{76, 2.90956\times10^{-8}\}, \{77, 2.86826\times10^{-8}\}, \{78, 2.60508\times10^{-8}\},$$
$$\{79, 2.48112\times10^{-8}\}, \{80, 2.35564\times10^{-8}\}, \{81, 2.16012\times10^{-8}\}, \{82, 2.05722\times10^{-8}\},$$
$$\{83, 1.91048\times10^{-8}\}, \{84, 1.8302\times10^{-8}\}, \{85, 1.77232\times10^{-8}\}, \{86, 1.6055\times10^{-8}\}, \{87, 1.33092\times10^{-8}\},$$
$$\{88, 1.30798\times10^{-8}\}, \{89, 1.18892\times10^{-8}\}, \{90, 1.13869\times10^{-8}\}, \{91, 1.07354\times10^{-8}\},$$
$$\{92, 9.65699\times10^{-9}\}, \{93, 9.05161\times10^{-9}\}, \{94, 8.5692\times10^{-9}\}, \{95, 7.46263\times10^{-9}\}, \{96, 6.35708\times10^{-9}\},$$
$$\{97, 5.89204\times10^{-9}\}, \{98, 5.37817\times10^{-9}\}, \{99, 4.93851\times10^{-9}\}, \{100, 1.9478\times10^{-15}\},$$
$$\{101, 1.90793\times10^{-15}\}, \{102, 9.83722\times10^{-16}\}, \{103, 8.37003\times10^{-16}\}, \{104, 8.23828\times10^{-16}\},$$
$$\{105, 7.83648\times10^{-16}\}, \{106, 7.04329\times10^{-16}\}, \{107, 6.05993\times10^{-16}\}, \{108, 5.82555\times10^{-16}\},$$
$$\{109, 4.99546\times10^{-16}\}, \{110, 4.55227\times10^{-16}\}, \{111, 4.38513\times10^{-16}\}, \{112, 3.66576\times10^{-16}\},$$
$$\{113, 3.36333\times10^{-16}\}, \{114, 3.31081\times10^{-16}\}, \{115, 2.88604\times10^{-16}\}, \{116, 2.69325\times10^{-16}\},$$
$$\{117, 2.10538\times10^{-16}\}, \{118, 1.99042\times10^{-16}\}, \{119, 1.76583\times10^{-16}\}, \{120, 1.44568\times10^{-16}\},$$
$$\{121, 1.08602\times10^{-16}\}, \{122, 1.08602\times10^{-16}\}, \{123, 1.08602\times10^{-16}\}, \{124, 1.08602\times10^{-16}\},$$
$$\{125, 9.11129\times10^{-17}\}, \{126, 6.50605\times10^{-17}\}, \{127, 6.18397\times10^{-17}\}, \{128, 2.94084\times10^{-17}\}\}$$

Plot of singular values: (i-th Sing Val vs. i)



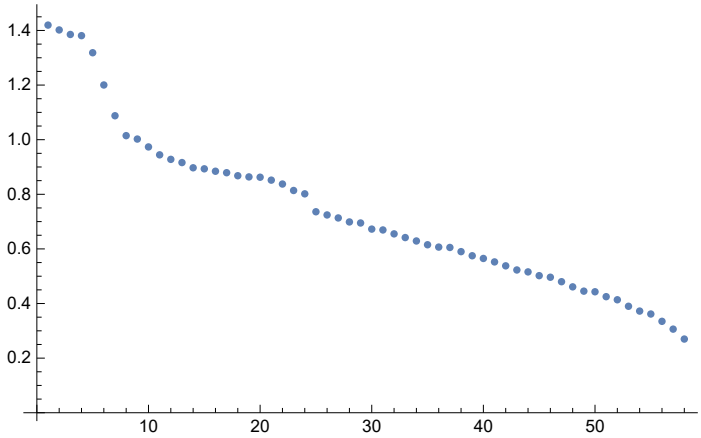
LogPlot of singular values: (Log[i-th Sing Val] vs. i)



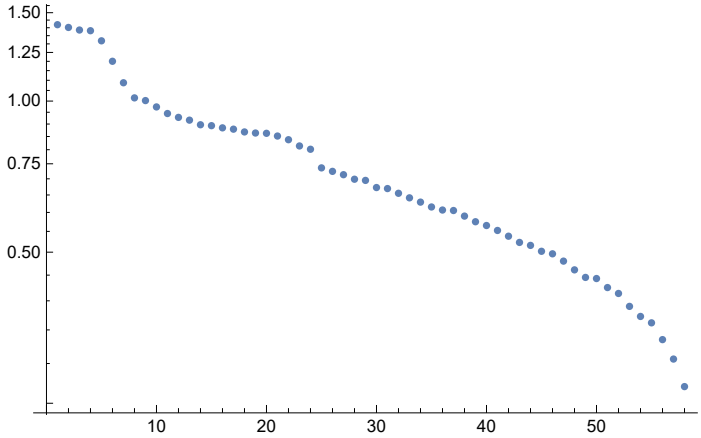
For C15the singular values of the 8-th SVD are:

```
{{1, 1.41964}, {2, 1.40187}, {3, 1.38533}, {4, 1.38098}, {5, 1.31844}, {6, 1.20031},
 {7, 1.08766}, {8, 1.01477}, {9, 1.00229}, {10, 0.973472}, {11, 0.944473}, {12, 0.927914},
 {13, 0.916182}, {14, 0.897065}, {15, 0.893309}, {16, 0.884426}, {17, 0.879056}, {18, 0.867979},
 {19, 0.863678}, {20, 0.862532}, {21, 0.851827}, {22, 0.83755}, {23, 0.813933}, {24, 0.801678},
 {25, 0.736044}, {26, 0.724374}, {27, 0.713383}, {28, 0.698726}, {29, 0.694943}, {30, 0.672526},
 {31, 0.669401}, {32, 0.65506}, {33, 0.641524}, {34, 0.629042}, {35, 0.615204}, {36, 0.606637},
 {37, 0.605273}, {38, 0.589965}, {39, 0.574907}, {40, 0.565034}, {41, 0.552377},
 {42, 0.537995}, {43, 0.522852}, {44, 0.515798}, {45, 0.502025}, {46, 0.496238},
 {47, 0.479884}, {48, 0.461019}, {49, 0.445311}, {50, 0.44303}, {51, 0.425067}, {52, 0.413718},
 {53, 0.389903}, {54, 0.37232}, {55, 0.361559}, {56, 0.334753}, {57, 0.306203}, {58, 0.269863}}
```

Plot of singular values: (i-th Sing Val vs. i)



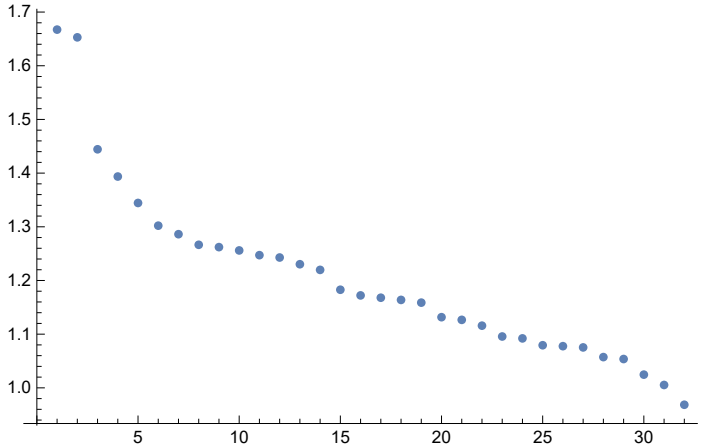
LogPlot of singular values: (Log[i-th Sing Val] vs. i)



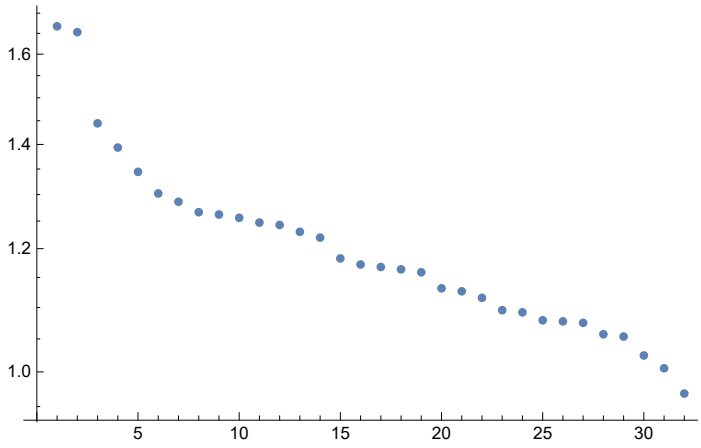
For C15the singular values of the 9-th SVD are:

```
{{1, 1.6673}, {2, 1.65291}, {3, 1.44437}, {4, 1.39362}, {5, 1.3444},
 {6, 1.3021}, {7, 1.28622}, {8, 1.26648}, {9, 1.26213}, {10, 1.25597}, {11, 1.24717},
 {12, 1.24279}, {13, 1.23027}, {14, 1.21975}, {15, 1.18275}, {16, 1.1722}, {17, 1.1679},
 {18, 1.16382}, {19, 1.15874}, {20, 1.13163}, {21, 1.12665}, {22, 1.11583},
 {23, 1.09565}, {24, 1.09213}, {25, 1.07938}, {26, 1.07762}, {27, 1.07532},
 {28, 1.05729}, {29, 1.0537}, {30, 1.02462}, {31, 1.00537}, {32, 0.968521}}
```

Plot of singular values: (i-th Sing Val vs. i)



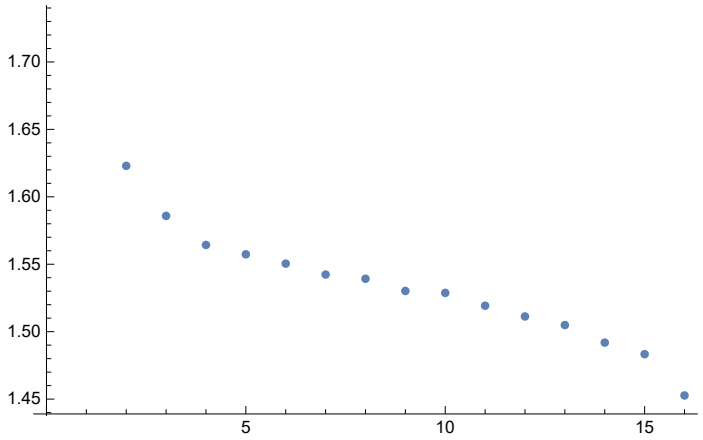
LogPlot of singular values: (Log[i-th Sing Val] vs. i)



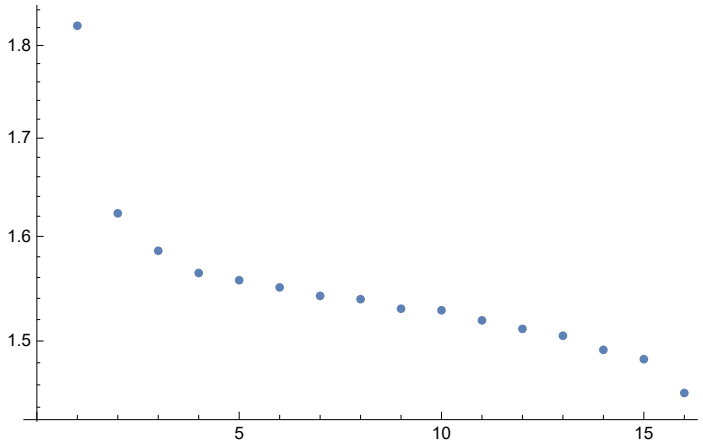
For C15the singular values of the 10-th SVD are:

{{1, 1.82203}, {2, 1.62296}, {3, 1.58586}, {4, 1.56429}, {5, 1.55736},
 {6, 1.55045}, {7, 1.54235}, {8, 1.53922}, {9, 1.53019}, {10, 1.52875}, {11, 1.51923},
 {12, 1.51128}, {13, 1.50489}, {14, 1.49189}, {15, 1.48331}, {16, 1.45269}}

Plot of singular values: (i-th Sing Val vs. i)



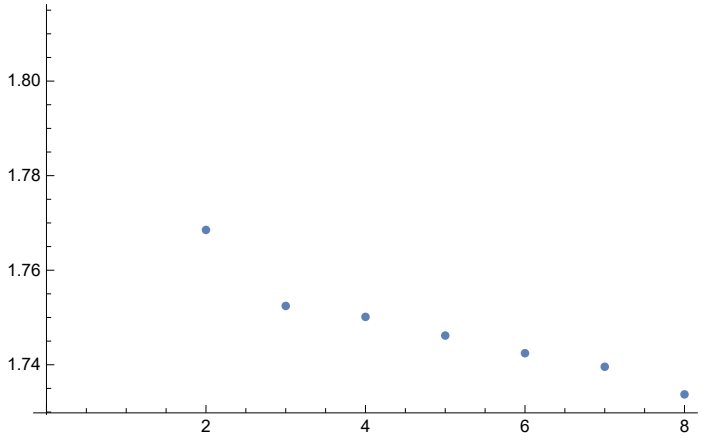
LogPlot of singular values: (Log[i-th Sing Val] vs. i)



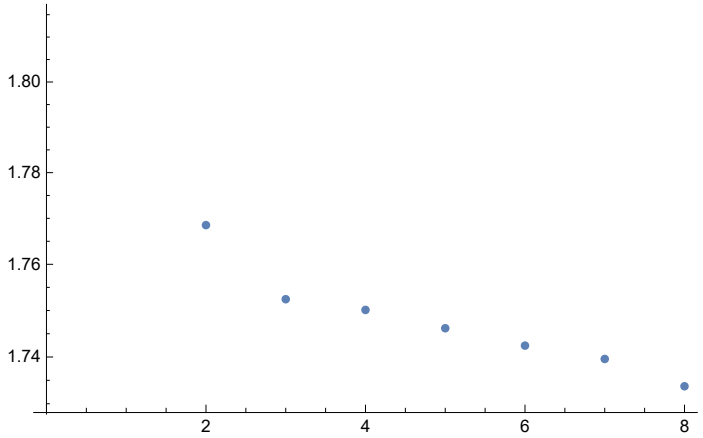
For C15the singular values of the 11-th SVD are:

{{1, 1.85145}, {2, 1.76852}, {3, 1.75244},
 {4, 1.75013}, {5, 1.74618}, {6, 1.74244}, {7, 1.73958}, {8, 1.73374}}

Plot of singular values: (i-th Sing Val vs. i)



