Figures Draft

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## Figure A

confusion matrix

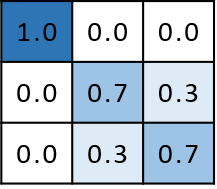
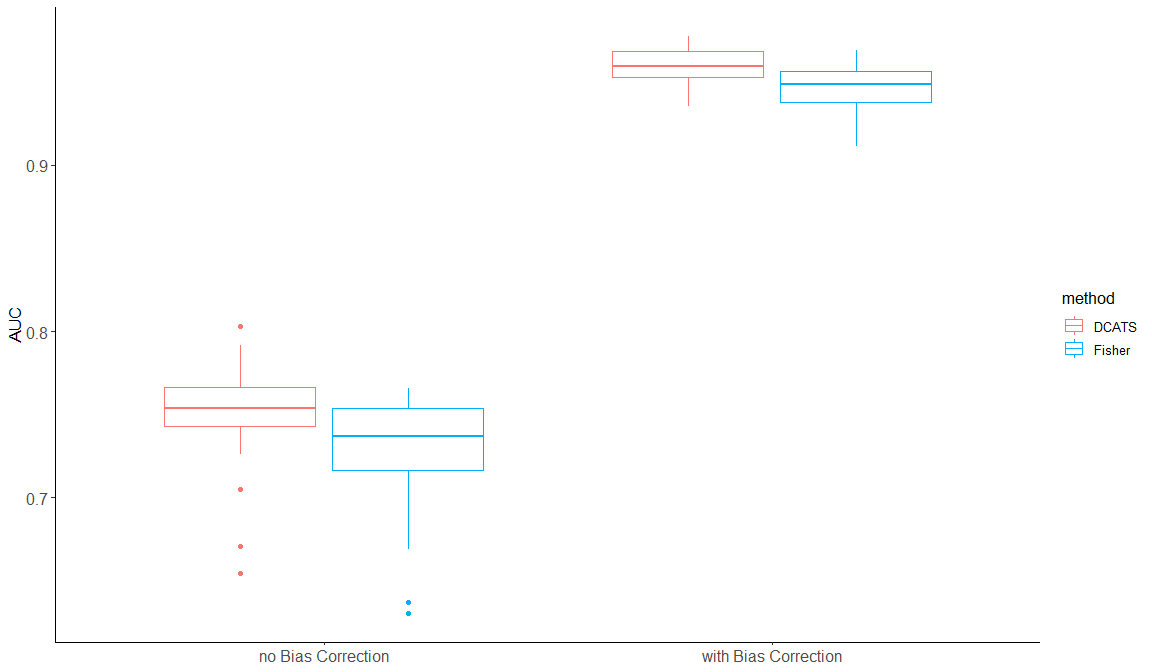


Figure A-1

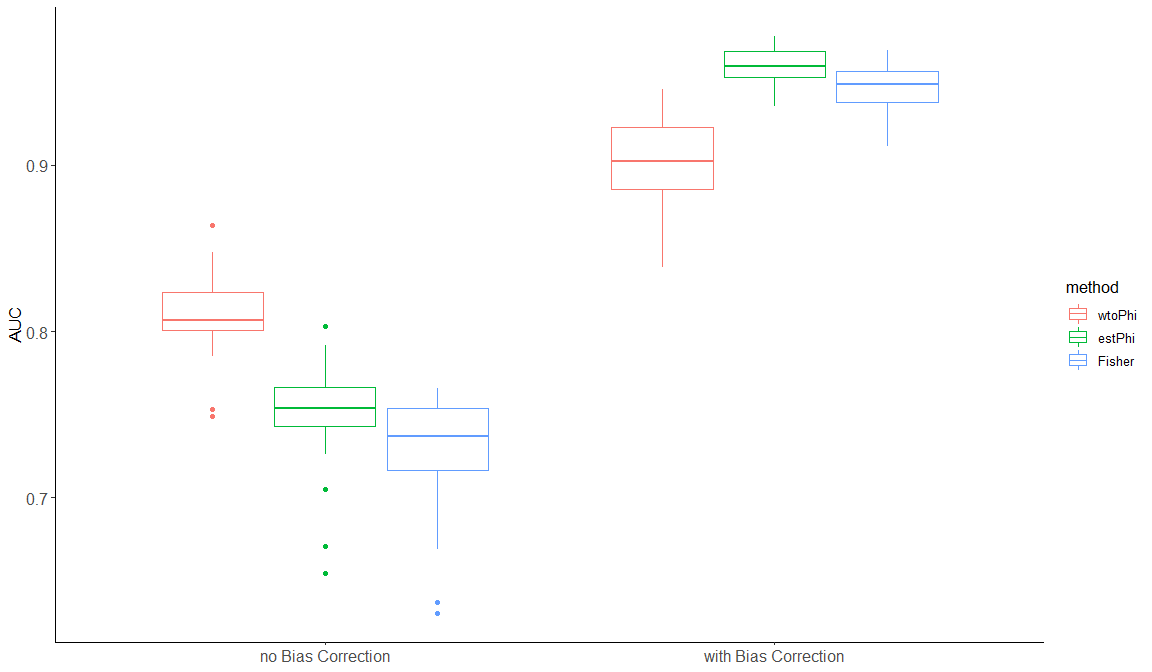
#Figure A-1

## Fig A-2



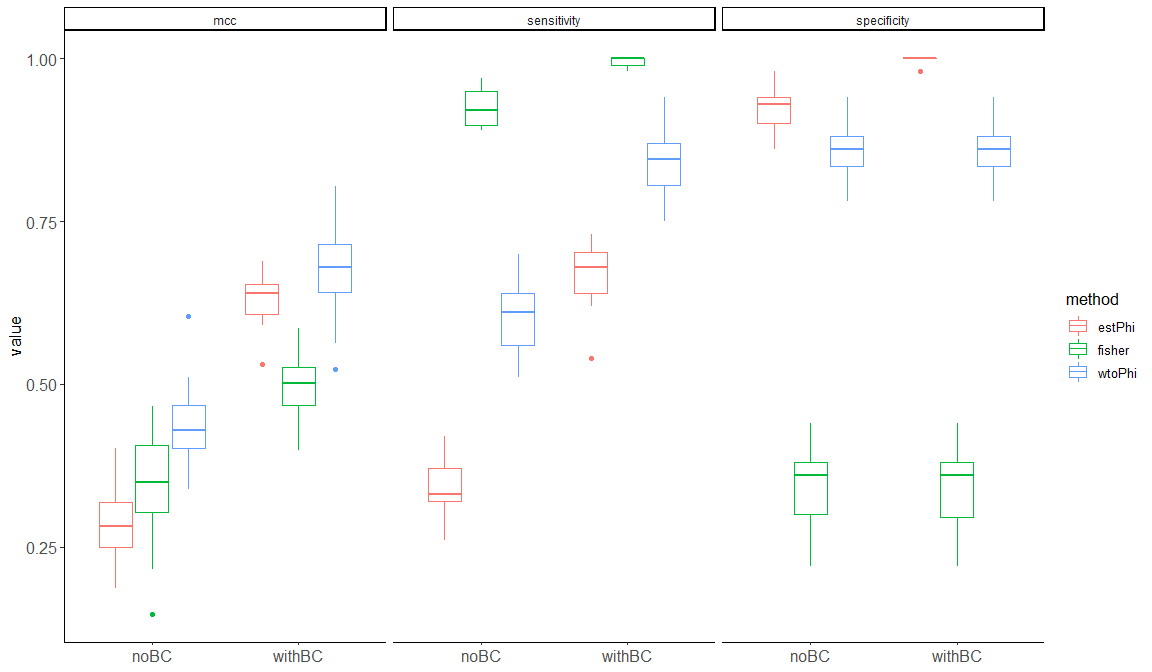
## Saving 12 x 7 in image

Plots -Supplementary1

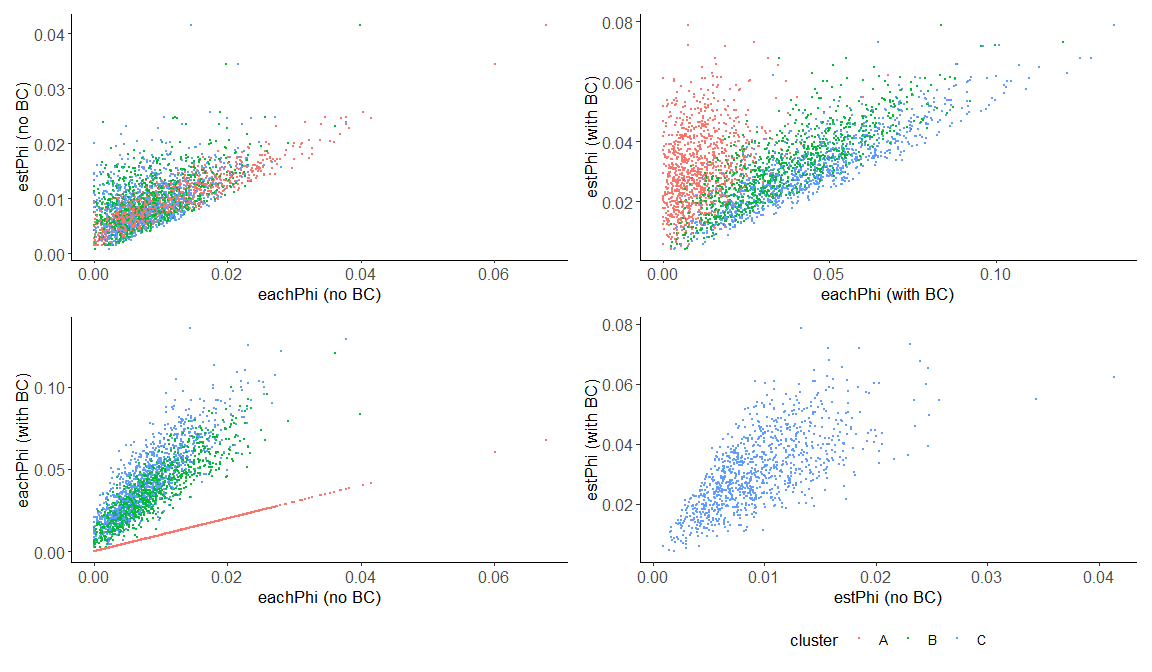


## Saving 12 x 7 in image

Plots -Supplementary2



## Saving 12 x 7 in image

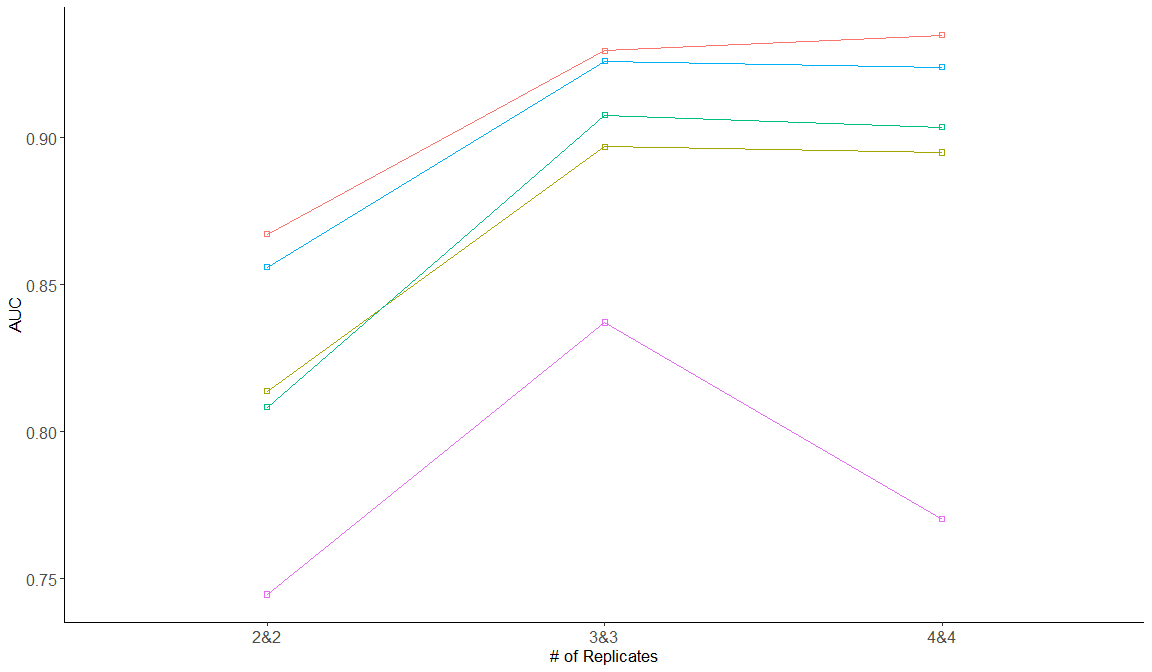


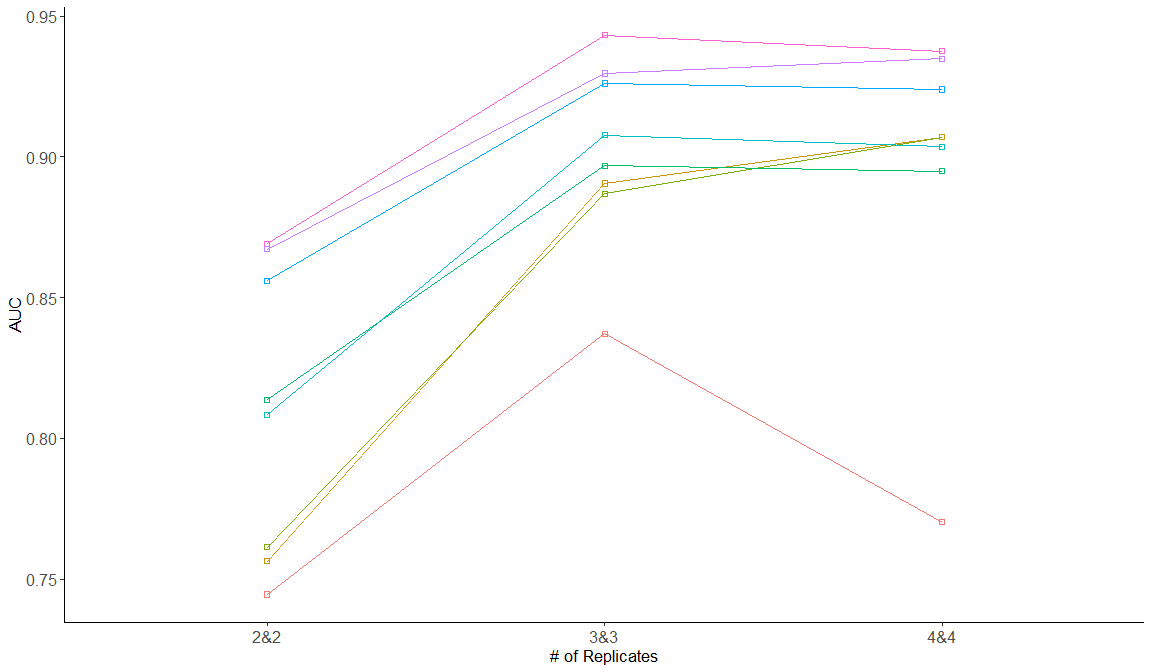
## Figure B

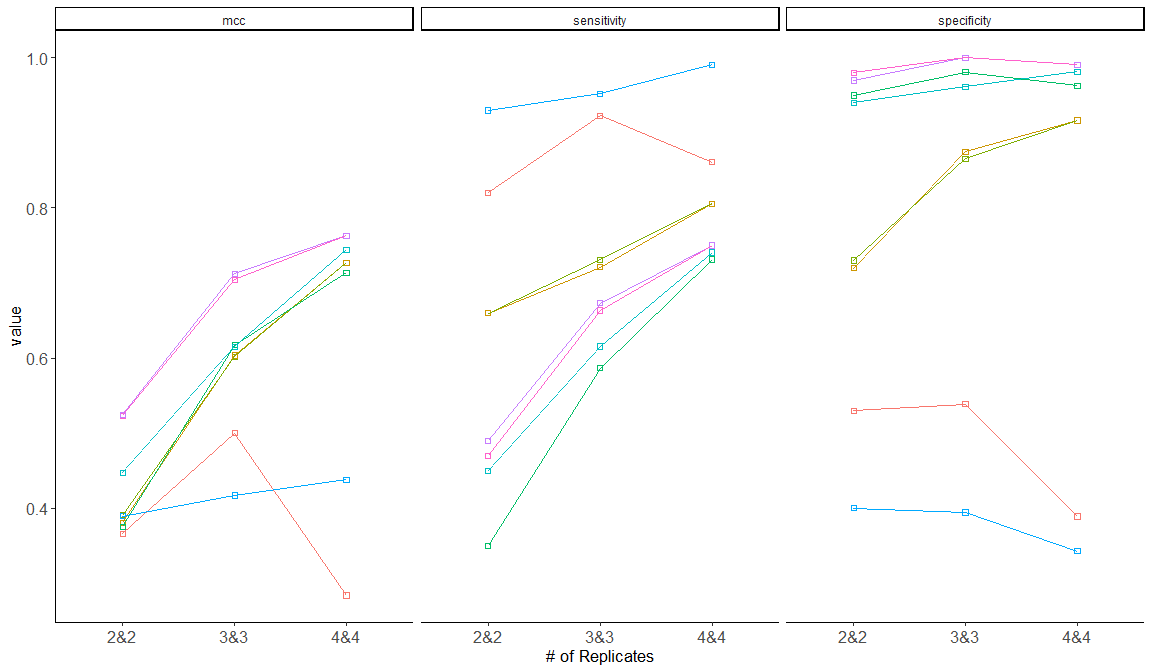
### Different number of replicates

## [1] "D:/Data/DCATS/simulation/replicates2&2\_K8\_con100\_splatter1500&2500.RData"  
## [2] "D:/Data/DCATS/simulation/replicates3&3\_K8\_con100\_splatter1500&2500.RData"  
## [3] "D:/Data/DCATS/simulation/replicates4&4\_K8\_con100\_splatter1500&2500.RData"

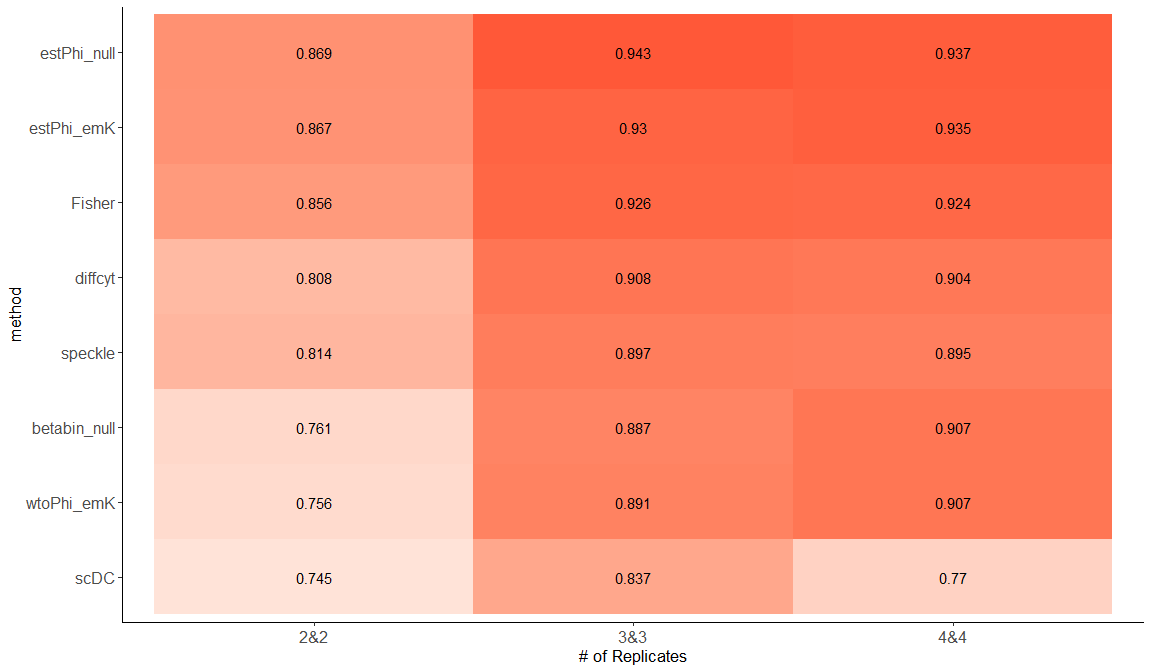
## method mcc auc sensitivity specificity F1 replicates  
## 1 estPhi\_null 0.523 0.869 0.470 0.980 0.631 2&2  
## 2 estPhi\_emK 0.524 0.867 0.490 0.970 0.645 2&2  
## 3 fisher 0.389 0.856 0.930 0.400 0.735 2&2  
## 4 speckle 0.375 0.814 0.350 0.950 0.500 2&2  
## 5 diffcyt 0.447 0.808 0.450 0.940 0.596 2&2  
## 6 betabin\_null 0.391 0.761 0.660 0.730 0.684 2&2  
## 7 wtoPhi\_emK 0.381 0.756 0.660 0.720 0.680 2&2  
## 8 scDC 0.366 0.745 0.820 0.530 0.716 2&2  
## 9 estPhi\_null 0.705 0.943 0.663 1.000 0.798 3&3  
## 10 estPhi\_emK 0.712 0.930 0.673 1.000 0.805 3&3  
## 11 fisher 0.417 0.926 0.952 0.394 0.744 3&3  
## 12 diffcyt 0.615 0.908 0.615 0.962 0.744 3&3  
## 13 speckle 0.617 0.897 0.587 0.981 0.731 3&3  
## 14 wtoPhi\_emK 0.603 0.891 0.721 0.875 0.781 3&3  
## 15 betabin\_null 0.602 0.887 0.731 0.865 0.784 3&3  
## 16 scDC 0.500 0.837 0.923 0.538 0.774 3&3  
## 17 estPhi\_null 0.763 0.937 0.750 0.991 0.853 4&4  
## 18 estPhi\_emK 0.763 0.935 0.750 0.991 0.853 4&4  
## 19 fisher 0.438 0.924 0.991 0.343 0.748 4&4  
## 20 betabin\_null 0.727 0.907 0.806 0.917 0.853 4&4  
## 21 wtoPhi\_emK 0.727 0.907 0.806 0.917 0.853 4&4  
## 22 diffcyt 0.744 0.904 0.741 0.981 0.842 4&4  
## 23 speckle 0.714 0.895 0.731 0.963 0.827 4&4  
## 24 scDC 0.284 0.770 0.861 0.389 0.697 4&4







Try to use heatmap

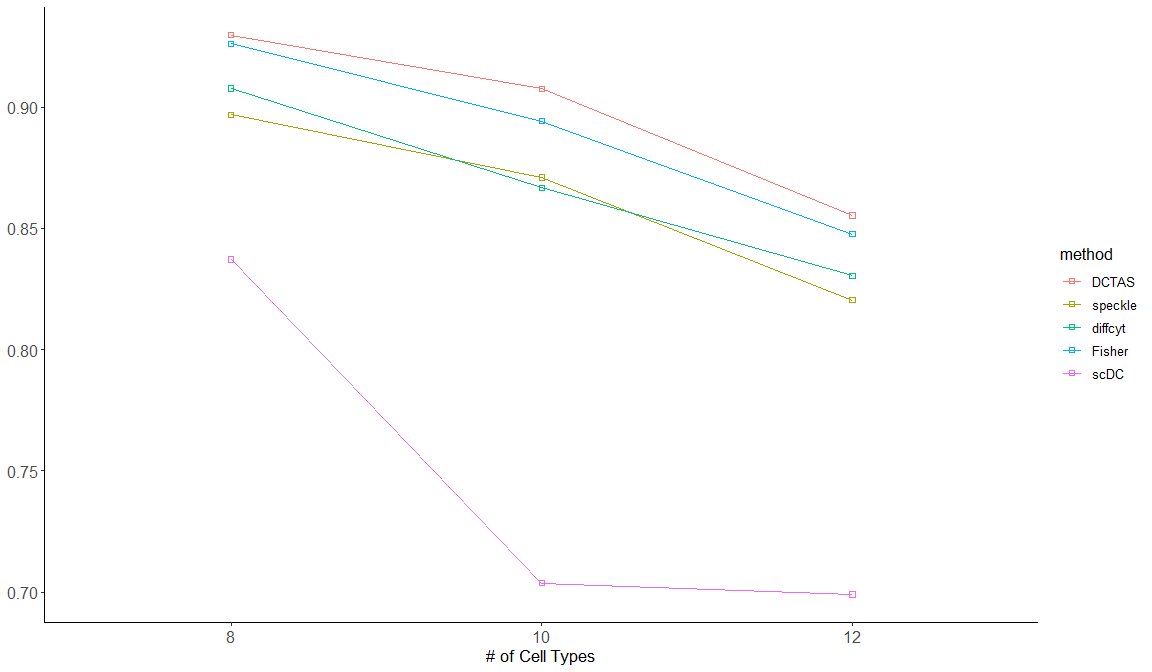


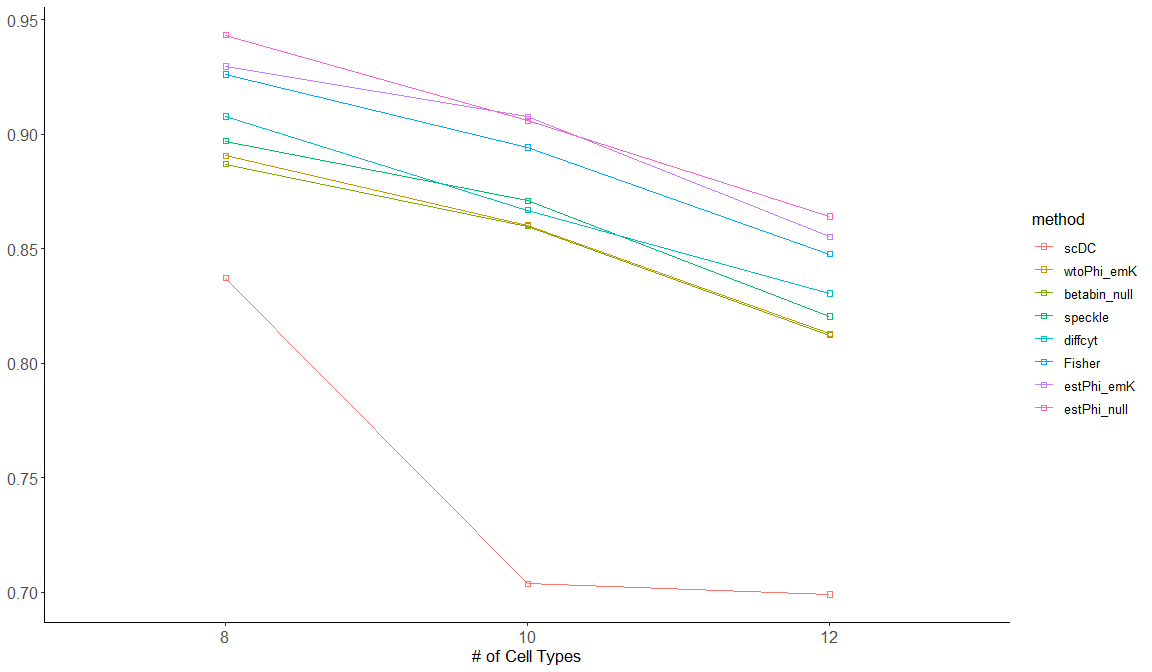
|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| method | mcc | prauc | auc | sensitivity | specificity | F1 | replicates |
| estPhi\_null | 0.523 | 0.8997604 | 0.869 | 0.470 | 0.980 | 0.631 | 2&2 |
| estPhi\_emK | 0.524 | 0.8942457 | 0.867 | 0.490 | 0.970 | 0.645 | 2&2 |
| Fisher | 0.389 | 0.8922918 | 0.856 | 0.930 | 0.400 | 0.735 | 2&2 |
| speckle | 0.375 | 0.8328290 | 0.814 | 0.350 | 0.950 | 0.500 | 2&2 |
| diffcyt | 0.447 | 0.8449180 | 0.808 | 0.450 | 0.940 | 0.596 | 2&2 |
| betabin\_null | 0.391 | 0.7444884 | 0.761 | 0.660 | 0.730 | 0.684 | 2&2 |
| wtoPhi\_emK | 0.381 | 0.7316957 | 0.756 | 0.660 | 0.720 | 0.680 | 2&2 |
| scDC | 0.366 | 0.7616693 | 0.745 | 0.820 | 0.530 | 0.716 | 2&2 |
| estPhi\_null | 0.705 | 0.9590899 | 0.943 | 0.663 | 1.000 | 0.798 | 3&3 |
| estPhi\_emK | 0.712 | 0.9557819 | 0.930 | 0.673 | 1.000 | 0.805 | 3&3 |
| Fisher | 0.417 | 0.9514592 | 0.926 | 0.952 | 0.394 | 0.744 | 3&3 |
| diffcyt | 0.615 | 0.9280542 | 0.908 | 0.615 | 0.962 | 0.744 | 3&3 |
| speckle | 0.617 | 0.9294739 | 0.897 | 0.587 | 0.981 | 0.731 | 3&3 |
| wtoPhi\_emK | 0.603 | 0.8935716 | 0.891 | 0.721 | 0.875 | 0.781 | 3&3 |
| betabin\_null | 0.602 | 0.8855435 | 0.887 | 0.731 | 0.865 | 0.784 | 3&3 |
| scDC | 0.500 | 0.8436959 | 0.837 | 0.923 | 0.538 | 0.774 | 3&3 |
| estPhi\_null | 0.763 | 0.9576111 | 0.937 | 0.750 | 0.991 | 0.853 | 4&4 |
| estPhi\_emK | 0.763 | 0.9557762 | 0.935 | 0.750 | 0.991 | 0.853 | 4&4 |
| Fisher | 0.438 | 0.9471641 | 0.924 | 0.991 | 0.343 | 0.748 | 4&4 |
| betabin\_null | 0.727 | 0.9203736 | 0.907 | 0.806 | 0.917 | 0.853 | 4&4 |
| wtoPhi\_emK | 0.727 | 0.9222353 | 0.907 | 0.806 | 0.917 | 0.853 | 4&4 |
| diffcyt | 0.744 | 0.9392535 | 0.904 | 0.741 | 0.981 | 0.842 | 4&4 |
| speckle | 0.714 | 0.9406568 | 0.895 | 0.731 | 0.963 | 0.827 | 4&4 |
| scDC | 0.284 | 0.7971399 | 0.770 | 0.861 | 0.389 | 0.697 | 4&4 |

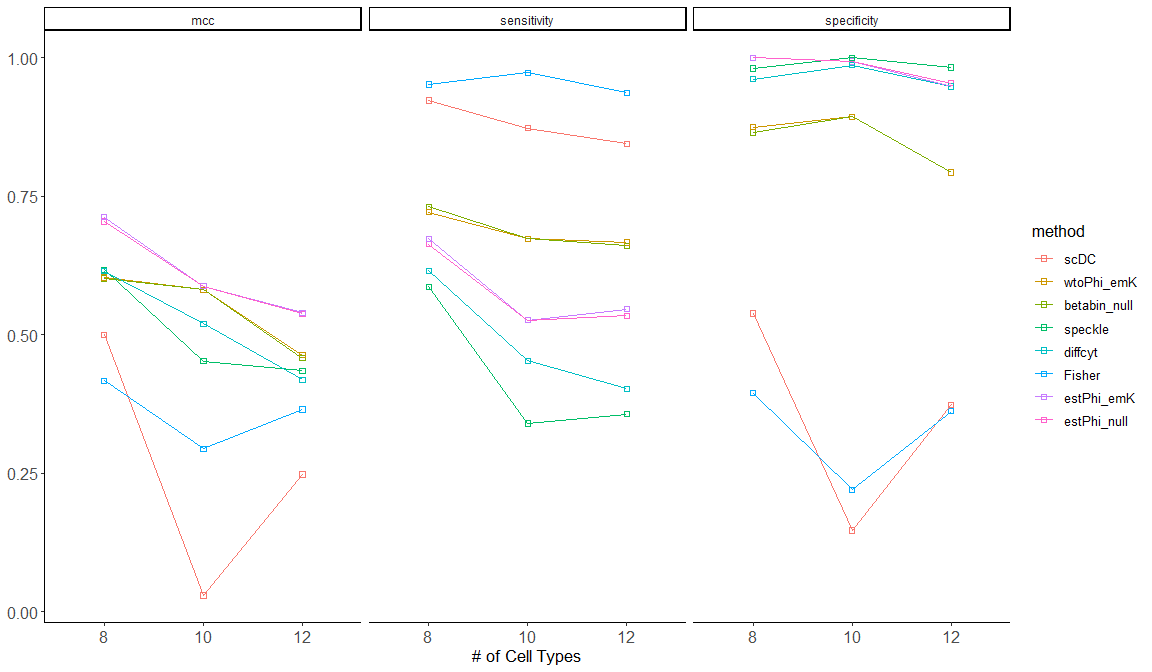
### Different number of cell types

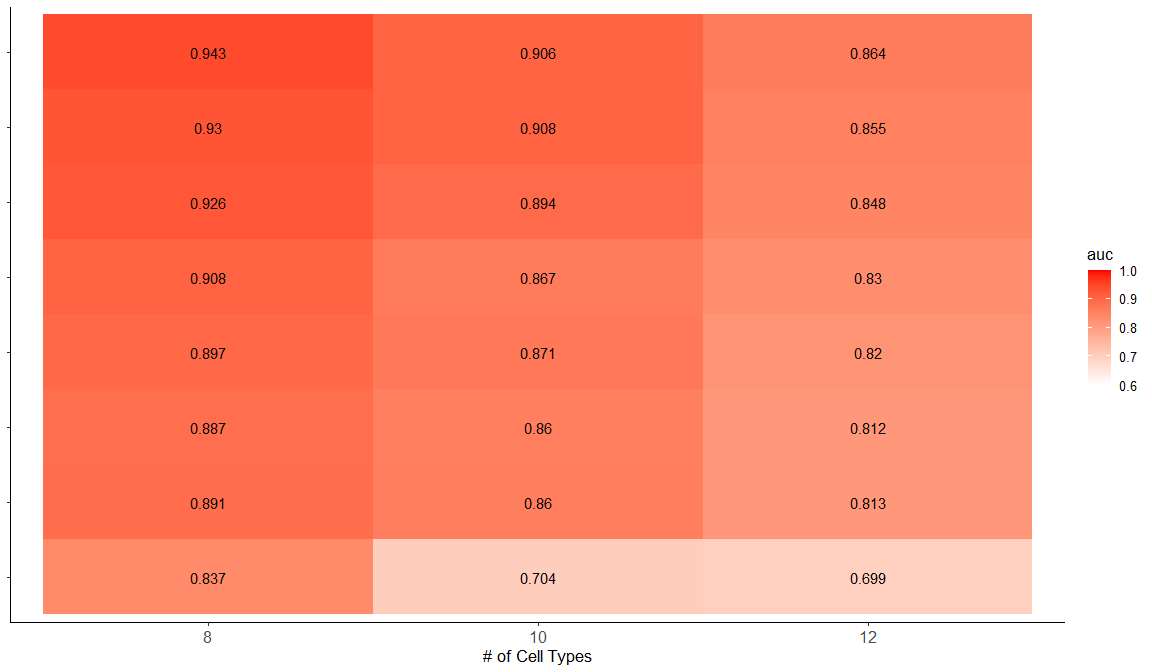
## [1] "D:/Data/DCATS/simulation/replicates3&3\_K10\_con100\_splatter1500&2500.RData"  
## [2] "D:/Data/DCATS/simulation/replicates3&3\_K12\_con100\_splatter1500&2500.RData"  
## [3] "D:/Data/DCATS/simulation/replicates3&3\_K8\_con100\_splatter1500&2500.RData"

## method mcc auc sensitivity specificity F1 clustersN  
## 1 estPhi\_null 0.705 0.943 0.663 1.000 0.798 8  
## 2 estPhi\_emK 0.712 0.930 0.673 1.000 0.805 8  
## 3 fisher 0.417 0.926 0.952 0.394 0.744 8  
## 4 diffcyt 0.615 0.908 0.615 0.962 0.744 8  
## 5 speckle 0.617 0.897 0.587 0.981 0.731 8  
## 6 wtoPhi\_emK 0.603 0.891 0.721 0.875 0.781 8  
## 7 betabin\_null 0.602 0.887 0.731 0.865 0.784 8  
## 8 scDC 0.500 0.837 0.923 0.538 0.774 8  
## 9 estPhi\_emK 0.588 0.908 0.527 0.993 0.687 10  
## 10 estPhi\_null 0.588 0.906 0.527 0.993 0.687 10  
## 11 fisher 0.294 0.894 0.973 0.220 0.707 10  
## 12 speckle 0.453 0.871 0.340 1.000 0.507 10  
## 13 diffcyt 0.520 0.867 0.453 0.987 0.618 10  
## 14 wtoPhi\_emK 0.581 0.860 0.673 0.893 0.757 10  
## 15 betabin\_null 0.581 0.860 0.673 0.893 0.757 10  
## 16 scDC 0.029 0.704 0.873 0.147 0.641 10  
## 17 estPhi\_null 0.538 0.864 0.534 0.954 0.676 12  
## 18 estPhi\_emK 0.540 0.855 0.546 0.948 0.683 12  
## 19 fisher 0.365 0.848 0.937 0.362 0.728 12  
## 20 diffcyt 0.418 0.830 0.402 0.948 0.553 12  
## 21 speckle 0.435 0.820 0.356 0.983 0.519 12  
## 22 wtoPhi\_emK 0.463 0.813 0.667 0.793 0.712 12  
## 23 betabin\_null 0.458 0.812 0.661 0.793 0.708 12  
## 24 scDC 0.248 0.699 0.845 0.374 0.684 12

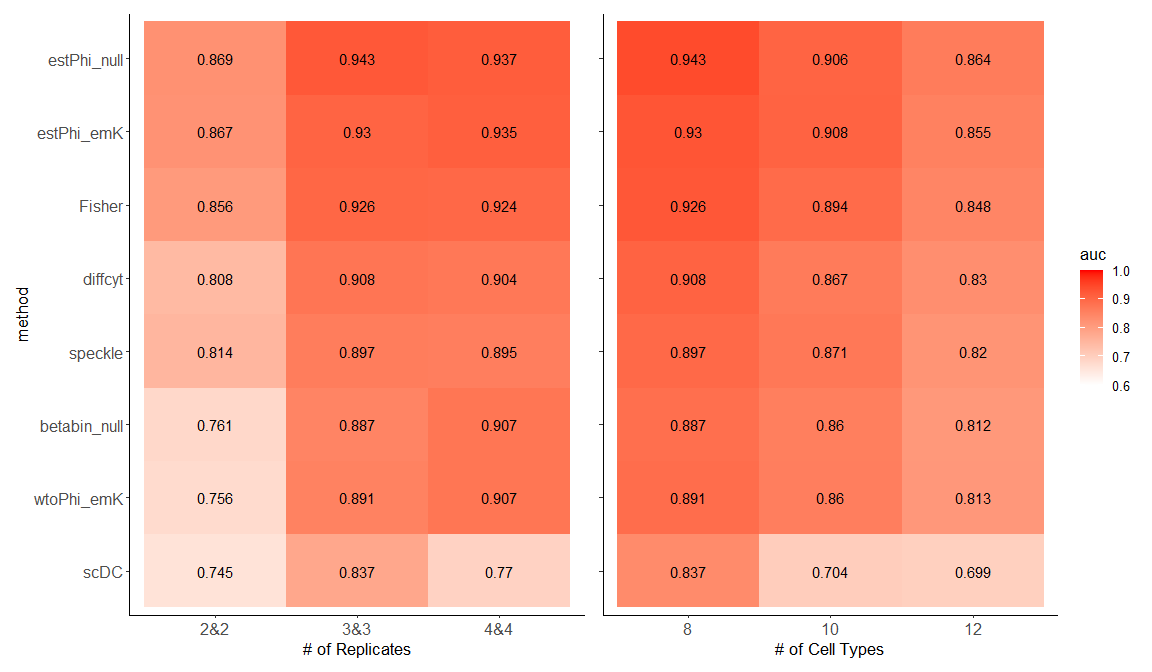
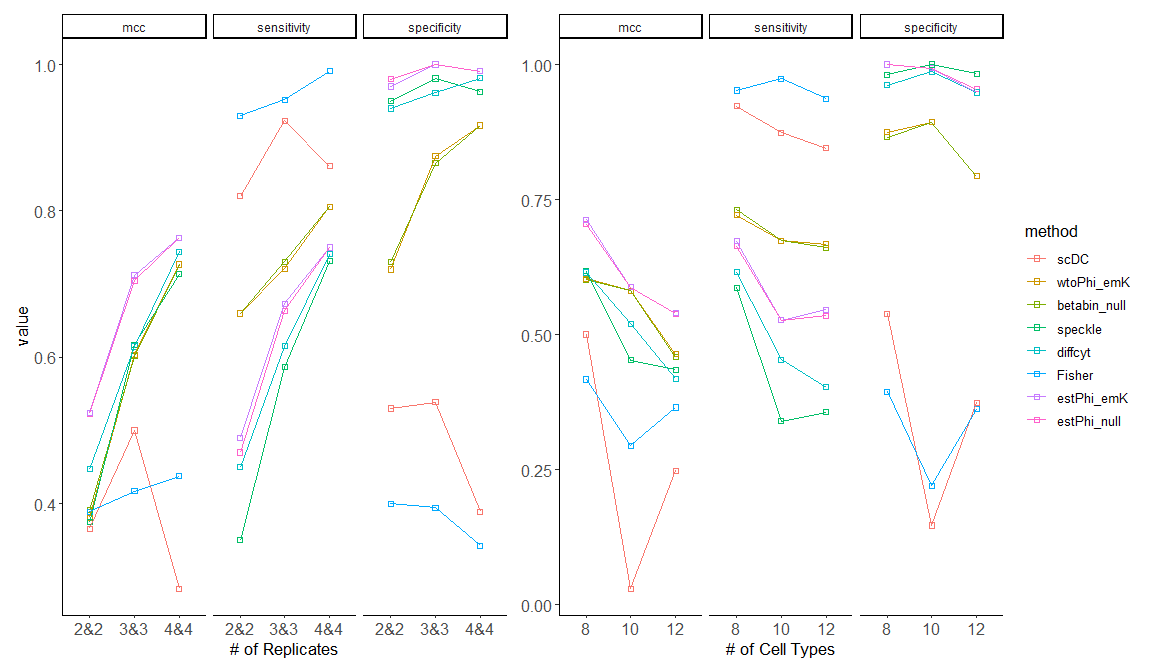
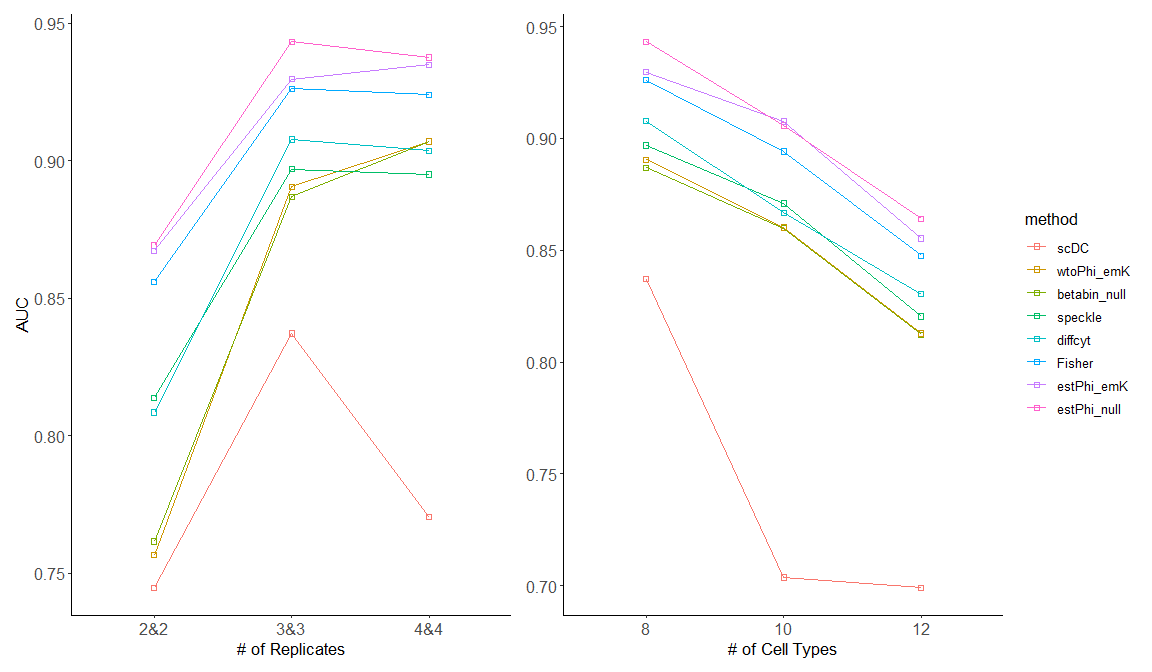
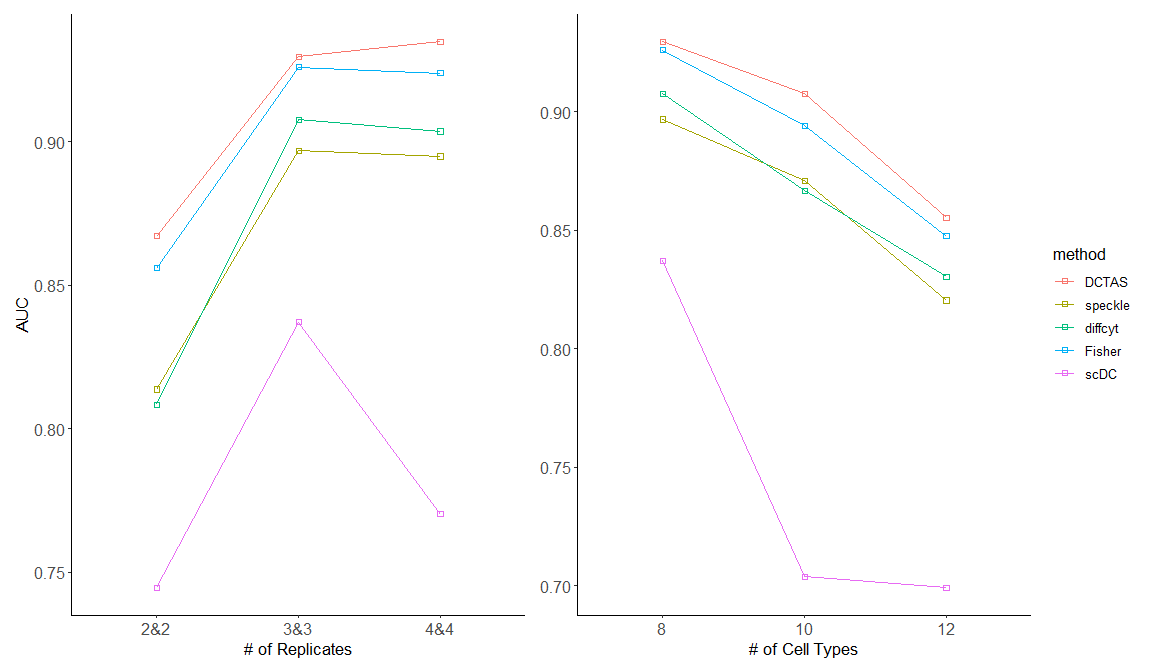








|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| method | mcc | prauc | auc | sensitivity | specificity | F1 | clustersN |
| estPhi\_null | 0.705 | 0.9590899 | 0.943 | 0.663 | 1.000 | 0.798 | 8 |
| estPhi\_emK | 0.712 | 0.9557819 | 0.930 | 0.673 | 1.000 | 0.805 | 8 |
| Fisher | 0.417 | 0.9514592 | 0.926 | 0.952 | 0.394 | 0.744 | 8 |
| diffcyt | 0.615 | 0.9280542 | 0.908 | 0.615 | 0.962 | 0.744 | 8 |
| speckle | 0.617 | 0.9294739 | 0.897 | 0.587 | 0.981 | 0.731 | 8 |
| wtoPhi\_emK | 0.603 | 0.8935716 | 0.891 | 0.721 | 0.875 | 0.781 | 8 |
| betabin\_null | 0.602 | 0.8855435 | 0.887 | 0.731 | 0.865 | 0.784 | 8 |
| scDC | 0.500 | 0.8436959 | 0.837 | 0.923 | 0.538 | 0.774 | 8 |
| estPhi\_emK | 0.588 | 0.9288600 | 0.908 | 0.527 | 0.993 | 0.687 | 10 |
| estPhi\_null | 0.588 | 0.9330608 | 0.906 | 0.527 | 0.993 | 0.687 | 10 |
| Fisher | 0.294 | 0.9217588 | 0.894 | 0.973 | 0.220 | 0.707 | 10 |
| speckle | 0.453 | 0.8951678 | 0.871 | 0.340 | 1.000 | 0.507 | 10 |
| diffcyt | 0.520 | 0.8981561 | 0.867 | 0.453 | 0.987 | 0.618 | 10 |
| betabin\_null | 0.581 | 0.8777486 | 0.860 | 0.673 | 0.893 | 0.757 | 10 |
| wtoPhi\_emK | 0.581 | 0.8767063 | 0.860 | 0.673 | 0.893 | 0.757 | 10 |
| scDC | 0.029 | 0.7613076 | 0.704 | 0.873 | 0.147 | 0.641 | 10 |
| estPhi\_null | 0.538 | 0.8794958 | 0.864 | 0.534 | 0.954 | 0.676 | 12 |
| estPhi\_emK | 0.540 | 0.8761658 | 0.855 | 0.546 | 0.948 | 0.683 | 12 |
| Fisher | 0.365 | 0.8682550 | 0.848 | 0.937 | 0.362 | 0.728 | 12 |
| diffcyt | 0.418 | 0.8394753 | 0.830 | 0.402 | 0.948 | 0.553 | 12 |
| speckle | 0.435 | 0.8426561 | 0.820 | 0.356 | 0.983 | 0.519 | 12 |
| wtoPhi\_emK | 0.463 | 0.6936592 | 0.813 | 0.667 | 0.793 | 0.712 | 12 |
| betabin\_null | 0.458 | 0.6916073 | 0.812 | 0.661 | 0.793 | 0.708 | 12 |
| scDC | 0.248 | 0.7203456 | 0.699 | 0.845 | 0.374 | 0.684 | 12 |



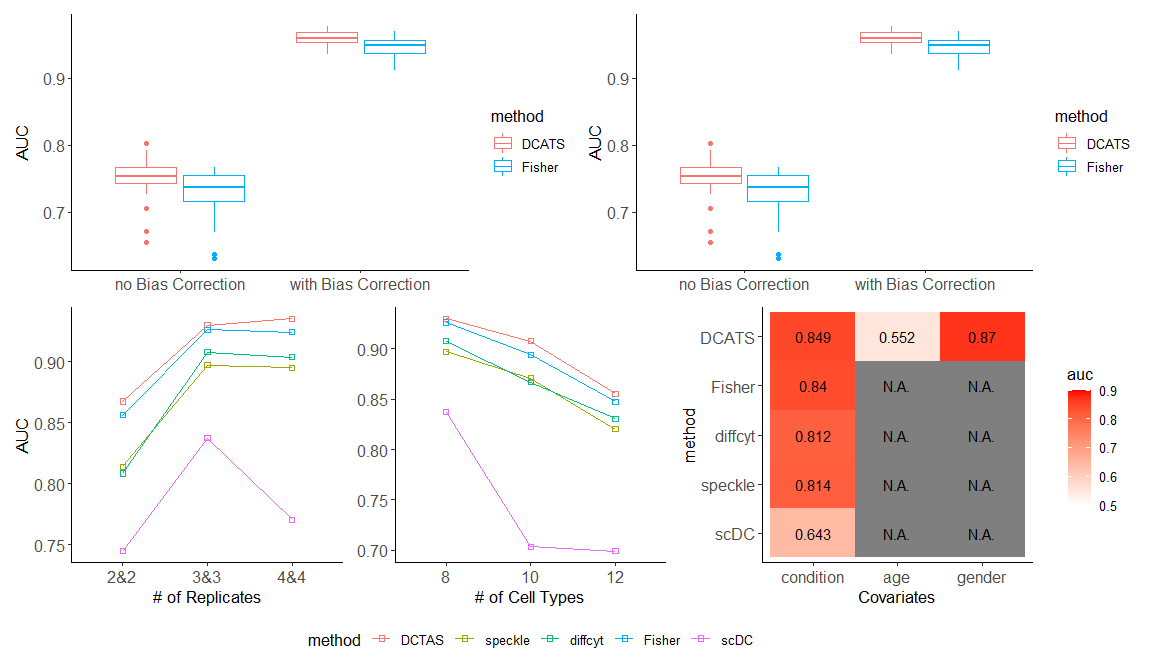
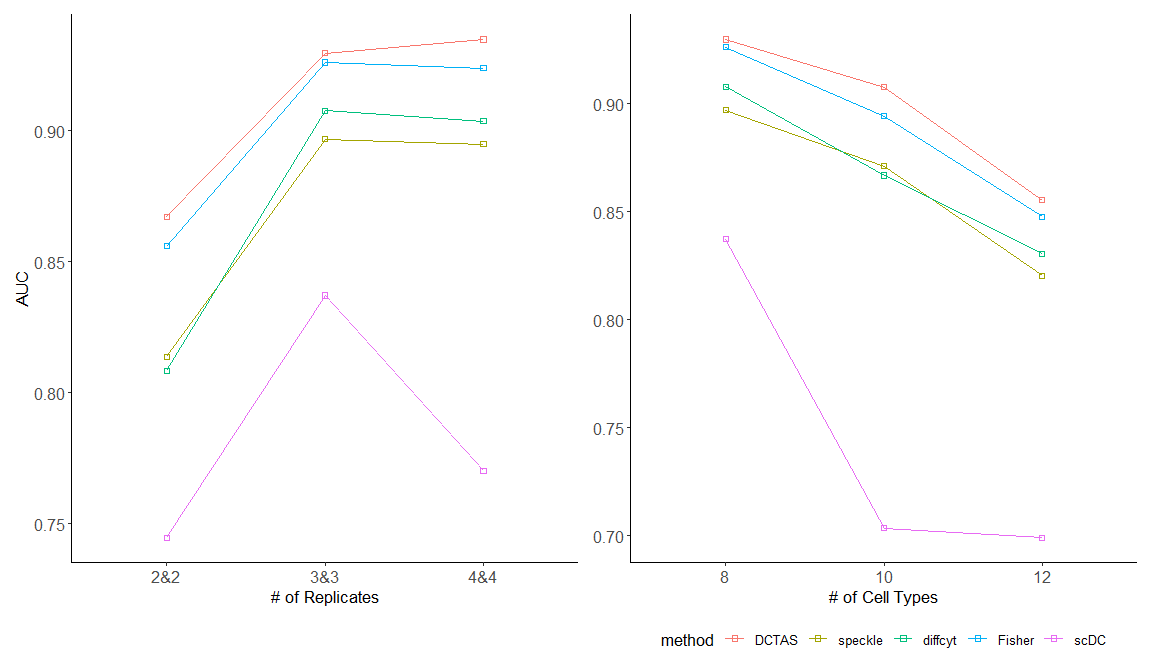
## Saving 12 x 7 in image

## Figure b2

## method mcc prauc auc sensitivity specificity  
## 1 betabin\_null 0.51442324 0.8796551 0.8547117 0.54310345 0.9310345  
## 2 estPhi\_null 0.37291111 0.8438764 0.8297785 0.31896552 0.9655172  
## 3 wtoPhi\_emSVM 0.50709255 0.8842317 0.8605083 0.53448276 0.9310345  
## 4 truePhi\_emSVM 0.49771575 0.8682074 0.8572756 0.46551724 0.9655172  
## 5 estPhi\_emSVM 0.43297246 0.8636451 0.8468341 0.38793103 0.9655172  
## 6 wtoPhi\_emT 0.50709255 0.8637453 0.8463139 0.53448276 0.9310345  
## 7 truePhi\_emT 0.47768763 0.8174457 0.8184081 0.50000000 0.9310345  
## 8 estPhi\_emT 0.38759371 0.8154958 0.8164016 0.39655172 0.9310345  
## 9 wtoPhi\_emU 0.49975543 0.8772384 0.8530767 0.52586207 0.9310345  
## 10 truePhi\_emU 0.47768763 0.8484382 0.8340146 0.50000000 0.9310345  
## 11 estPhi\_emU 0.48219797 0.8464320 0.8324911 0.49137931 0.9396552  
## 12 wtoPhi\_emK 0.51442324 0.8825152 0.8592821 0.54310345 0.9310345  
## 13 truePhi\_emK 0.49771575 0.8686954 0.8506614 0.46551724 0.9655172  
## 14 estPhi\_emK 0.46919238 0.8661294 0.8490636 0.43103448 0.9655172  
## 15 wtoPhi\_fullK 0.51442324 0.8760849 0.8527794 0.54310345 0.9310345  
## 16 wtoPhi\_fullU 0.51442324 0.8790062 0.8548974 0.54310345 0.9310345  
## 17 wtoPhi\_fullT 0.51861413 0.8796699 0.8542286 0.53448276 0.9396552  
## 18 wtoPhi\_fullSVM 0.51442324 0.8782690 0.8540800 0.54310345 0.9310345  
## 19 estPhi\_fullK 0.36514837 0.8439334 0.8290725 0.31034483 0.9655172  
## 20 estPhi\_fullU 0.36514837 0.8428412 0.8281436 0.31034483 0.9655172  
## 21 estPhi\_fullT 0.37291111 0.8431898 0.8385107 0.31896552 0.9655172  
## 22 estPhi\_fullSVM 0.38824236 0.8448642 0.8296671 0.33620690 0.9655172  
## 23 truePhi\_fullK 0.42673620 0.8477257 0.8305217 0.39655172 0.9568966  
## 24 truePhi\_fullU 0.44027963 0.8487770 0.8410375 0.39655172 0.9655172  
## 25 truePhi\_fullT 0.41931393 0.8478643 0.8397369 0.38793103 0.9568966  
## 26 truePhi\_fullSVM 0.44027963 0.8486534 0.8323053 0.39655172 0.9655172  
## 27 fisher 0.32984962 0.8635931 0.8398856 0.93965517 0.3189655  
## 28 scDC 0.14509525 0.6687411 0.6426501 0.72413793 0.4137931  
## 29 speckle 0.36291503 0.8531242 0.8138005 0.23275862 1.0000000  
## 30 diffcyt 0.40000000 0.8521335 0.8118683 0.27586207 1.0000000  
## 31 betabin\_null 0.05292561 0.5482742 0.5260850 0.13793103 0.8965517  
## 32 estPhi\_null 0.12734291 0.5968775 0.5496804 0.06896552 0.9827586  
## 33 wtoPhi\_emSVM 0.06720649 0.5437263 0.5236326 0.13793103 0.9051724  
## 34 truePhi\_emSVM 0.15774914 0.5935385 0.5486029 0.10344828 0.9741379  
## 35 estPhi\_emSVM 0.15569979 0.6005836 0.5514640 0.08620690 0.9827586  
## 36 wtoPhi\_emT 0.04032389 0.5399010 0.5211801 0.12931034 0.8965517  
## 37 truePhi\_emT 0.08492078 0.5473947 0.5245615 0.12931034 0.9224138  
## 38 estPhi\_emT 0.09667365 0.5538210 0.5253047 0.10344828 0.9482759  
## 39 wtoPhi\_emU 0.07938842 0.5400453 0.5231124 0.14655172 0.9051724  
## 40 truePhi\_emU 0.13520465 0.5980638 0.5575580 0.12931034 0.9482759  
## 41 estPhi\_emU 0.20435099 0.6024721 0.5591929 0.13793103 0.9741379  
## 42 wtoPhi\_emK 0.06720649 0.5490256 0.5250074 0.13793103 0.9051724  
## 43 truePhi\_emK 0.15774914 0.5930974 0.5504608 0.10344828 0.9741379  
## 44 estPhi\_emK 0.15569979 0.5988298 0.5516498 0.08620690 0.9827586  
## 45 wtoPhi\_fullK 0.05292561 0.5492658 0.5258992 0.13793103 0.8965517  
## 46 wtoPhi\_fullU 0.06720649 0.5461489 0.5242643 0.13793103 0.9051724  
## 47 wtoPhi\_fullT 0.06950480 0.5496274 0.5237441 0.12931034 0.9137931  
## 48 wtoPhi\_fullSVM 0.05292561 0.5459325 0.5260107 0.13793103 0.8965517  
## 49 estPhi\_fullK 0.12734291 0.5963288 0.5497548 0.06896552 0.9827586  
## 50 estPhi\_fullU 0.12734291 0.5941897 0.5411341 0.06896552 0.9827586  
## 51 estPhi\_fullT 0.11160826 0.5967185 0.5502378 0.06034483 0.9827586  
## 52 estPhi\_fullSVM 0.12734291 0.5980109 0.5496804 0.06896552 0.9827586  
## 53 truePhi\_fullK 0.16867425 0.5891013 0.5478225 0.09482759 0.9827586  
## 54 truePhi\_fullU 0.16867425 0.5920696 0.5411712 0.09482759 0.9827586  
## 55 truePhi\_fullT 0.15569979 0.5861154 0.5462990 0.08620690 0.9827586  
## 56 truePhi\_fullSVM 0.16867425 0.5898641 0.5478225 0.09482759 0.9827586  
## 57 betabin\_null 0.58394549 0.8887538 0.8703181 0.61206897 0.9396552  
## 58 estPhi\_null 0.44755260 0.8689654 0.8615116 0.40517241 0.9655172  
## 59 wtoPhi\_emSVM 0.57667263 0.8894469 0.8625892 0.60344828 0.9396552  
## 60 truePhi\_emSVM 0.47635407 0.8772219 0.8671225 0.43965517 0.9655172  
## 61 estPhi\_emSVM 0.47635407 0.8802176 0.8698722 0.43965517 0.9655172  
## 62 wtoPhi\_emT 0.56940673 0.8841138 0.8649301 0.59482759 0.9396552  
## 63 truePhi\_emT 0.48702325 0.8545185 0.8480603 0.48275862 0.9482759  
## 64 estPhi\_emT 0.47249954 0.8544829 0.8492122 0.46551724 0.9482759  
## 65 wtoPhi\_emU 0.57667263 0.8864051 0.8695749 0.60344828 0.9396552  
## 66 truePhi\_emU 0.53312954 0.8721453 0.8628864 0.55172414 0.9396552  
## 67 estPhi\_emU 0.50709255 0.8726182 0.8642241 0.53448276 0.9310345  
## 68 wtoPhi\_emK 0.59122678 0.8921911 0.8732907 0.62068966 0.9396552  
## 69 truePhi\_emK 0.48349378 0.8781358 0.8671968 0.44827586 0.9655172  
## 70 estPhi\_emK 0.48349378 0.8811520 0.8704667 0.44827586 0.9655172  
## 71 wtoPhi\_fullK 0.58394549 0.8888608 0.8708754 0.61206897 0.9396552  
## 72 wtoPhi\_fullU 0.58777469 0.8866229 0.8696492 0.60344828 0.9482759  
## 73 wtoPhi\_fullT 0.58394549 0.8900566 0.8718787 0.61206897 0.9396552  
## 74 wtoPhi\_fullSVM 0.56940673 0.8887347 0.8708754 0.59482759 0.9396552  
## 75 estPhi\_fullK 0.46200648 0.8689623 0.8620318 0.42241379 0.9655172  
## 76 estPhi\_fullU 0.45479403 0.8704008 0.8619203 0.41379310 0.9655172  
## 77 estPhi\_fullT 0.45479403 0.8685668 0.8617717 0.41379310 0.9655172  
## 78 estPhi\_fullSVM 0.45479403 0.8691854 0.8621061 0.41379310 0.9655172  
## 79 truePhi\_fullK 0.46200648 0.8680827 0.8595794 0.42241379 0.9655172  
## 80 truePhi\_fullU 0.46200648 0.8677655 0.8592078 0.42241379 0.9655172  
## 81 truePhi\_fullT 0.45479403 0.8667456 0.8593936 0.41379310 0.9655172  
## 82 truePhi\_fullSVM 0.46919238 0.8679174 0.8597280 0.43103448 0.9655172  
## F1 factor  
## 1 0.6737968 condition  
## 2 0.4713376 condition  
## 3 0.6666667 condition  
## 4 0.6206897 condition  
## 5 0.5454545 condition  
## 6 0.6666667 condition  
## 7 0.6373626 condition  
## 8 0.5411765 condition  
## 9 0.6594595 condition  
## 10 0.6373626 condition  
## 11 0.6333333 condition  
## 12 0.6737968 condition  
## 13 0.6206897 condition  
## 14 0.5882353 condition  
## 15 0.6737968 condition  
## 16 0.6737968 condition  
## 17 0.6702703 condition  
## 18 0.6737968 condition  
## 19 0.4615385 condition  
## 20 0.4615385 condition  
## 21 0.4713376 condition  
## 22 0.4905660 condition  
## 23 0.5508982 condition  
## 24 0.5542169 condition  
## 25 0.5421687 condition  
## 26 0.5542169 condition  
## 27 0.7171053 condition  
## 28 0.6268657 condition  
## 29 0.3776224 condition  
## 30 0.4324324 condition  
## 31 0.2222222 age  
## 32 0.1269841 age  
## 33 0.2237762 age  
## 34 0.1832061 age  
## 35 0.1562500 age  
## 36 0.2097902 age  
## 37 0.2142857 age  
## 38 0.1791045 age  
## 39 0.2361111 age  
## 40 0.2189781 age  
## 41 0.2370370 age  
## 42 0.2237762 age  
## 43 0.1832061 age  
## 44 0.1562500 age  
## 45 0.2222222 age  
## 46 0.2237762 age  
## 47 0.2127660 age  
## 48 0.2222222 age  
## 49 0.1269841 age  
## 50 0.1269841 age  
## 51 0.1120000 age  
## 52 0.1269841 age  
## 53 0.1705426 age  
## 54 0.1705426 age  
## 55 0.1562500 age  
## 56 0.1705426 age  
## 57 0.7319588 gender  
## 58 0.5628743 gender  
## 59 0.7253886 gender  
## 60 0.5964912 gender  
## 61 0.5964912 gender  
## 62 0.7187500 gender  
## 63 0.6292135 gender  
## 64 0.6136364 gender  
## 65 0.7253886 gender  
## 66 0.6844920 gender  
## 67 0.6666667 gender  
## 68 0.7384615 gender  
## 69 0.6046512 gender  
## 70 0.6046512 gender  
## 71 0.7319588 gender  
## 72 0.7291667 gender  
## 73 0.7319588 gender  
## 74 0.7187500 gender  
## 75 0.5798817 gender  
## 76 0.5714286 gender  
## 77 0.5714286 gender  
## 78 0.5714286 gender  
## 79 0.5798817 gender  
## 80 0.5798817 gender  
## 81 0.5714286 gender  
## 82 0.5882353 gender

## Saving 12 x 7 in image

## Saving 12 x 7 in image



## method mcc prauc auc sensitivity specificity  
## 1 wtoPhi\_emK 0.06720649 0.5490256 0.5250074 0.13793103 0.9051724  
## 2 betabin\_null 0.05292561 0.5482742 0.5260850 0.13793103 0.8965517  
## 3 estPhi\_emK 0.15569979 0.5988298 0.5516498 0.08620690 0.9827586  
## 4 estPhi\_null 0.12734291 0.5968775 0.5496804 0.06896552 0.9827586  
## 5 fisher 0.32984962 0.8635931 0.8398856 0.93965517 0.3189655  
## 6 betabin\_null 0.51442324 0.8796551 0.8547117 0.54310345 0.9310345  
## 7 wtoPhi\_emK 0.51442324 0.8825152 0.8592821 0.54310345 0.9310345  
## 8 scDC 0.14509525 0.6687411 0.6426501 0.72413793 0.4137931  
## 9 estPhi\_emK 0.46919238 0.8661294 0.8490636 0.43103448 0.9655172  
## 10 estPhi\_null 0.37291111 0.8438764 0.8297785 0.31896552 0.9655172  
## 11 diffcyt 0.40000000 0.8521335 0.8118683 0.27586207 1.0000000  
## 12 speckle 0.36291503 0.8531242 0.8138005 0.23275862 1.0000000  
## 13 wtoPhi\_emK 0.59122678 0.8921911 0.8732907 0.62068966 0.9396552  
## 14 betabin\_null 0.58394549 0.8887538 0.8703181 0.61206897 0.9396552  
## 15 estPhi\_emK 0.48349378 0.8811520 0.8704667 0.44827586 0.9655172  
## 16 estPhi\_null 0.44755260 0.8689654 0.8615116 0.40517241 0.9655172  
## F1 factor  
## 1 0.2237762 age  
## 2 0.2222222 age  
## 3 0.1562500 age  
## 4 0.1269841 age  
## 5 0.7171053 condition  
## 6 0.6737968 condition  
## 7 0.6737968 condition  
## 8 0.6268657 condition  
## 9 0.5882353 condition  
## 10 0.4713376 condition  
## 11 0.4324324 condition  
## 12 0.3776224 condition  
## 13 0.7384615 gender  
## 14 0.7319588 gender  
## 15 0.6046512 gender  
## 16 0.5628743 gender

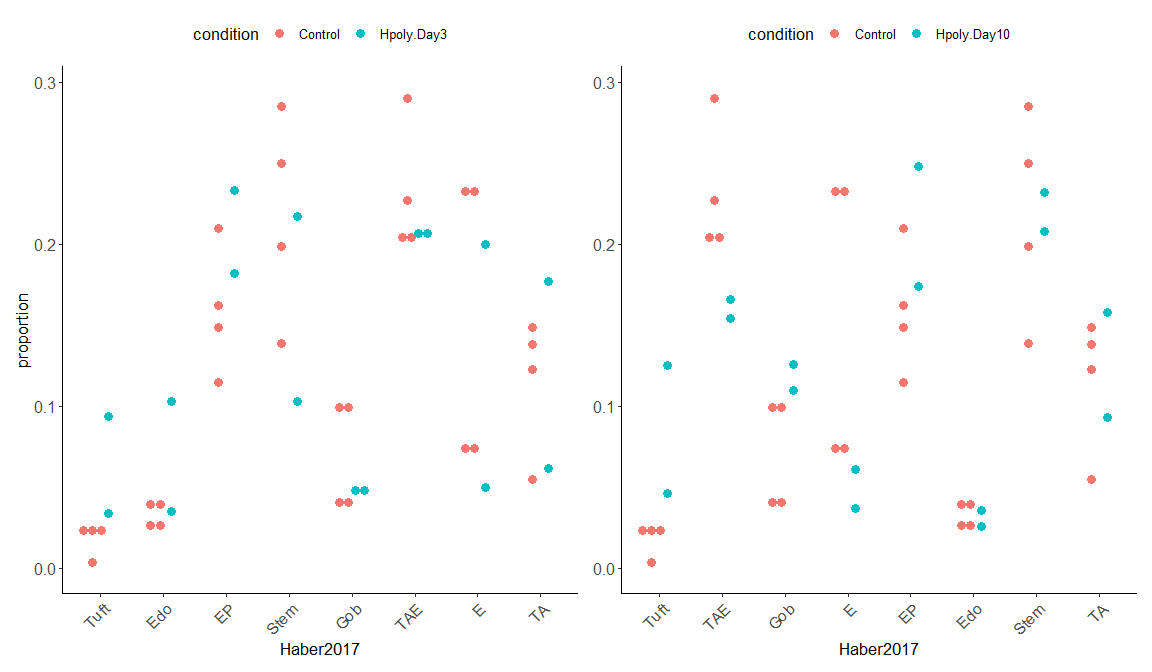
## real-world data 1 - Experiment 7

The ‘group’ column started with ‘B’ is the indicators of replicates

## `summarise()` has grouped output by 'batch', 'condition'. You can override using the `.groups` argument.

## `summarise()` has grouped output by 'condition'. You can override using the `.groups` argument.

## Bin width defaults to 1/30 of the range of the data. Pick better value with `binwidth`.  
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|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Tuft | Endocrine | Enterocyte.Progenitor | Stem | Goblet | TA.Early | Enterocyte | TA |
| origin | P | N | N | N | N | N | N | N |
| DCATS | \* | n.s. | n.s. | n.s. | n.s. | n.s. | n.s. | n.s. |
| fisher | \*\*\* | \*\*\* | \*\*\* | \*\* | \*\*\* | \*\*\* | \*\*\* | n.s. |
| scDC | \* | n.s. | n.s. | \*\* | \*\*\* | \*\*\* | \*\*\* | n.s. |
| speckle | n.s. | n.s. | n.s. | n.s. | n.s. | n.s. | n.s. | n.s. |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Tuft | TA.Early | Goblet | Enterocyte | Enterocyte.Progenitor | Endocrine | Stem | TA |
| origin | P | P | P | P | N | N | N | N |
| DCATS | \*\* | n.s. | n.s. | \*\*\* | n.s. | n.s. | n.s. | n.s. |
| fisher | \*\*\* | \*\*\* | \*\*\* | \*\*\* | \*\*\* | n.s. | n.s. | n.s. |
| scDC | \*\*\* | n.s. | \*\* | \*\*\* | n.s. | \*\* | n.s. | n.s. |
| speckle | n.s. | n.s. | n.s. | n.s. | n.s. | n.s. | n.s. | n.s. |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Enterocyte | Stem | TA | TA.Early | Enterocyte.Progenitor | Tuft | Goblet | Endocrine |
| origin | P | P | P | P | N | N | N | N |
| DCATS | \*\*\* | \* | n.s. | n.s. | n.s. | n.s. | n.s. | n.s. |
| fisher | \*\*\* | \*\*\* | \*\*\* | \*\*\* | \*\*\* | n.s. | n.s. | n.s. |
| scDC | \*\* | \* | n.s. | n.s. | n.s. | \* | n.s. | n.s. |
| speckle | \*\*\* | \* | n.s. | n.s. | n.s. | n.s. | n.s. | n.s. |

## real-world data2

## cell tsne1 tsne2 ind condition cluster clusterRes  
## 1 AAACATACAATGCC-1 -4.277833 -19.294709 107 ctrl 5 CD4 T cells  
## 2 AAACATACATTTCC-1 -27.640373 14.966629 1016 ctrl 9 CD14+ Monocytes  
## 3 AAACATACCAGAAA-1 -27.493646 28.924885 1256 ctrl 9 CD14+ Monocytes  
## 4 AAACATACCAGCTA-1 -28.132584 24.925484 1256 ctrl 9 CD14+ Monocytes  
## 5 AAACATACCATGCA-1 -10.468194 -5.984389 1488 ctrl 3 CD4 T cells  
## 6 AAACATACCTCGCT-1 -24.367997 20.429285 1256 ctrl 9 CD14+ Monocytes  
## multiplets  
## 1 doublet  
## 2 singlet  
## 3 singlet  
## 4 doublet  
## 5 singlet  
## 6 singlet

## `summarise()` has grouped output by 'condition'. You can override using the `.groups` argument.

## # A tibble: 16 x 3  
## # Groups: condition [2]  
## condition clusterRes n  
## <chr> <chr> <int>  
## 1 ctrl B cells 1488  
## 2 ctrl CD14+ Monocytes 3365  
## 3 ctrl CD4 T cells 6005  
## 4 ctrl CD8 T cells 1409  
## 5 ctrl Dendritic cells 227  
## 6 ctrl FCGR3A+ Monocytes 906  
## 7 ctrl Megakaryocytes 166  
## 8 ctrl NK cells 1051  
## 9 stim B cells 1392  
## 10 stim CD14+ Monocytes 3082  
## 11 stim CD4 T cells 6028  
## 12 stim CD8 T cells 1225  
## 13 stim Dendritic cells 245  
## 14 stim FCGR3A+ Monocytes 1008  
## 15 stim Megakaryocytes 180  
## 16 stim NK cells 1279

## # A tibble: 0 x 2  
## # ... with 2 variables: cell <chr>, n <int>

## BARCODE RD.TOTL RD.PASS RD.UNIQ N.SNP BEST SNG.1ST  
## 1 AAACATACAATGCC-1 5799 280 269 185 DBL-107-1244-0.500 107  
## 2 AAACATACATTTCC-1 5466 592 501 236 SNG-1016 1016  
## 3 AAACATACCAGAAA-1 4337 330 300 154 SNG-1256 1256  
## 4 AAACATACCAGCTA-1 7120 418 338 179 DBL-1256-1244-0.500 1256  
## 5 AAACATACCATGCA-1 2422 86 76 54 SNG-1488 1488  
## 6 AAACATACCTCGCT-1 5312 561 497 207 SNG-1256 1256  
## SNG.LLK1 SNG.2ND SNG.LLK2 SNG.LLK0 DBL.1ST DBL.2ND ALPHA LLK12  
## 1 -78.5388 1244 -92.3864 -75.9878 107 1244 0.5 -62.8745  
## 2 -61.8525 1256 -193.3940 -135.9317 1016 1256 0.5 -93.0213  
## 3 -50.6213 1015 -100.6965 -67.2587 101 1256 0.5 -64.5022  
## 4 -70.2734 1244 -110.3962 -82.1916 1256 1244 0.5 -67.3787  
## 5 -16.1294 1015 -31.7146 -27.0167 1015 1488 0.5 -18.5646  
## 6 -66.3586 1015 -180.3066 -115.0556 1256 101 0.5 -101.4645  
## LLK1 LLK2 LLK10 LLK20 LLK00 PRB.DBL PRB.SNG1  
## 1 -78.5388 -92.3864 -88.6649 -94.1498 -77.4107 1.00e+00 1  
## 2 -61.8525 -193.3940 -103.2284 -168.3927 -132.6010 4.15e-15 1  
## 3 -107.8190 -50.6213 -111.3319 -64.5022 -72.4244 1.95e-07 1  
## 4 -70.2734 -110.3962 -80.3745 -103.1706 -85.1143 7.21e-01 1  
## 5 -31.7146 -16.1294 -30.2045 -22.5295 -28.2980 1.28e-02 1  
## 6 -66.3586 -190.9367 -101.4645 -194.9529 -124.2197 8.42e-17 1

## BARCODE RD.TOTL RD.PASS RD.UNIQ N.SNP BEST SNG.1ST SNG.LLK1  
## 1 AAACATACCAAGCT-1 2491 239 228 141 SNG-101 101 -31.2822  
## 2 AAACATACCCCTAC-1 3747 282 274 173 SNG-1488 1488 -37.4261  
## 3 AAACATACCCGTAA-1 2844 144 133 108 SNG-1244 1244 -35.0043  
## 4 AAACATACCCTCGT-1 3575 199 189 115 SNG-1488 1488 -31.5489  
## 5 AAACATACGAGGTG-1 2649 170 158 99 SNG-1488 1488 -33.2782  
## 6 AAACATACGCGAAG-1 9874 880 822 345 SNG-101 101 -139.7810  
## SNG.2ND SNG.LLK2 SNG.LLK0 DBL.1ST DBL.2ND ALPHA LLK12 LLK1  
## 1 1015 -81.3393 -59.5871 101 1015 0.5 -47.8026 -31.2822  
## 2 1256 -104.7874 -74.9247 1256 1488 0.5 -53.8991 -104.7874  
## 3 1488 -61.5604 -51.6974 1488 1244 0.5 -36.9775 -61.5604  
## 4 1244 -79.8040 -57.9696 1256 1488 0.5 -42.8116 -83.5802  
## 5 1244 -66.4966 -48.9522 101 1488 0.5 -36.4330 -75.8228  
## 6 1256 -266.4763 -170.1924 101 1488 0.5 -154.9333 -139.7810  
## LLK2 LLK10 LLK20 LLK00 PRB.DBL PRB.SNG1  
## 1 -81.3393 -32.1591 -47.8026 -64.9647 1.07e-08 1  
## 2 -37.4261 -101.7666 -64.5707 -79.2115 1.00e-08 1  
## 3 -35.0043 -72.6479 -50.8297 -52.6835 2.03e-02 1  
## 4 -31.5489 -80.4661 -49.8506 -58.0733 2.38e-06 1  
## 5 -33.2782 -72.2344 -36.4330 -48.3017 8.06e-03 1  
## 6 -273.8806 -136.9040 -154.9333 -175.5614 3.82e-08 1

## cell batch  
## 1 AAACATACATTTCC-1 SNG-1016  
## 2 AAACATACCAGAAA-1 SNG-1256  
## 3 AAACATACCATGCA-1 SNG-1488  
## 4 AAACATACCTCGCT-1 SNG-1256  
## 5 AAACATACCTGGTA-1 SNG-1039  
## 6 AAACATACGATGAA-1 SNG-1488

## `summarise()` has grouped output by 'condition', 'clusterRes'. You can override using the `.groups` argument.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | B cells | CD14+ Monocytes | CD4 T cells | CD8 T cells | Dendritic cells | FCGR3A+ Monocytes | Megakaryocytes | NK cells |
| origin | N | N | N | N | N | N | N | N |
| DCATS | n.s. | n.s. | n.s. | n.s. | n.s. | n.s. | n.s. | n.s. |
| fisher | n.s. | \*\*\* | n.s. | \*\*\* | n.s. | \*\*\* | n.s. | \*\*\* |
| scDC | \*\*\* | n.s. | n.s. | n.s. | n.s. | \* | n.s. | \*\* |
| speckle | n.s. | n.s. | n.s. | n.s. | n.s. | n.s. | n.s. | n.s. |

## real-world data 3

## test between different groups

control vs mild/moderate\_progression

## Warning in aod::betabin(formula\_fm1, ~1, data = df\_tmp, warnings = FALSE):   
## Possible convergence problem. Optimization process code: 1 (see ?optim).  
  
## Warning in aod::betabin(formula\_fm1, ~1, data = df\_tmp, warnings = FALSE):   
## Possible convergence problem. Optimization process code: 1 (see ?optim).  
  
## Warning in aod::betabin(formula\_fm1, ~1, data = df\_tmp, warnings = FALSE):   
## Possible convergence problem. Optimization process code: 1 (see ?optim).  
  
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## Possible convergence problem. Optimization process code: 1 (see ?optim).  
  
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## Possible convergence problem. Optimization process code: 1 (see ?optim).  
  
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## Possible convergence problem. Optimization process code: 1 (see ?optim).  
  
## Warning in aod::betabin(formula\_fm1, ~1, data = df\_tmp, warnings = FALSE):   
## Possible convergence problem. Optimization process code: 1 (see ?optim).

## Warning in aod::betabin(cbind(n1, total - n1) ~ ., ~1, data = df\_use, warnings = FALSE):   
## Possible convergence problem. Optimization process code: 1 (see ?optim).

## Warning in aod::betabin(formula\_fm1, ~1, data = df\_tmp, warnings = FALSE):   
## Possible convergence problem. Optimization process code: 1 (see ?optim).  
  
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## Possible convergence problem. Optimization process code: 1 (see ?optim).  
  
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## Warning in aod::betabin(formula\_fm1, ~1, data = df\_tmp, warnings = FALSE):   
## Possible convergence problem. Optimization process code: 1 (see ?optim).

## age sex sample\_type state  
## B 0.009557798 0.44592507 0.007075457 0.02396015  
## CD4 0.864906426 0.45943249 0.019573013 0.07848264  
## CD8 0.550349827 0.02357195 0.171339106 0.13838389  
## DC 0.575293535 0.06550192 0.226893419 0.02325693  
## Mega 0.089981457 0.80641355 0.036601827 0.41203651  
## Mono 0.001573386 0.01855385 0.010162272 0.56642332  
## NK 0.505382586 0.57616053 0.099689096 0.20467731  
## Macro 0.466606560 0.12769788 0.066782830 0.07413260  
## Plasma 0.134565440 0.27418933 0.196012479 0.03129536  
## Neu 0.199171244 1.00000000 0.004471399 0.83147821

## age sex sample\_type state  
## B 1.732182e-02 0.5160466103 0.0130419887 0.03994983  
## CD4 8.892648e-01 0.5462112207 0.0499493278 0.14689980  
## CD8 4.860029e-01 0.0074751460 0.1191220829 0.08720240  
## DC 9.209477e-01 0.5695054003 0.5803739871 0.43704007  
## Mega 2.551560e-01 0.9077441624 0.1490152034 0.86885270  
## Mono 5.976639e-06 0.0008229389 0.0003436601 0.42859579  
## NK 5.848849e-01 0.6256023356 0.1393285283 0.26406886  
## Macro 2.764405e-01 0.5499689811 0.0745613302 0.15895838  
## Plasma 6.130465e-01 0.6088209427 0.5058976104 0.31242649  
## Neu 2.365562e-01 0.8790041739 0.1099021651 0.52437836

control vs severe/critical\_progression

## Warning in aod::betabin(formula\_fm1, ~1, data = df\_tmp, warnings = FALSE):   
## Possible convergence problem. Optimization process code: 1 (see ?optim).  
  
## Warning in aod::betabin(formula\_fm1, ~1, data = df\_tmp, warnings = FALSE):   
## Possible convergence problem. Optimization process code: 1 (see ?optim).  
  
## Warning in aod::betabin(formula\_fm1, ~1, data = df\_tmp, warnings = FALSE):   
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## Possible convergence problem. Optimization process code: 1 (see ?optim).  
  
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## Possible convergence problem. Optimization process code: 1 (see ?optim).  
  
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## Possible convergence problem. Optimization process code: 1 (see ?optim).  
  
## Warning in aod::betabin(formula\_fm1, ~1, data = df\_tmp, warnings = FALSE):   
## Possible convergence problem. Optimization process code: 1 (see ?optim).  
  
## Warning in aod::betabin(formula\_fm1, ~1, data = df\_tmp, warnings = FALSE):   
## Possible convergence problem. Optimization process code: 1 (see ?optim).

## Warning in aod::betabin(cbind(n1, total - n1) ~ ., ~1, data = df\_use, warnings = FALSE):   
## Possible convergence problem. Optimization process code: 1 (see ?optim).

## Warning in aod::betabin(formula\_fm1, ~1, data = df\_tmp, warnings = FALSE):   
## Possible convergence problem. Optimization process code: 1 (see ?optim).  
  
## Warning in aod::betabin(formula\_fm1, ~1, data = df\_tmp, warnings = FALSE):   
## Possible convergence problem. Optimization process code: 1 (see ?optim).  
  
## Warning in aod::betabin(formula\_fm1, ~1, data = df\_tmp, warnings = FALSE):   
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mild/moderate\_convalescence vs mild/moderate\_progression

## Warning in aod::betabin(formula\_fm1, ~1, data = df\_tmp, warnings = FALSE):   
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## Warning in aod::betabin(formula\_fm1, ~1, data = df\_tmp, warnings = FALSE):   
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## Possible convergence problem. Optimization process code: 1 (see ?optim).

## Warning in aod::betabin(cbind(n1, total - n1) ~ ., ~1, data = df\_use, warnings = FALSE):   
## Possible convergence problem. Optimization process code: 1 (see ?optim).

## Warning in aod::betabin(formula\_fm1, ~1, data = df\_tmp, warnings = FALSE):   
## Possible convergence problem. Optimization process code: 1 (see ?optim).  
  
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## age sex sample\_type state  
## B TRUE FALSE TRUE TRUE  
## CD4 TRUE TRUE FALSE FALSE  
## CD8 FALSE FALSE FALSE FALSE  
## DC FALSE FALSE FALSE TRUE  
## Mega FALSE FALSE TRUE TRUE  
## Mono TRUE FALSE TRUE FALSE  
## NK FALSE FALSE FALSE FALSE  
## Macro FALSE FALSE FALSE FALSE  
## Plasma FALSE FALSE FALSE FALSE  
## Neu FALSE FALSE FALSE FALSE

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## Mono TRUE FALSE TRUE TRUE  
## NK FALSE FALSE FALSE FALSE  
## Macro FALSE FALSE FALSE FALSE  
## Plasma FALSE FALSE FALSE FALSE  
## Neu FALSE FALSE FALSE FALSE

## clusterRes group1 group2  
## 1 B mild/moderate (convalescence) mild/moderate (progression)  
## 2 CD4 mild/moderate (convalescence) mild/moderate (progression)  
## 3 CD8 mild/moderate (convalescence) mild/moderate (progression)  
## 4 DC mild/moderate (convalescence) mild/moderate (progression)  
## 5 Mega mild/moderate (convalescence) mild/moderate (progression)  
## 6 Mono mild/moderate (convalescence) mild/moderate (progression)  
## 7 NK mild/moderate (convalescence) mild/moderate (progression)  
## 8 Macro mild/moderate (convalescence) mild/moderate (progression)  
## 9 Plasma mild/moderate (convalescence) mild/moderate (progression)  
## 10 Neu mild/moderate (convalescence) mild/moderate (progression)  
## p  
## 1 0.04380129  
## 2 0.95988352  
## 3 0.37717824  
## 4 0.15546045  
## 5 0.55768608  
## 6 0.01901875  
## 7 0.52801613  
## 8 0.47139601  
## 9 0.78254301  
## 10 0.63137314

severe/critical\_convalescence vs severe/critical\_progression

## Warning in aod::betabin(formula\_fm1, ~1, data = df\_tmp, warnings = FALSE):   
## Possible convergence problem. Optimization process code: 1 (see ?optim).  
  
## Warning in aod::betabin(formula\_fm1, ~1, data = df\_tmp, warnings = FALSE):   
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## Warning in aod::betabin(cbind(n1, total - n1) ~ ., ~1, data = df\_use, warnings = FALSE):   
## Possible convergence problem. Optimization process code: 1 (see ?optim).

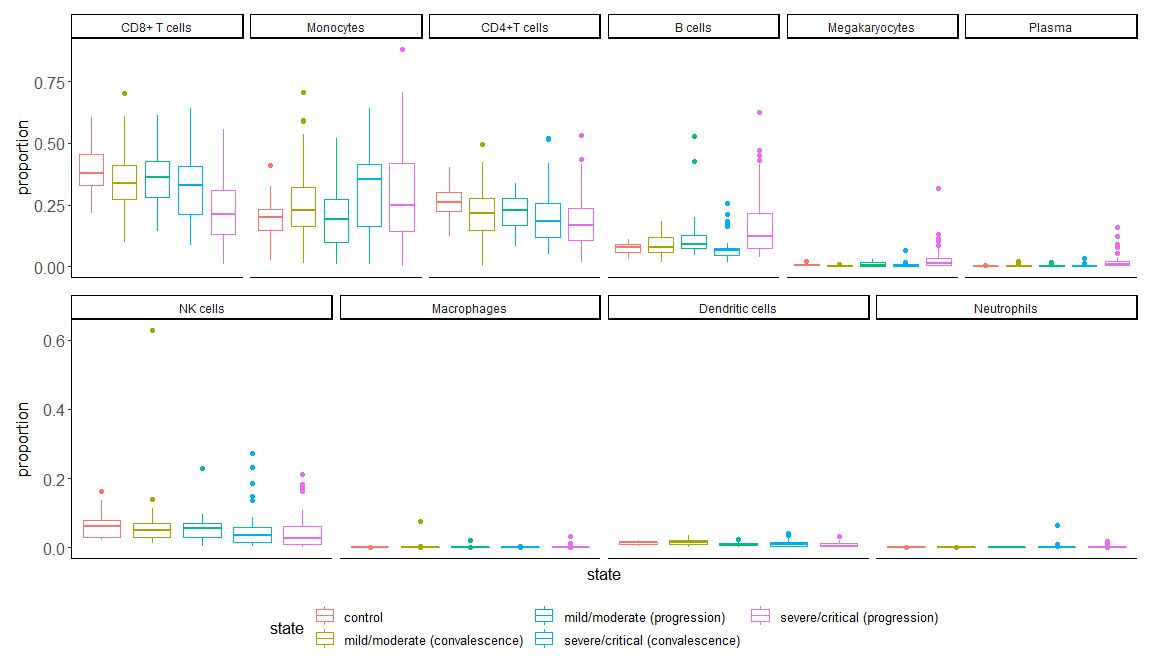
## Warning in aod::betabin(formula\_fm1, ~1, data = df\