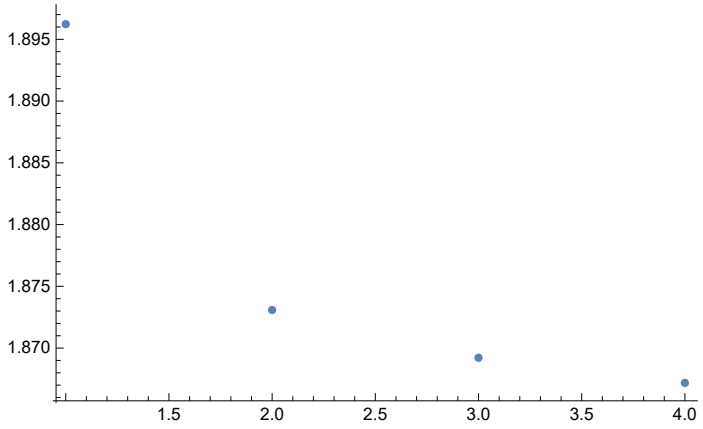
LogPlot of singular values: (Log[i-th Sing Val] vs. i)



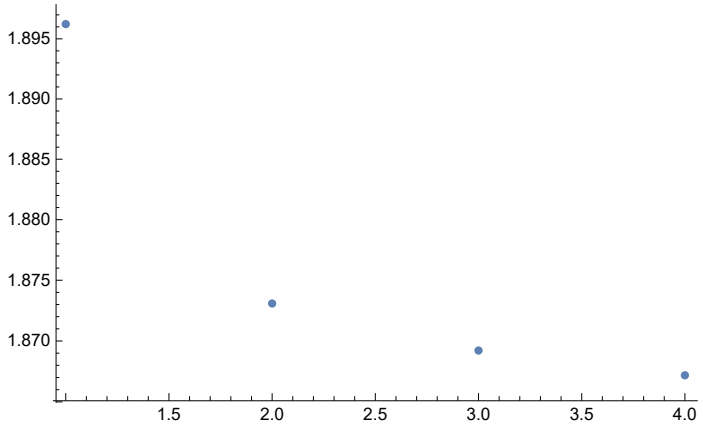
For C15the singular values of the 12-th SVD are:

{{1, 1.89623}, {2, 1.87308}, {3, 1.86922}, {4, 1.86718}}

Plot of singular values: (i-th Sing Val vs. i)



LogPlot of singular values: (Log[i-th Sing Val] vs. i)



C16

C17

C18

C19

Random (Marchenko-Pastur) Distribution SVD analog of C19, call it MPC19

Random MP SVD Samples

Random MP SVD sample plots

Cut sample C_{1,32}

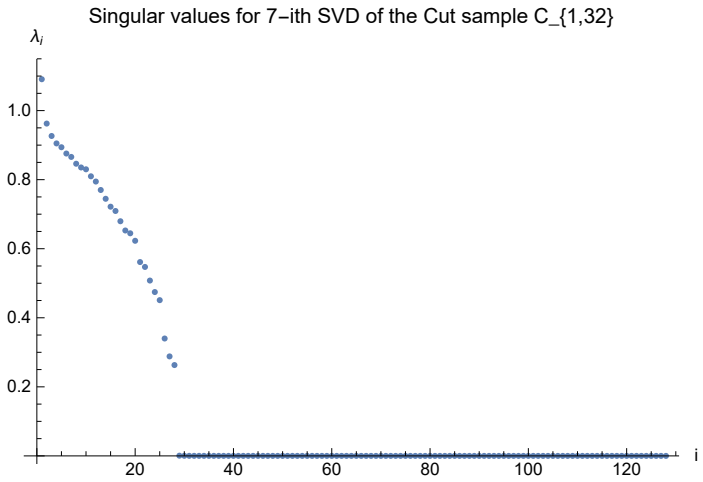
Cut sample C_{1,32} data

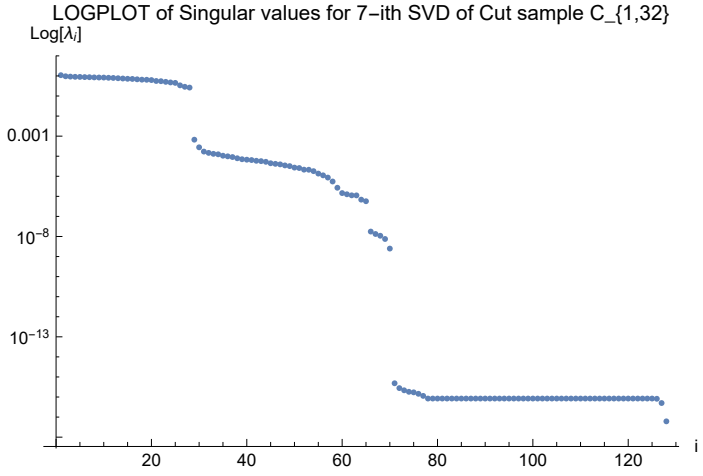
Cut sample C_{1,32} data plots

```
Table[{k, CutC1to32[[k]]}, {k, 1, Length[CutC1to32]}]
```

$$\{\{1, 1.09086\}, \{2, 0.962425\}, \{3, 0.926492\}, \{4, 0.904965\}, \{5, 0.893919\}, \{6, 0.875662\},$$
$$\{7, 0.865863\}, \{8, 0.846116\}, \{9, 0.835332\}, \{10, 0.83002\}, \{11, 0.809739\}, \{12, 0.794524\},$$
$$\{13, 0.770083\}, \{14, 0.744616\}, \{15, 0.7217\}, \{16, 0.709288\}, \{17, 0.679583\},$$
$$\{18, 0.652795\}, \{19, 0.644678\}, \{20, 0.622975\}, \{21, 0.561385\}, \{22, 0.54721\},$$
$$\{23, 0.507801\}, \{24, 0.474523\}, \{25, 0.451047\}, \{26, 0.339941\}, \{27, 0.288126\},$$
$$\{28, 0.263079\}, \{29, 0.000666255\}, \{30, 0.000277524\}, \{31, 0.000170296\}, \{32, 0.000146546\},$$
$$\{33, 0.000131282\}, \{34, 0.000124474\}, \{35, 0.000105946\}, \{36, 0.000098526\},$$
$$\{37, 0.00009089\}, \{38, 0.0000790127\}, \{39, 0.0000707403\}, \{40, 0.0000671636\},$$
$$\{41, 0.0000643872\}, \{42, 0.0000591848\}, \{43, 0.0000567926\}, \{44, 0.0000526031\},$$
$$\{45, 0.0000445858\}, \{46, 0.0000416892\}, \{47, 0.0000392429\}, \{48, 0.0000348008\},$$
$$\{49, 0.0000321145\}, \{50, 0.0000271068\}, \{51, 0.0000257536\}, \{52, 0.0000213848\},$$
$$\{53, 0.0000211667\}, \{54, 0.0000180096\}, \{55, 0.0000136388\}, \{56, 0.0000111381\},$$
$$\{57, 8.62431 \times 10^{-6}\}, \{58, 5.49551 \times 10^{-6}\}, \{59, 2.68224 \times 10^{-6}\}, \{60, 1.45461 \times 10^{-6}\},$$
$$\{61, 1.26868 \times 10^{-6}\}, \{62, 1.1232 \times 10^{-6}\}, \{63, 1.11688 \times 10^{-6}\}, \{64, 6.85269 \times 10^{-7}\},$$
$$\{65, 5.7153 \times 10^{-7}\}, \{66, 1.75776 \times 10^{-8}\}, \{67, 1.33094 \times 10^{-8}\}, \{68, 1.08756 \times 10^{-8}\},$$
$$\{69, 7.51146 \times 10^{-9}\}, \{70, 2.4959 \times 10^{-9}\}, \{71, 4.84438 \times 10^{-16}\}, \{72, 2.77836 \times 10^{-16}\},$$
$$\{73, 2.1627 \times 10^{-16}\}, \{74, 1.8205 \times 10^{-16}\}, \{75, 1.71223 \times 10^{-16}\}, \{76, 1.44849 \times 10^{-16}\},$$
$$\{77, 1.13912 \times 10^{-16}\}, \{78, 8.39411 \times 10^{-17}\}, \{79, 8.39411 \times 10^{-17}\}, \{80, 8.39411 \times 10^{-17}\},$$
$$\{81, 8.39411 \times 10^{-17}\}, \{82, 8.39411 \times 10^{-17}\}, \{83, 8.39411 \times 10^{-17}\}, \{84, 8.39411 \times 10^{-17}\},$$
$$\{85, 8.39411 \times 10^{-17}\}, \{86, 8.39411 \times 10^{-17}\}, \{87, 8.39411 \times 10^{-17}\}, \{88, 8.39411 \times 10^{-17}\},$$
$$\{89, 8.39411 \times 10^{-17}\}, \{90, 8.39411 \times 10^{-17}\}, \{91, 8.39411 \times 10^{-17}\}, \{92, 8.39411 \times 10^{-17}\},$$
$$\{93, 8.39411 \times 10^{-17}\}, \{94, 8.39411 \times 10^{-17}\}, \{95, 8.39411 \times 10^{-17}\}, \{96, 8.39411 \times 10^{-17}\},$$
$$\{97, 8.39411 \times 10^{-17}\}, \{98, 8.39411 \times 10^{-17}\}, \{99, 8.39411 \times 10^{-17}\}, \{100, 8.39411 \times 10^{-17}\},$$
$$\{101, 8.39411 \times 10^{-17}\}, \{102, 8.39411 \times 10^{-17}\}, \{103, 8.39411 \times 10^{-17}\}, \{104, 8.39411 \times 10^{-17}\},$$
$$\{105, 8.39411 \times 10^{-17}\}, \{106, 8.39411 \times 10^{-17}\}, \{107, 8.39411 \times 10^{-17}\}, \{108, 8.39411 \times 10^{-17}\},$$
$$\{109, 8.39411 \times 10^{-17}\}, \{110, 8.39411 \times 10^{-17}\}, \{111, 8.39411 \times 10^{-17}\}, \{112, 8.39411 \times 10^{-17}\},$$
$$\{113, 8.39411 \times 10^{-17}\}, \{114, 8.39411 \times 10^{-17}\}, \{115, 8.39411 \times 10^{-17}\}, \{116, 8.39411 \times 10^{-17}\},$$
$$\{117, 8.39411 \times 10^{-17}\}, \{118, 8.39411 \times 10^{-17}\}, \{119, 8.39411 \times 10^{-17}\}, \{120, 8.39411 \times 10^{-17}\},$$
$$\{121, 8.39411 \times 10^{-17}\}, \{122, 8.39411 \times 10^{-17}\}, \{123, 8.39411 \times 10^{-17}\}, \{124, 8.39411 \times 10^{-17}\},$$
$$\{125, 8.39411 \times 10^{-17}\}, \{126, 8.18024 \times 10^{-17}\}, \{127, 5.01524 \times 10^{-17}\}, \{128, 6.13445 \times 10^{-18}\}\}$$

```
ListPlot[CutC1to32, PlotLabel → StringJoin["Singular values for ",
   ToString[7], "-ith SVD of the Cut sample C_{1,32}"], AxesLabel → {"i", "λi"}]
ListLogPlot[CutC1to32, PlotLabel → StringJoin["LOGPLOT of Singular values for ",
   ToString[7], "-ith SVD of Cut sample C_{1,32}"], AxesLabel → {"i", "Log[λi]"}]
```





Comparison

pre

setup to get Normalized Samples

Normalized Samples Input Form (Run this before running Comparison Plots)

Adjusted So Max value = 1 (Run this before running Comparison Plots)

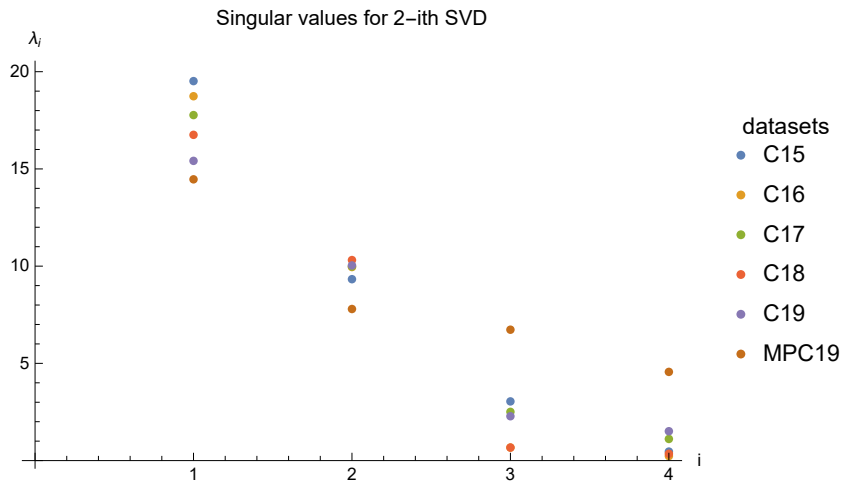
Comparison Plots

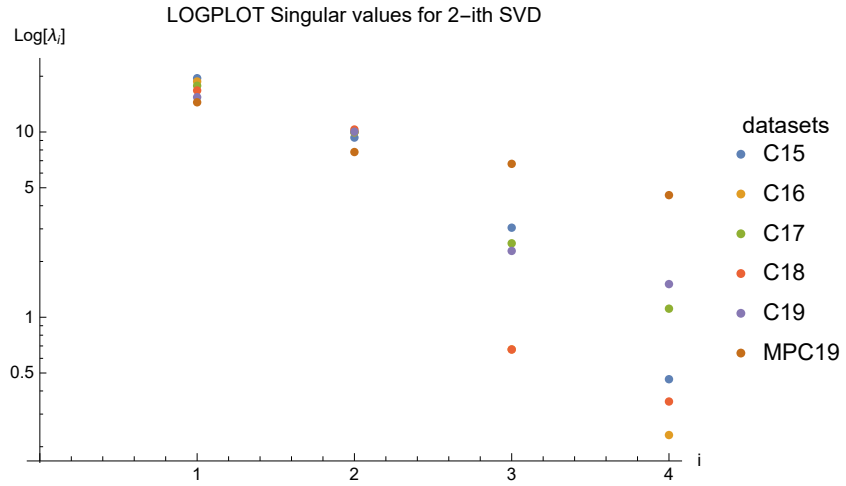
```
(*Do[
 Print[
  ToExpression[Join[
    Table[StringJoin["C1",ToString[a],"num",ToString[numSVD]],{a,amin,amax}],
    {StringJoin["MP1",ToString[9],"num",ToString[numSVD]]}
   ]]
 ]
 ,{numSVD,2,12}]*)

amin = 5;
amax = 9;
Do[
 Print[ Style[StringJoin["For the ", ToString[numSVD],
     "-th SVD, the Singular Values are:"], Black, Bold, 22] ] ×
  Print[
   ListPlot[
    ToExpression[Join[
      Table[StringJoin["C1", ToString[a], "num", ToString[numSVD]], {a, amin, amax}],
      {StringJoin["MP1", ToString[9], "num", ToString[numSVD]]}
     ]]
    , PlotLegends → PointLegend[Automatic, {"C15", "C16", "C17", "C18", "C19", "MPC19"},
      LegendFunction → "Frame", LegendLabel → "datasets"],
    PlotLabel → StringJoin["Singular values for ", ToString[numSVD], "-ith SVD"],
    AxesLabel → {"i", "λi"}]
  ] ×
  Print[
   ListLogPlot[
    ToExpression[Join[
      Table[StringJoin["C1", ToString[a], "num", ToString[numSVD]], {a, amin, amax}],
      {StringJoin["MP1", ToString[9], "num", ToString[numSVD]]}
     ]]
    , PlotLegends → PointLegend[Automatic, {"C15", "C16", "C17", "C18", "C19", "MPC19"},
      LegendFunction → "Frame", LegendLabel → "datasets"],
    PlotLabel → StringJoin["LOGPLOT Singular values for ", ToString[numSVD], "-ith SVD"],
    AxesLabel → {"i", "Log[λi]"}]
  ] ×
  Print["Normalizing the Singular Values, these plots become: "] ×
  Print[
   ListPlot[
    ToExpression[Join[
      Table[StringJoin["Normalized", "C1",
        ToString[a], "num", ToString[numSVD]], {a, amin, amax}],
      {StringJoin["Normalized", "MP1", ToString[9], "num", ToString[numSVD]]}
     ]]
    , PlotLegends → PointLegend[Automatic, {"C15", "C16", "C17", "C18", "C19", "MPC19"},
      LegendFunction → "Frame", LegendLabel → "datasets"],
    PlotLabel → StringJoin["Normalized Singular values for ",
      ToString[numSVD], "-ith SVD"], AxesLabel → {"i", "λi"}]
  ] ×
  Print[
```

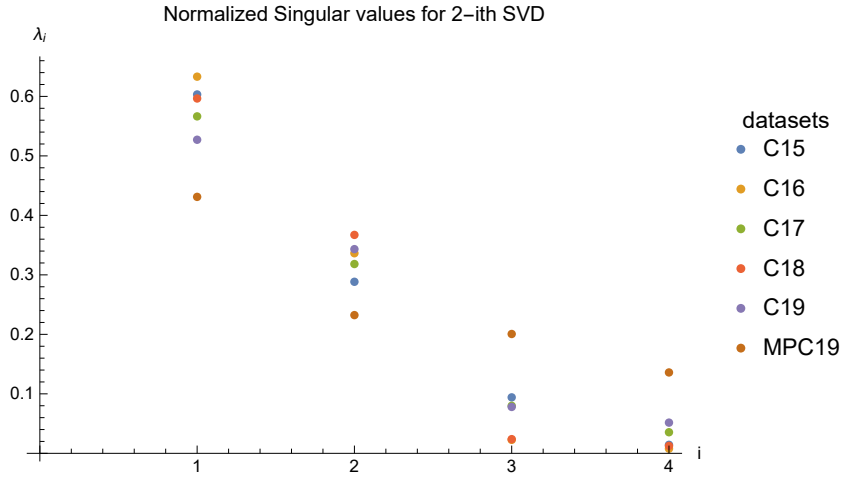
```
 ListLogPlot[
  ToExpression[Join[
    Table[StringJoin["Normalized", "C1",
      ToString[a], "num", ToString[numSVD]], {a, amin, amax}],
    {StringJoin["Normalized", "MP1", ToString[9], "num", ToString[numSVD]]}
   ]]
  , PlotLegends → PointLegend[Automatic, {"C15", "C16", "C17", "C18", "C19", "MPC19"},
    LegendFunction → "Frame", LegendLabel → "datasets"],
  PlotLabel → StringJoin["LOGPLOT Normalized Singular values for ",
    ToString[numSVD], "-ith SVD"], AxesLabel → {"i", "Log[λᵢ]"}]
] ×
Print["And Adjusting the Singular Values so Max
   singular value of each SVD sample is 1, these plots become: "] ×
Print[
 ListPlot[
  ToExpression[Join[
    Table[StringJoin["AdjMax", "C1",
      ToString[a], "num", ToString[numSVD]], {a, amin, amax}],
    {StringJoin["AdjMax", "MP1", ToString[9], "num", ToString[numSVD]]}
   ]]
  , PlotLegends → PointLegend[Automatic, {"C15", "C16", "C17", "C18", "C19", "MPC19"},
    LegendFunction → "Frame", LegendLabel → "datasets"],
  PlotLabel → StringJoin["AdjMax Singular values for ", ToString[numSVD], "-ith SVD"],
  AxesLabel → {"i", "λᵢ"}]
] ×
Print[
 ListLogPlot[
  ToExpression[Join[
    Table[StringJoin["AdjMax", "C1",
      ToString[a], "num", ToString[numSVD]], {a, amin, amax}],
    {StringJoin["AdjMax", "MP1", ToString[9], "num", ToString[numSVD]]}
   ]]
  , PlotLegends → PointLegend[Automatic, {"C15", "C16", "C17", "C18", "C19", "MPC19"},
    LegendFunction → "Frame", LegendLabel → "datasets"],
  PlotLabel → StringJoin["LOGPLOT AdjMax Singular values for ",
    ToString[numSVD], "-ith SVD"], AxesLabel → {"i", "Log[λᵢ]"}]
] ×
Print[
 "_____________________________________________________________________________
   _____________________________"]
, {numSVD, 2, 12}]
```

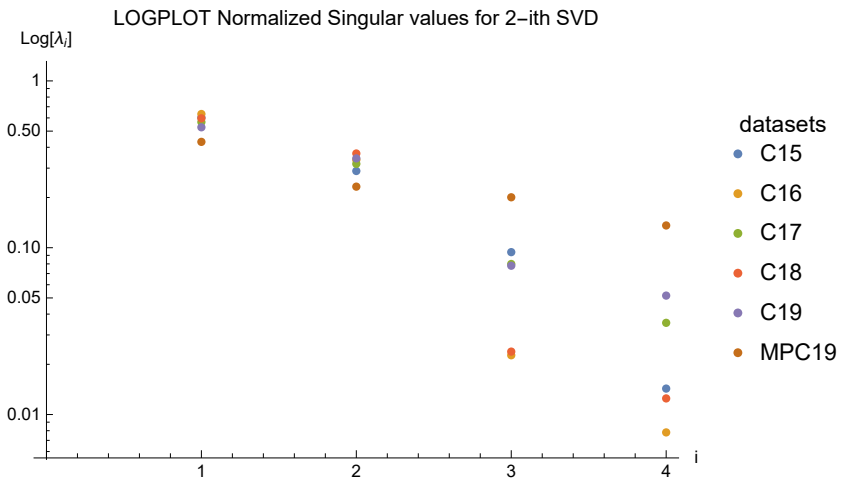
For the 2-th SVD, the Singular Values are:



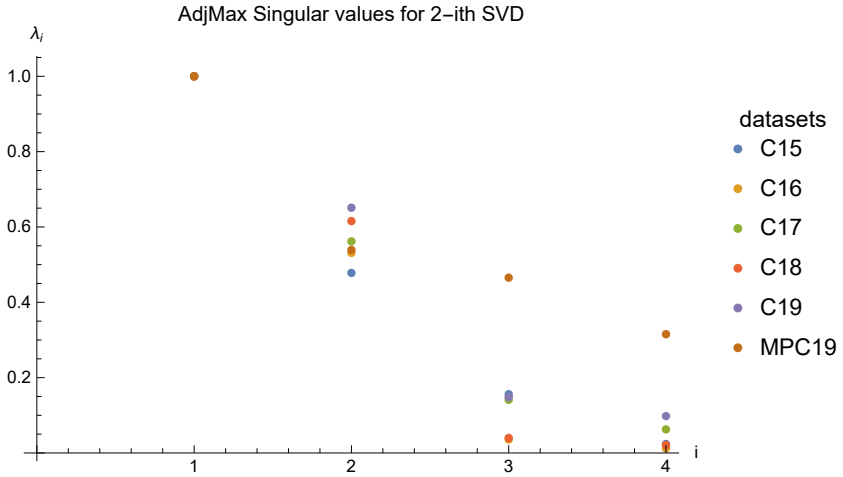


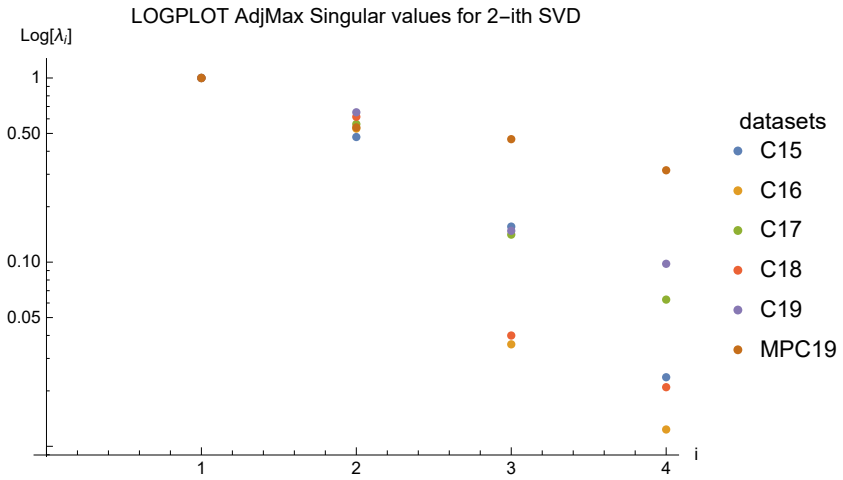
Normalizing the Singular Values, these plots become:



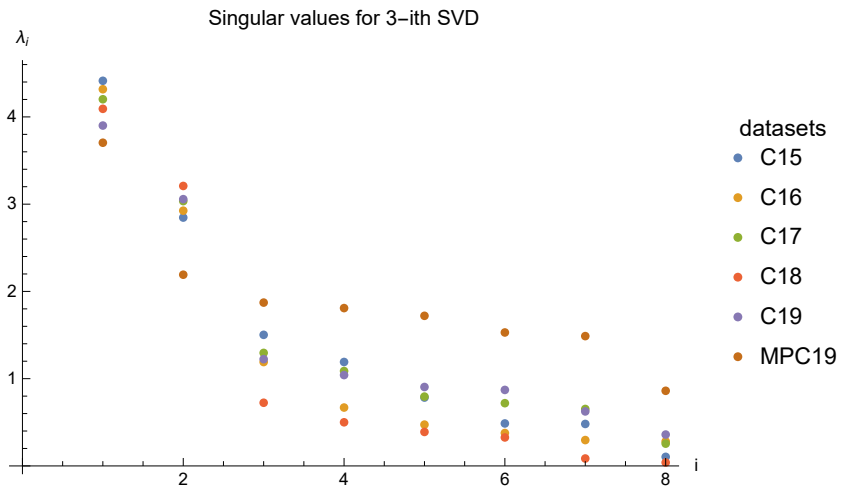


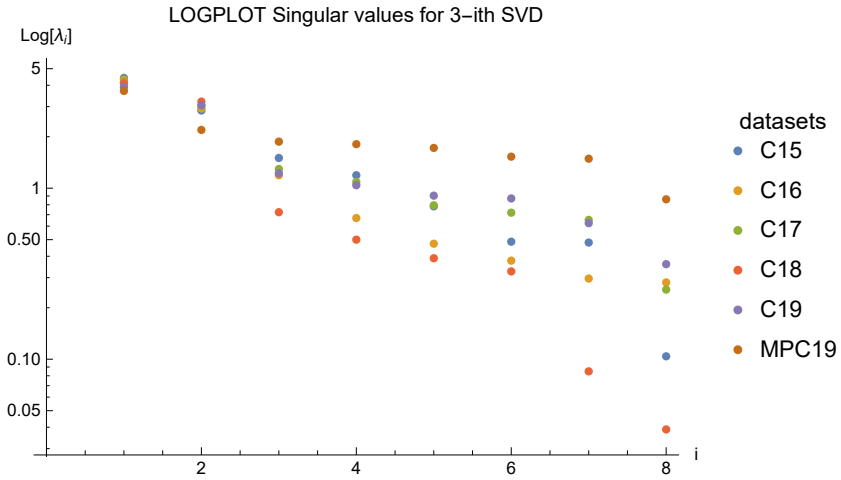
And Adjusting the Singular Values so Max
singular value of each SVD sample is 1, these plots become:



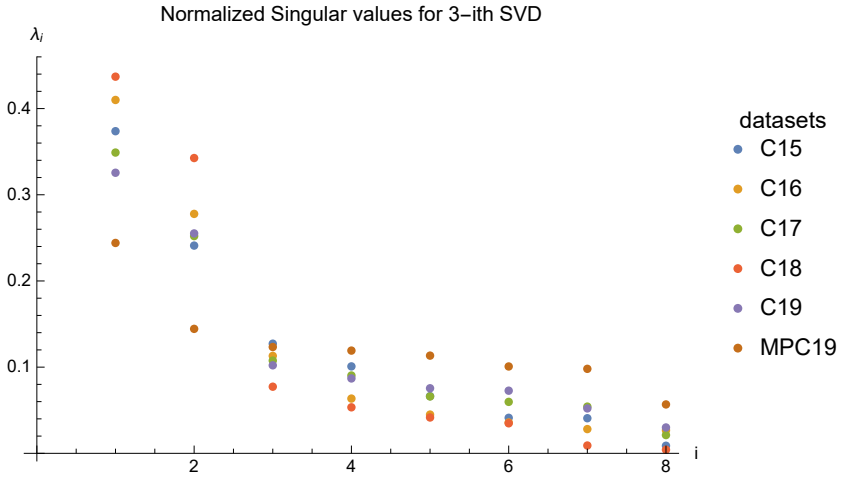


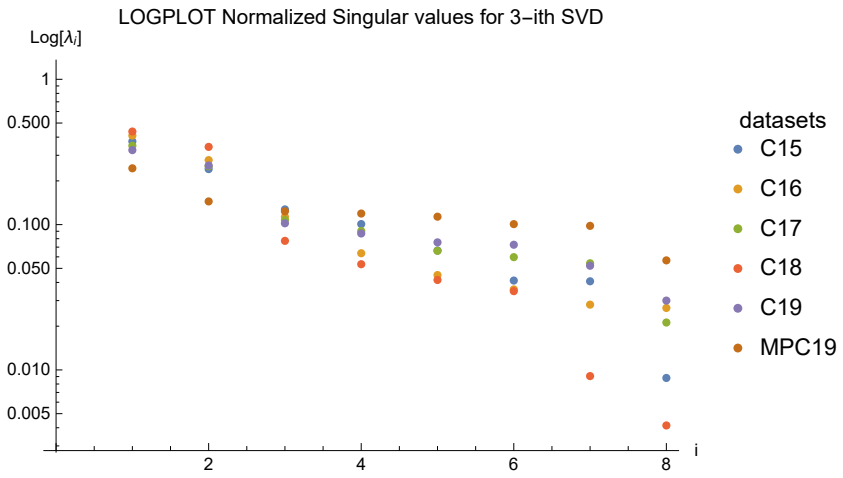
For the 3–th SVD, the Singular Values are:



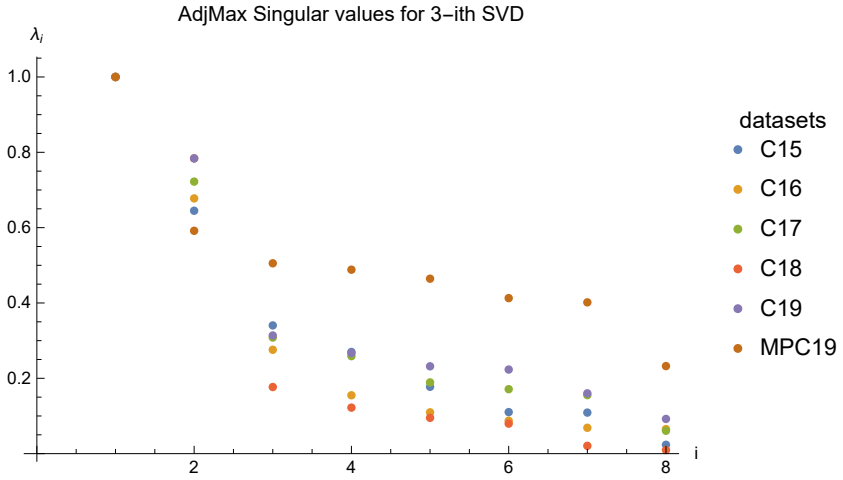


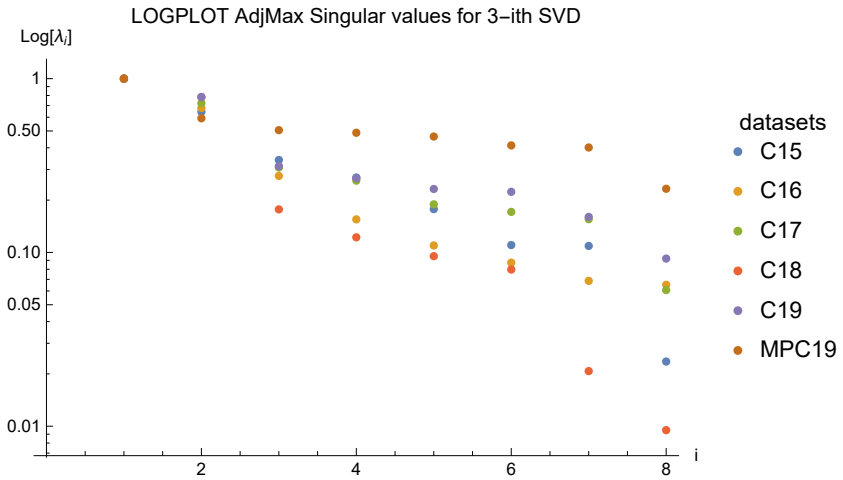
Normalizing the Singular Values, these plots become:



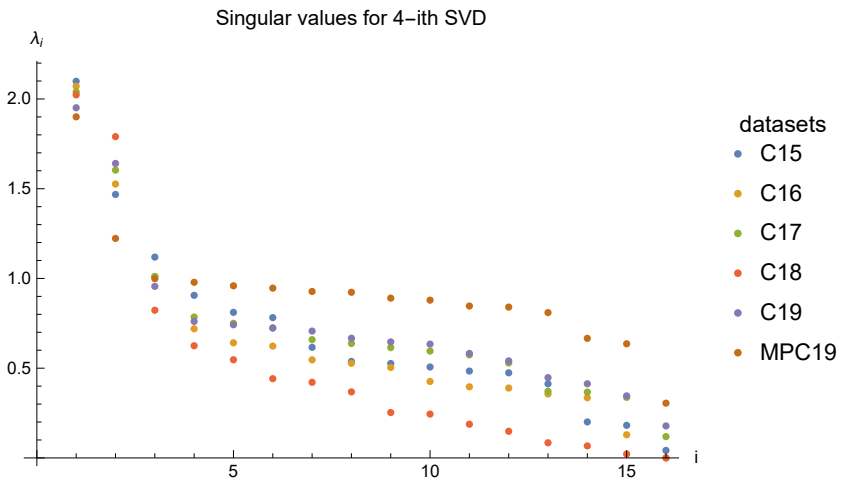


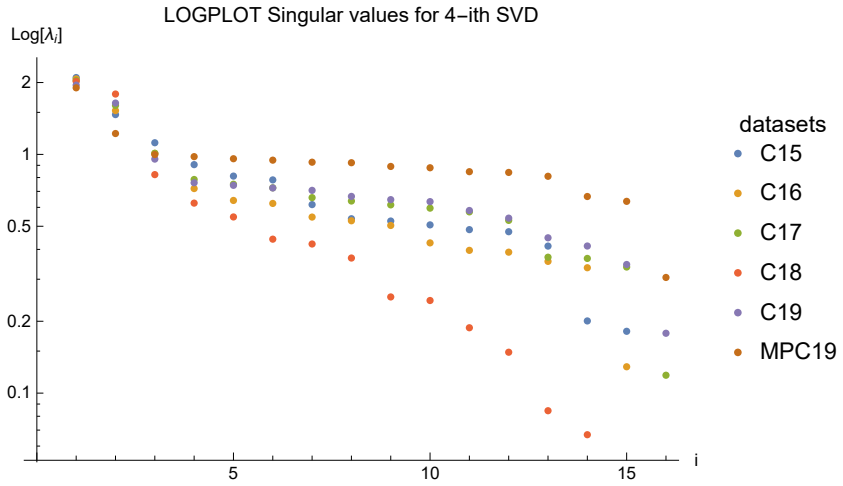
And Adjusting the Singular Values so Max singular value of each SVD sample is 1, these plots become:



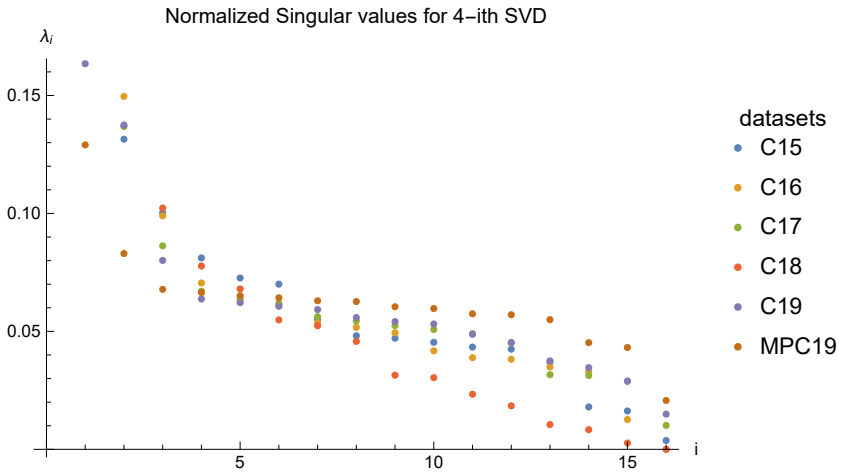


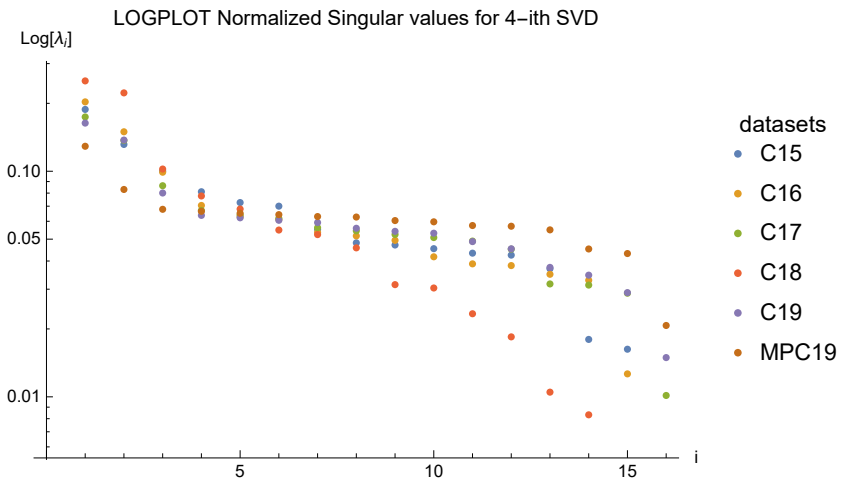
For the 4–th SVD, the Singular Values are:



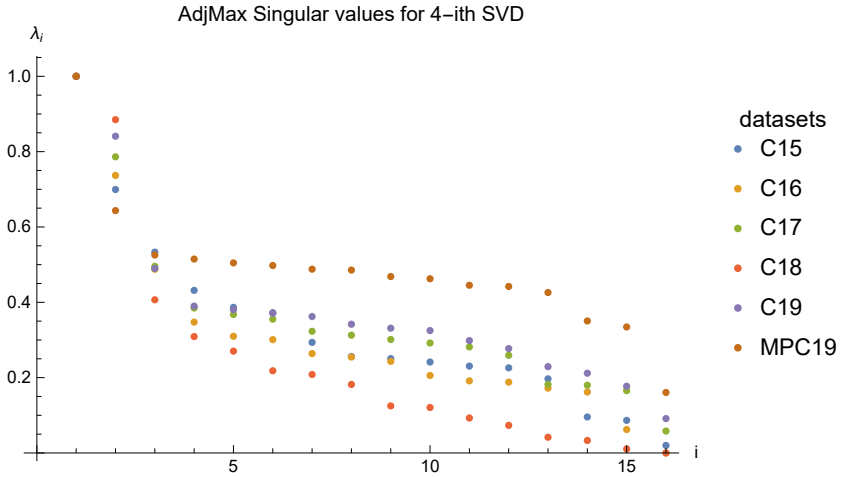


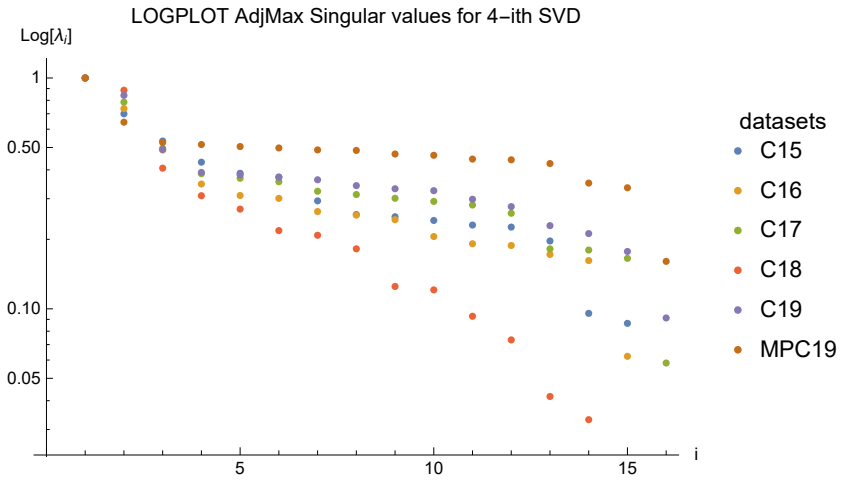
Normalizing the Singular Values, these plots become:



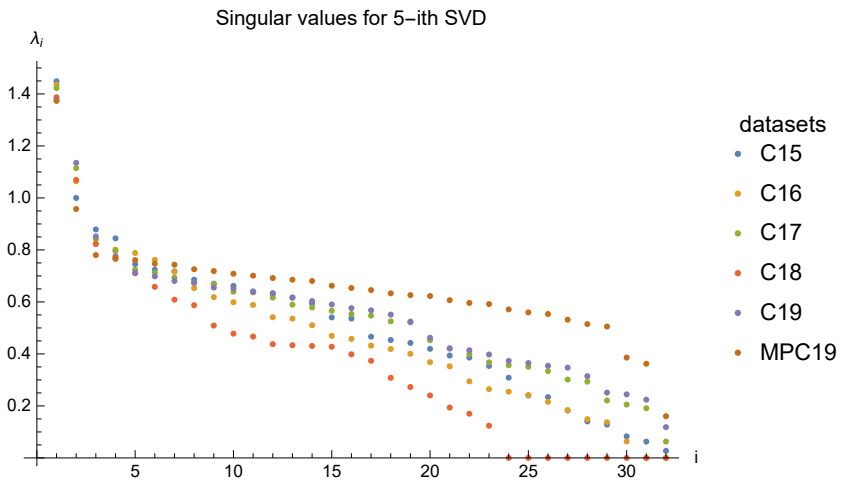


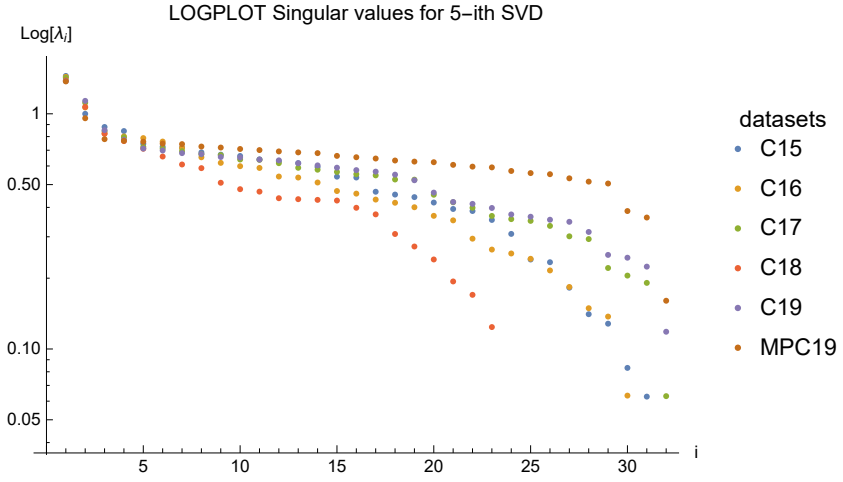
And Adjusting the Singular Values so Max singular value of each SVD sample is 1, these plots become:



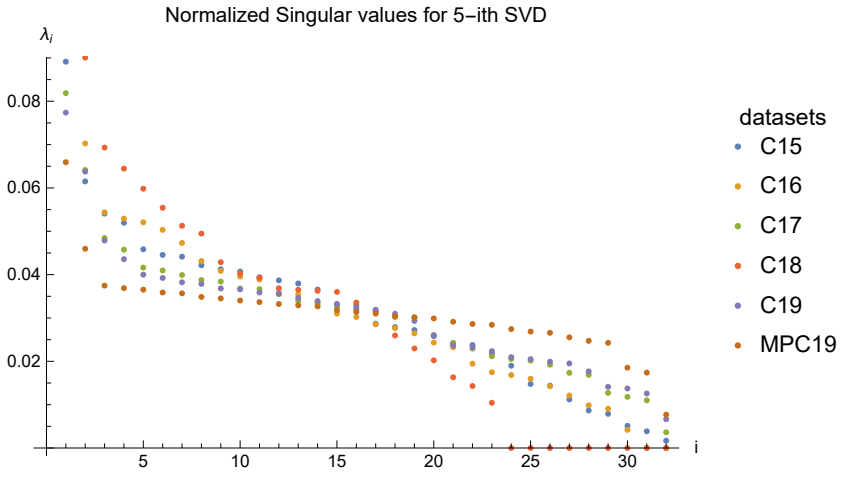


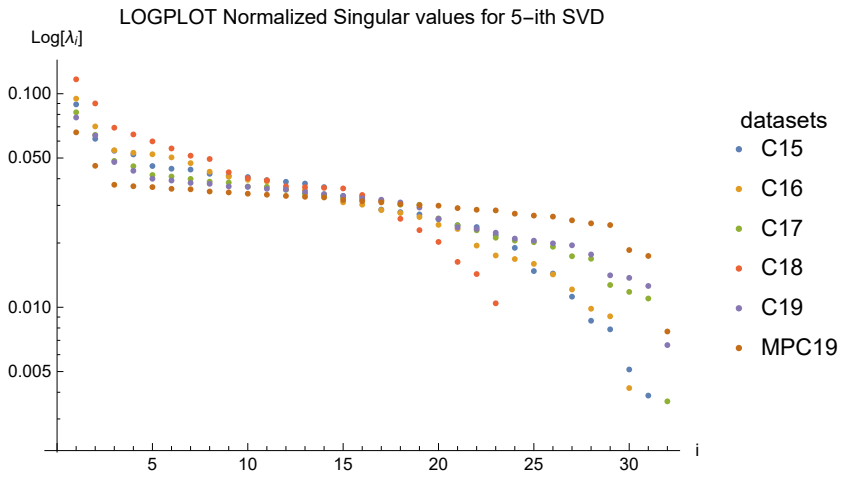
For the 5–th SVD, the Singular Values are:



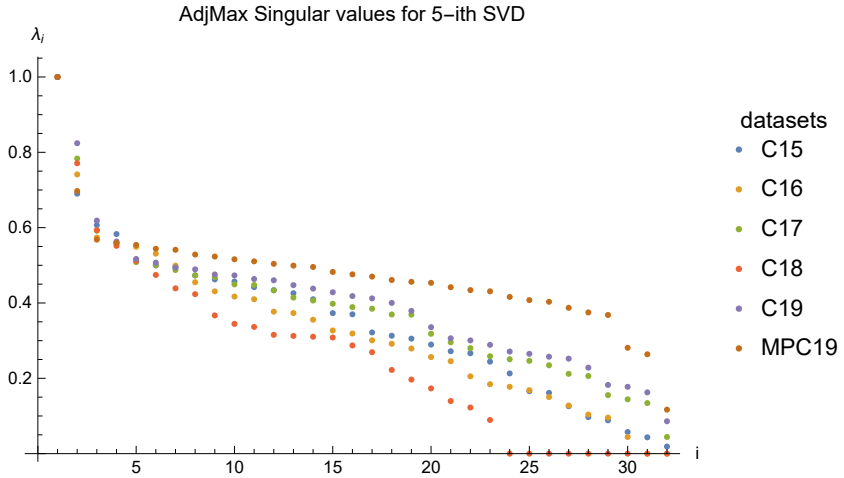


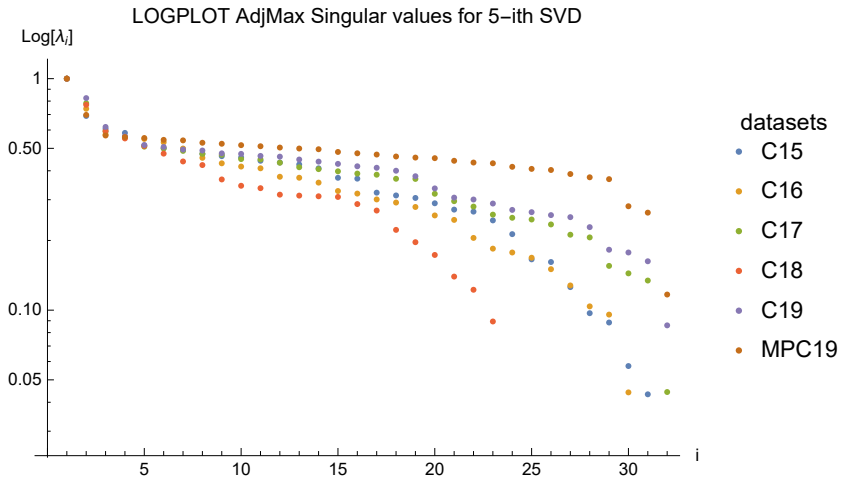
Normalizing the Singular Values, these plots become:



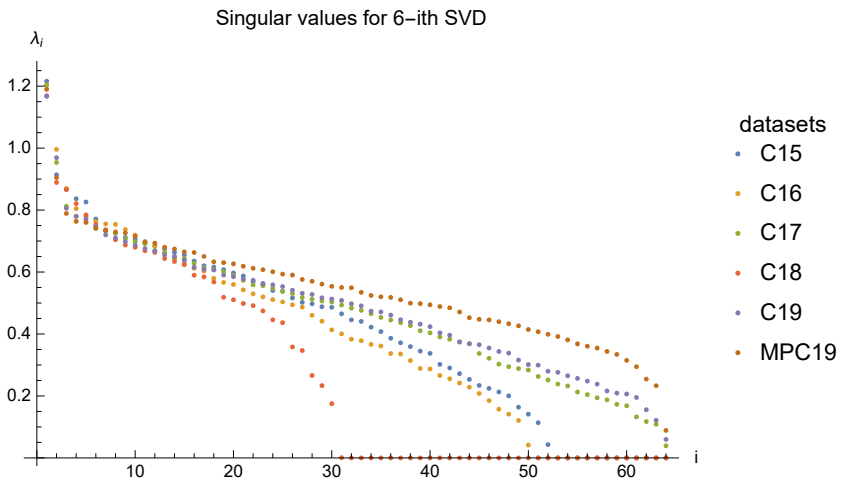


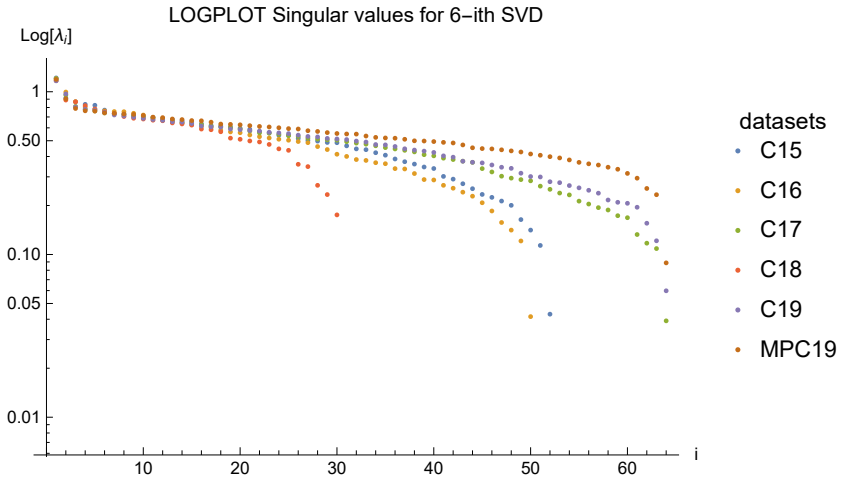
And Adjusting the Singular Values so Max singular value of each SVD sample is 1, these plots become:



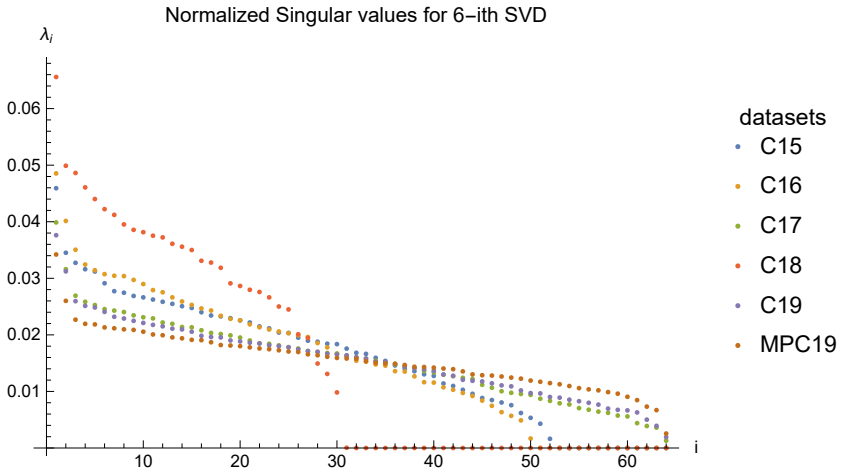


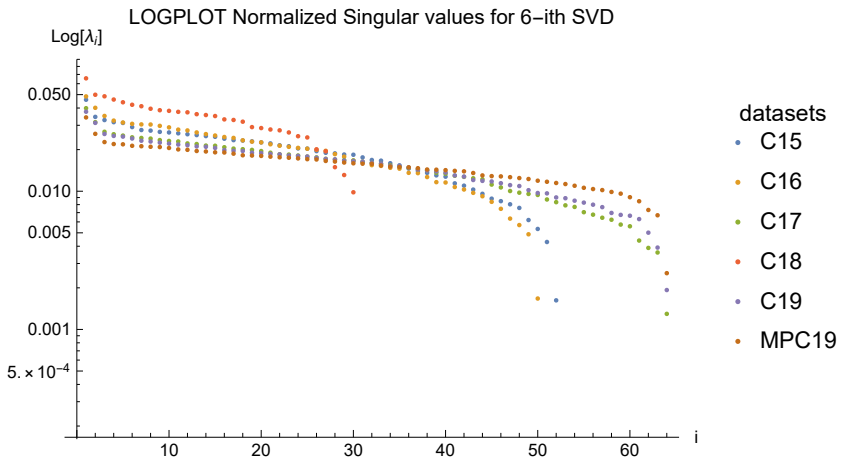
For the 6–th SVD, the Singular Values are:



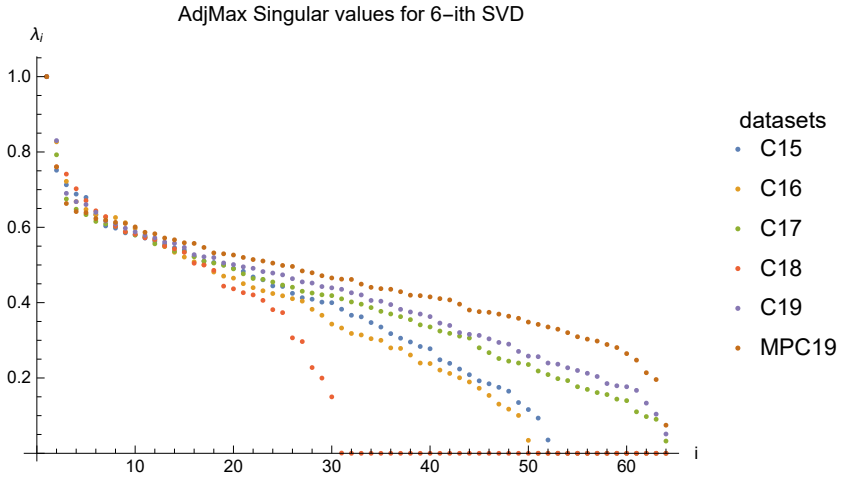


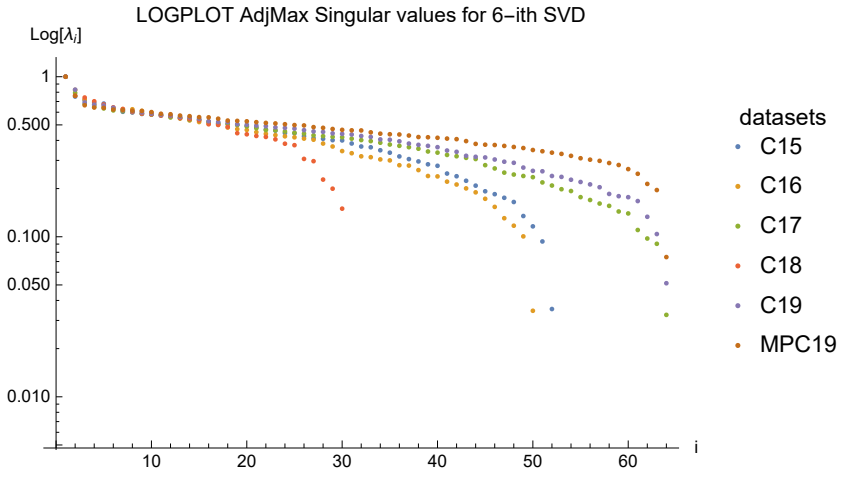
Normalizing the Singular Values, these plots become:



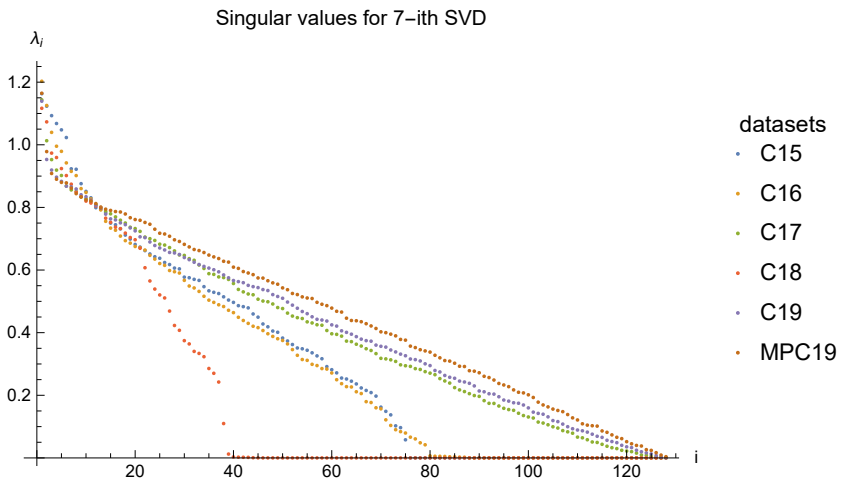


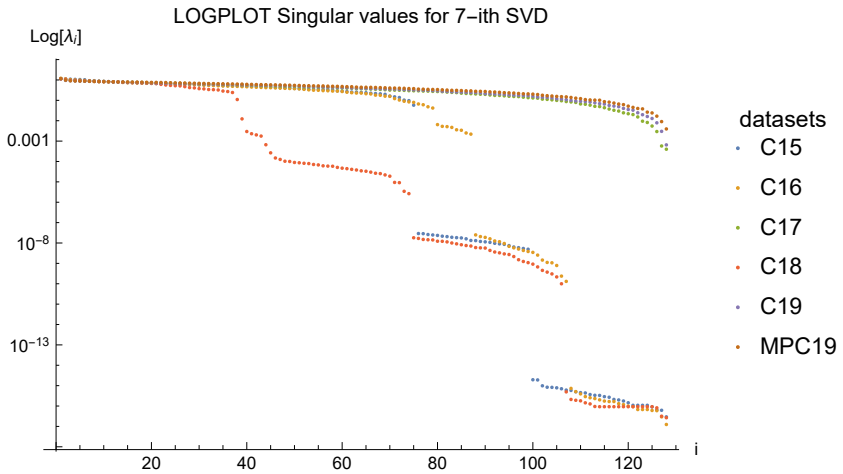
And Adjusting the Singular Values so Max singular value of each SVD sample is 1, these plots become:



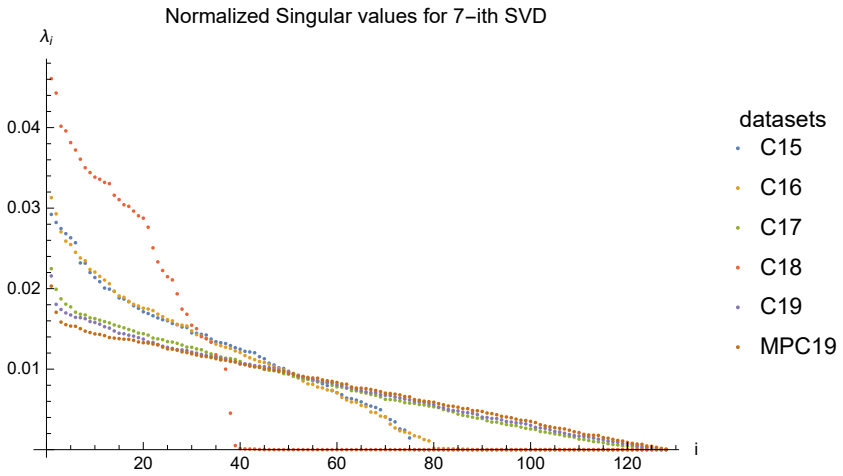


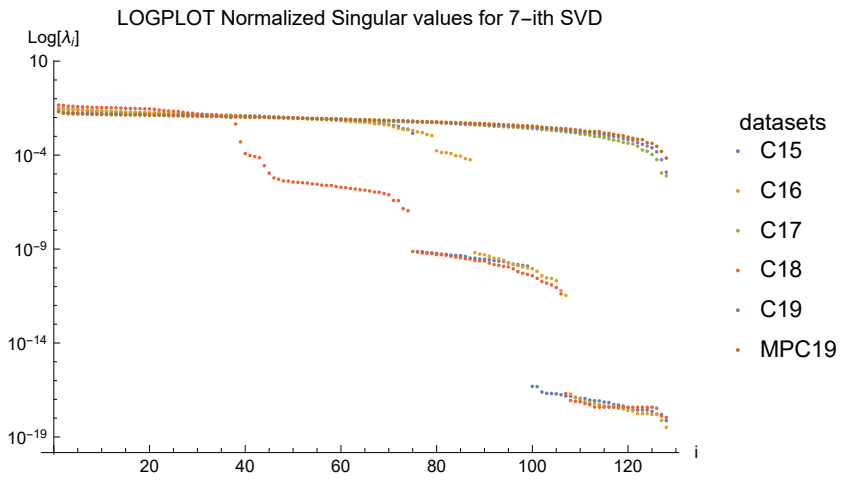
For the 7–th SVD, the Singular Values are:



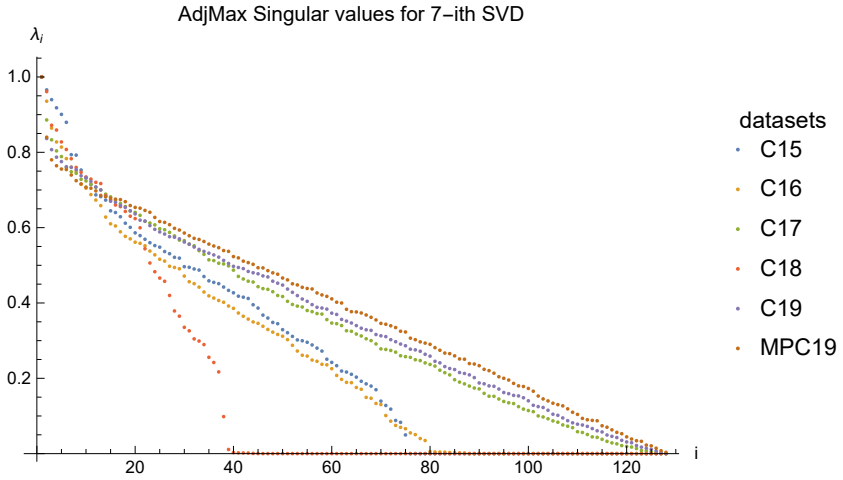


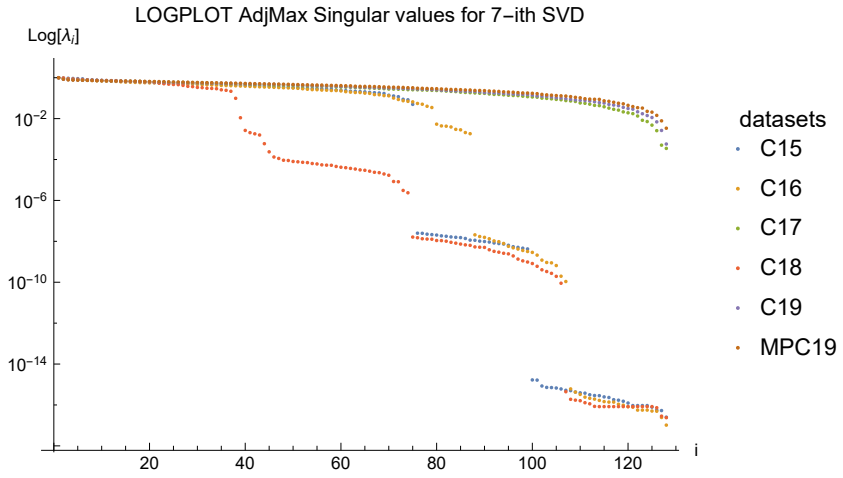
Normalizing the Singular Values, these plots become:



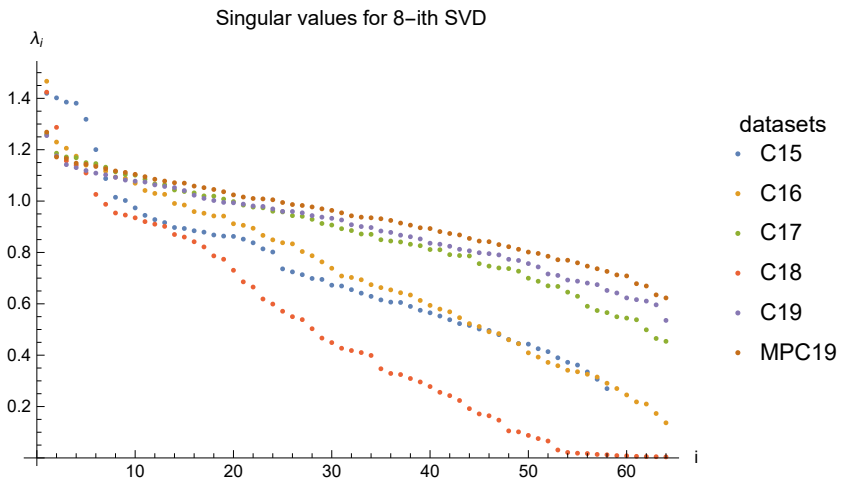


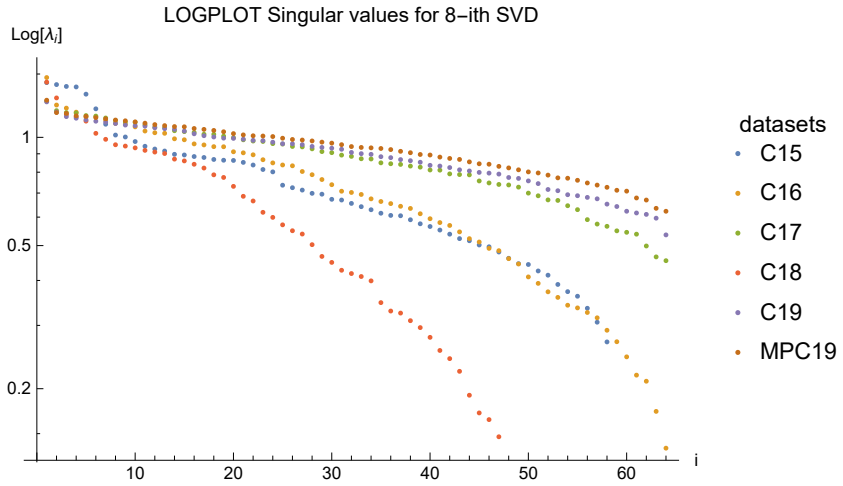
And Adjusting the Singular Values so Max singular value of each SVD sample is 1, these plots become:



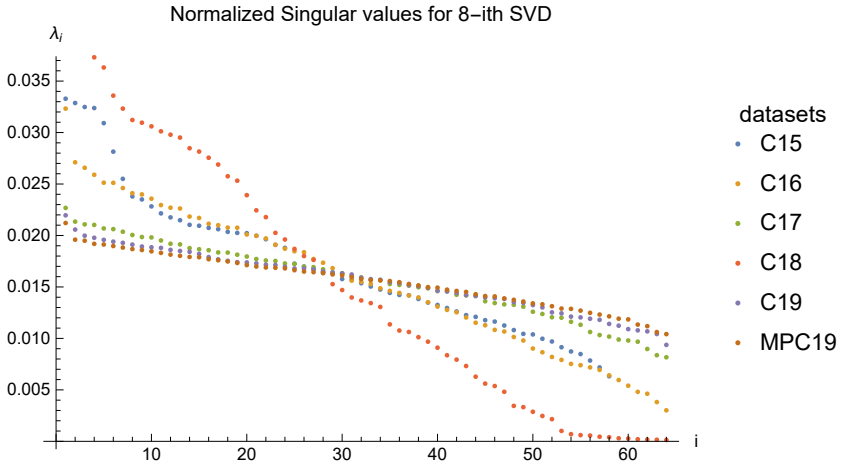


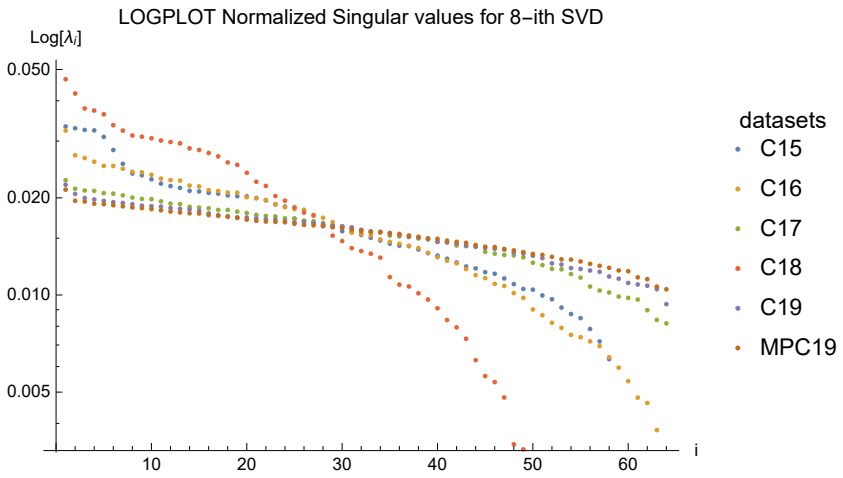
For the 8−th SVD, the Singular Values are:



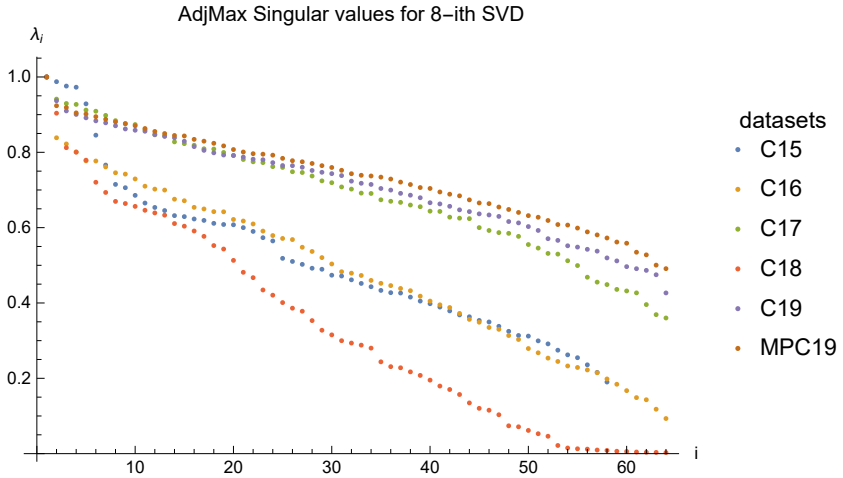


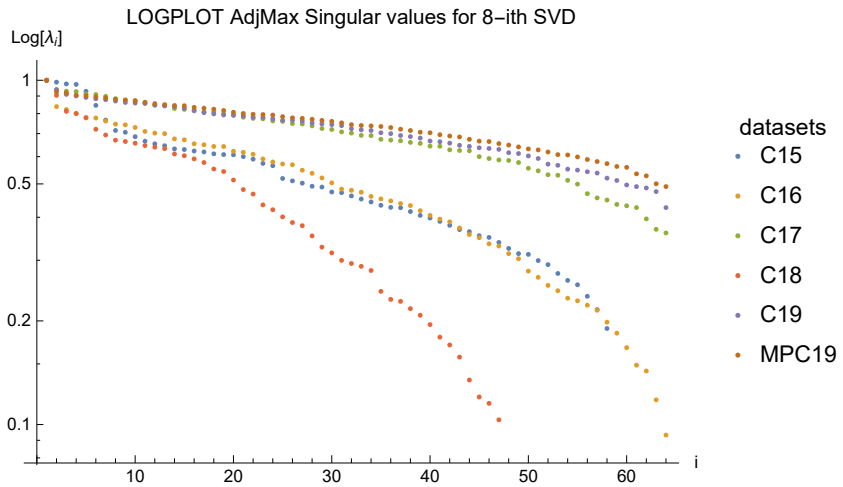
Normalizing the Singular Values, these plots become:



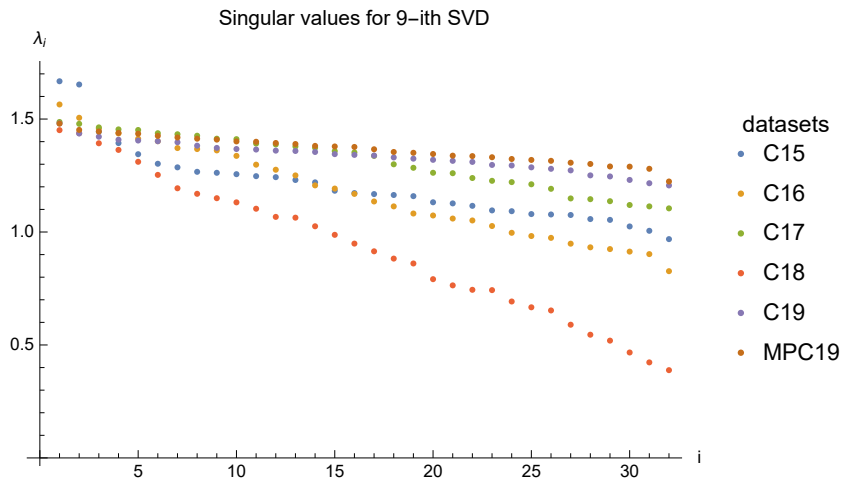


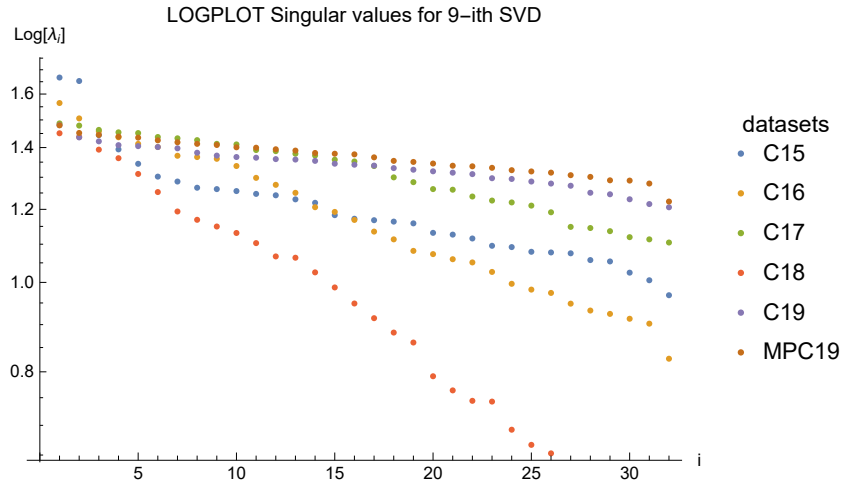
And Adjusting the Singular Values so Max
singular value of each SVD sample is 1, these plots become:



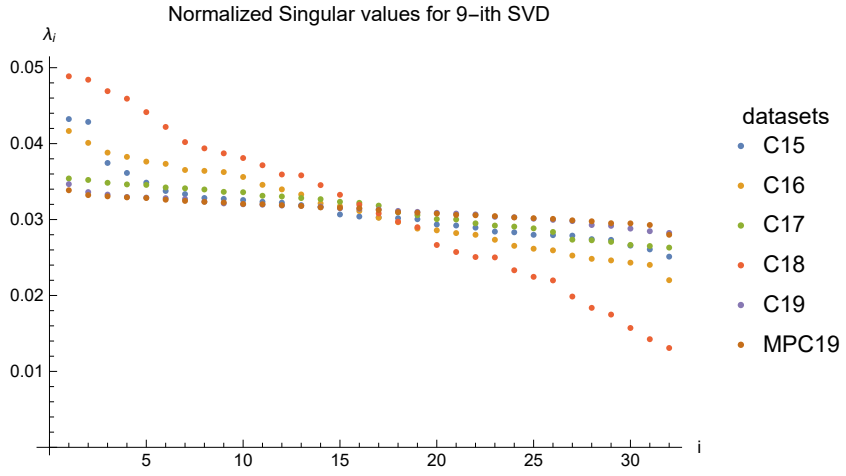


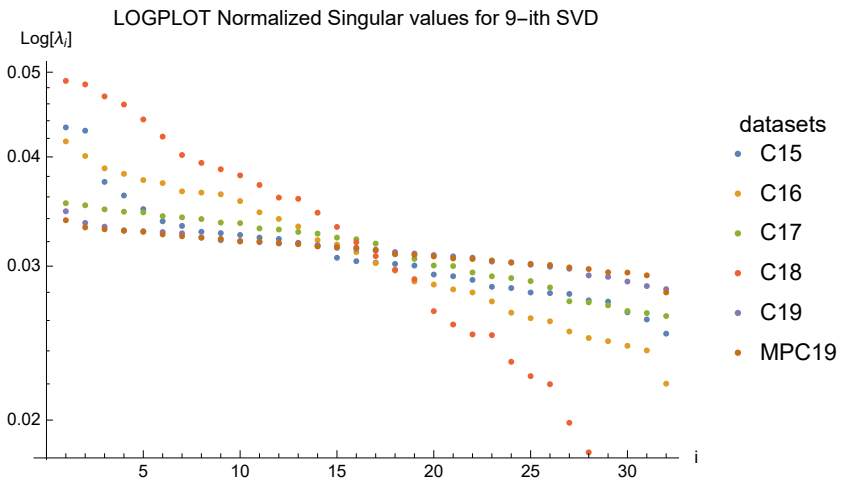
For the 9–th SVD, the Singular Values are:



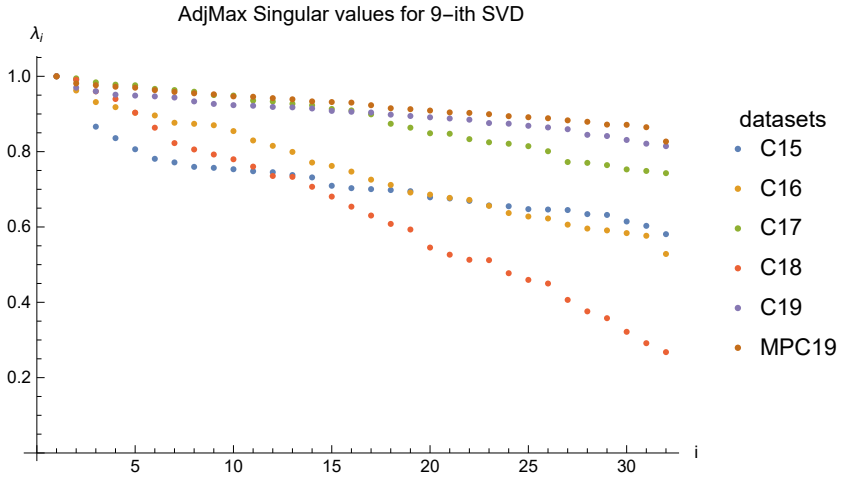


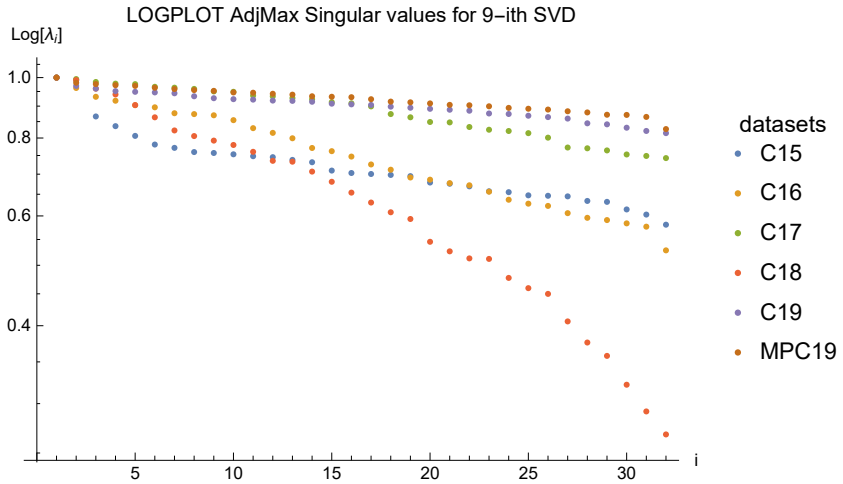
Normalizing the Singular Values, these plots become:



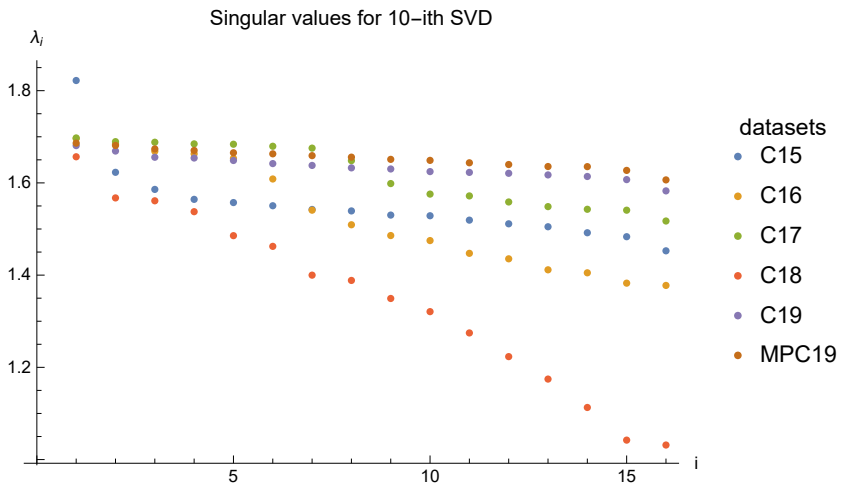


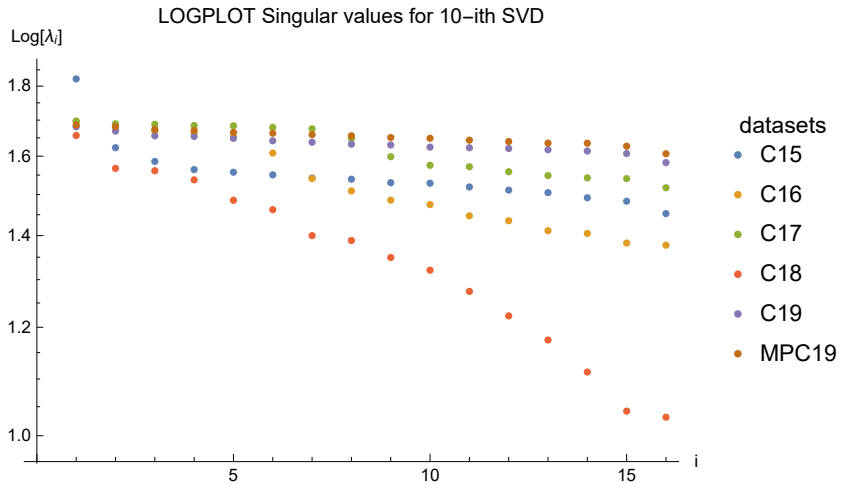
And Adjusting the Singular Values so Max singular value of each SVD sample is 1, these plots become:



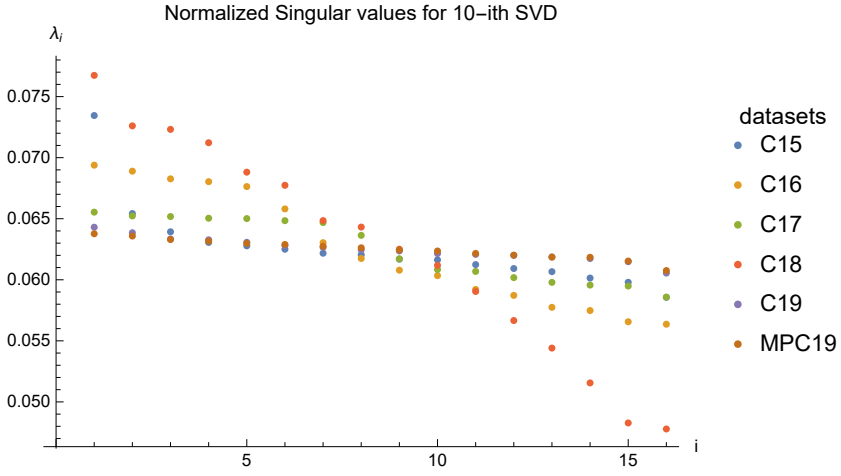


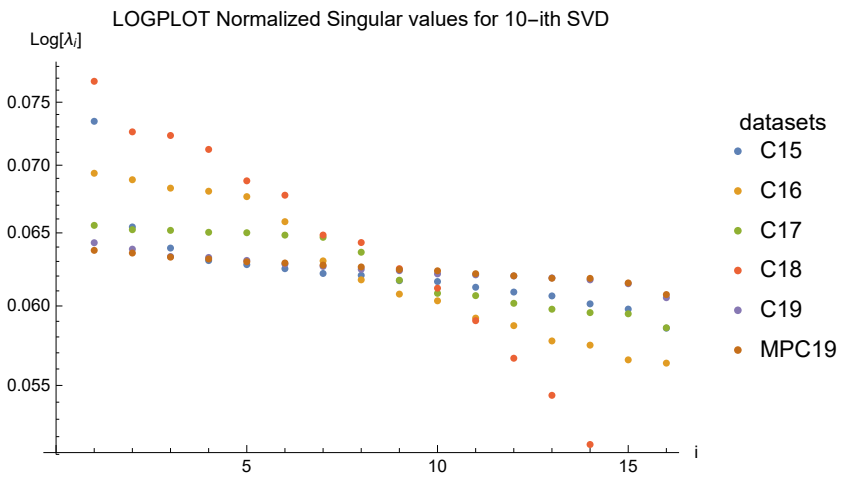
For the 10–th SVD, the Singular Values are:



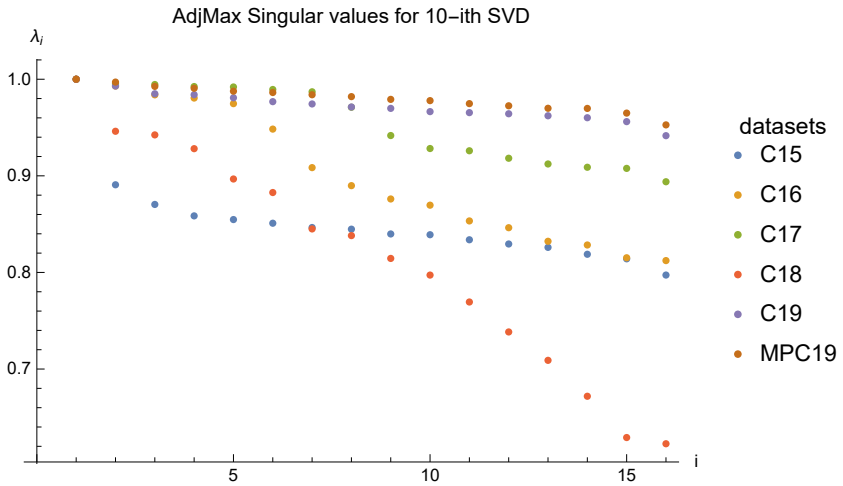


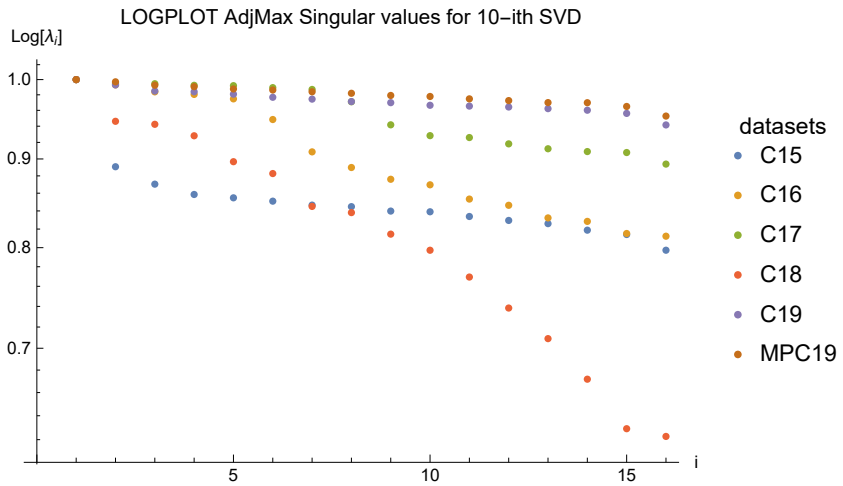
Normalizing the Singular Values, these plots become:



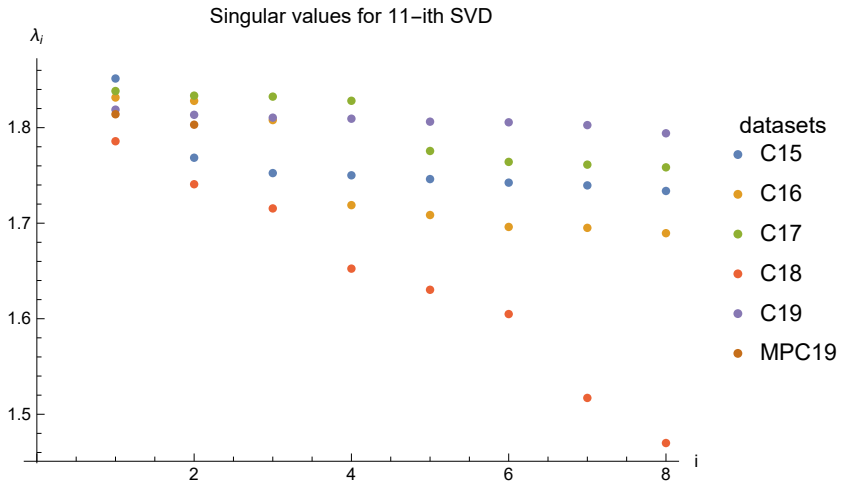


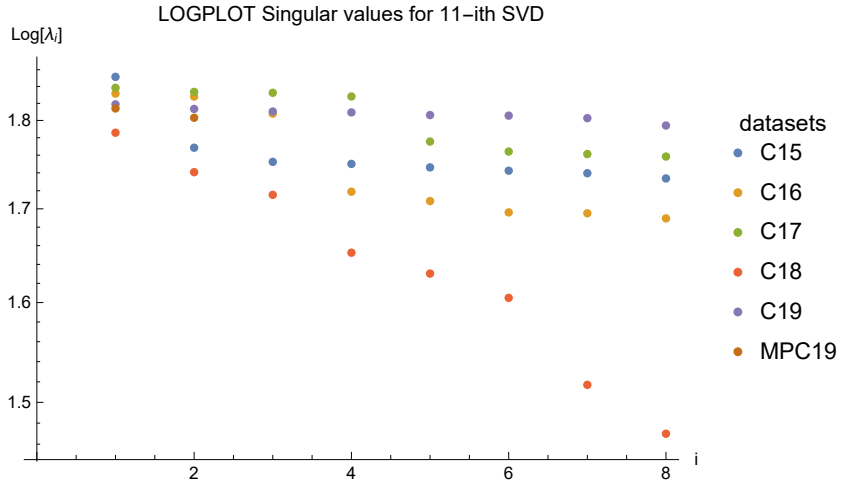
And Adjusting the Singular Values so Max singular value of each SVD sample is 1, these plots become:



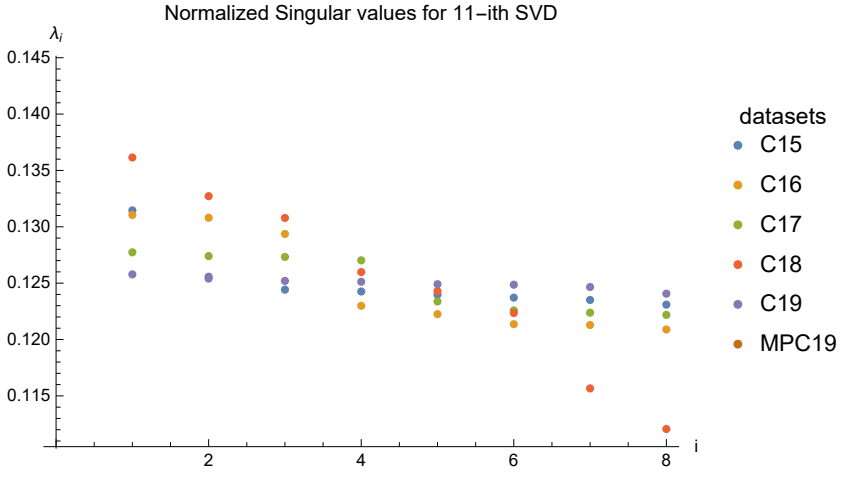


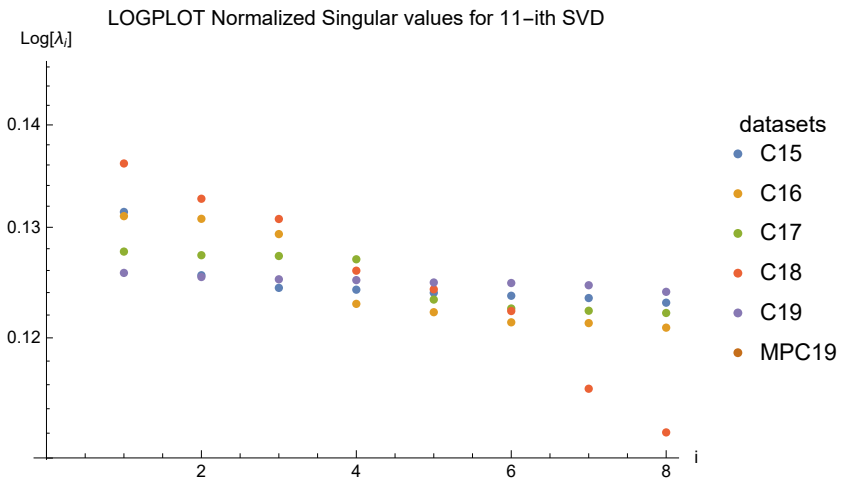
For the 11-th SVD, the Singular Values are:



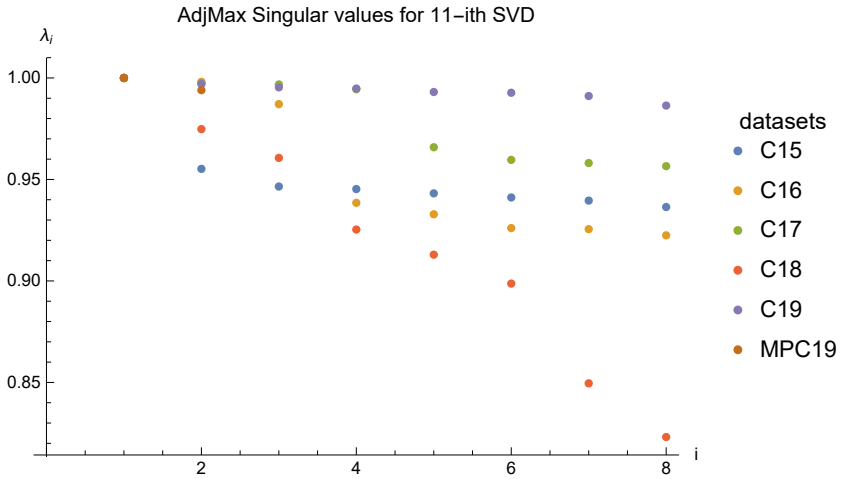


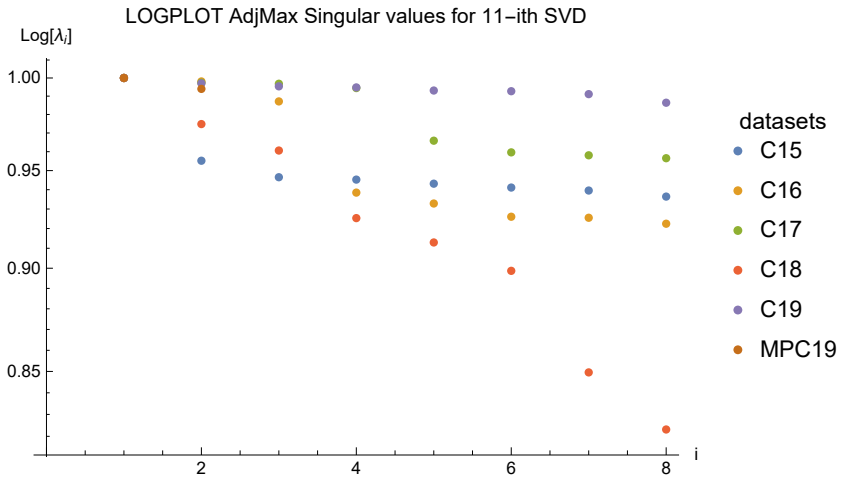
Normalizing the Singular Values, these plots become:



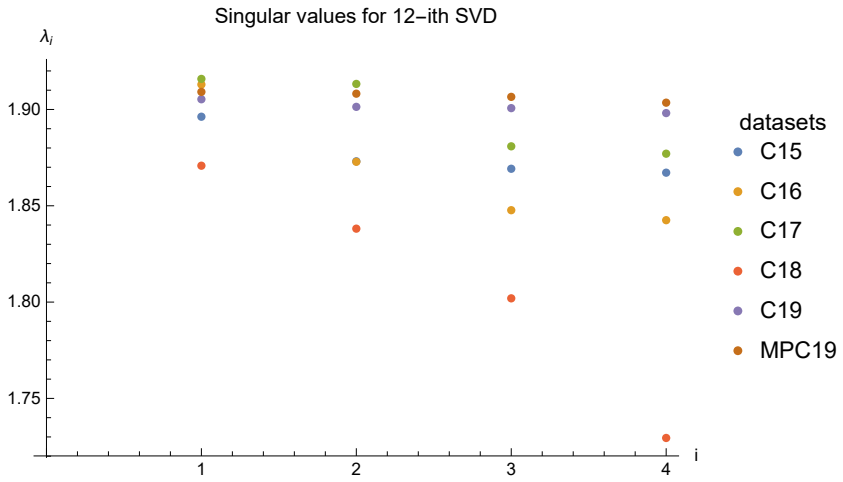


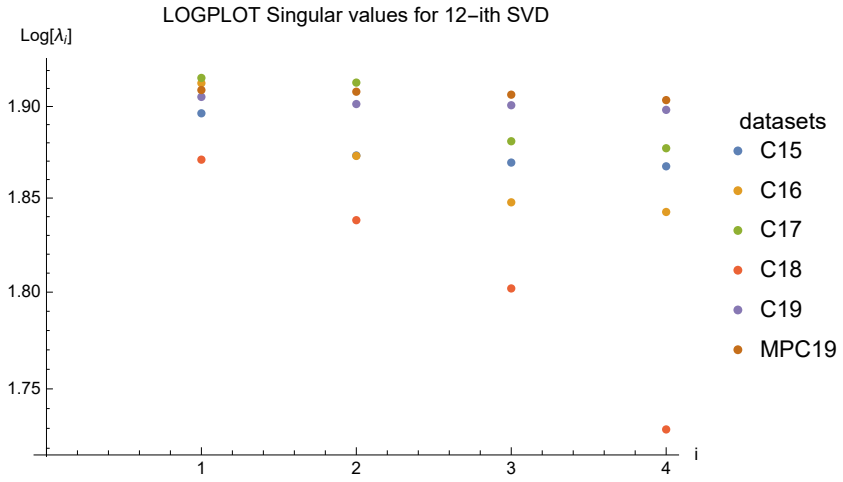
And Adjusting the Singular Values so Max
singular value of each SVD sample is 1, these plots become:



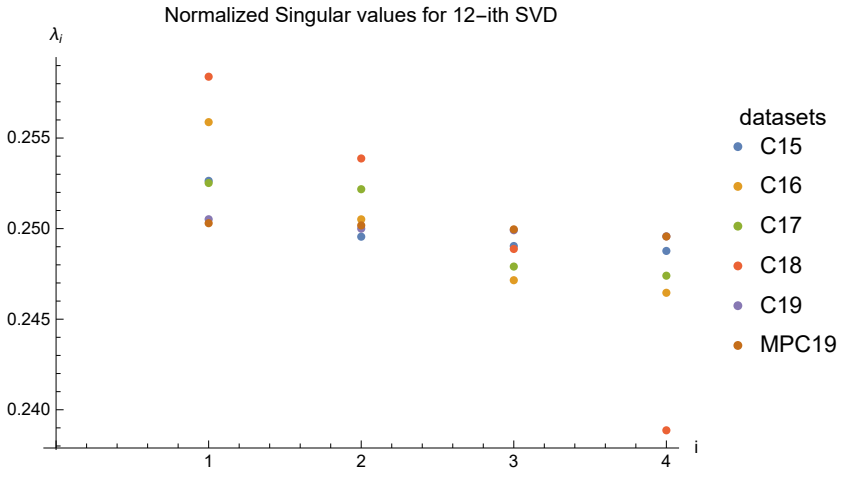


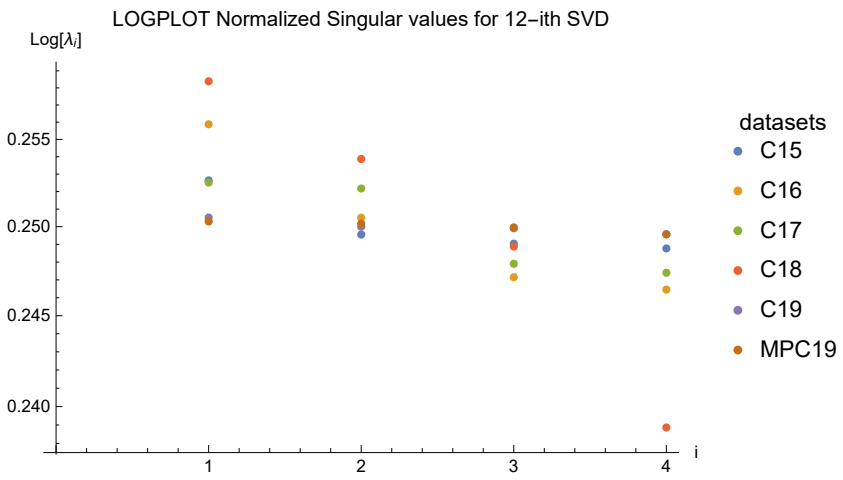
For the 12-th SVD, the Singular Values are:





Normalizing the Singular Values, these plots become:





And Adjusting the Singular Values so Max singular value of each SVD sample is 1, these plots become: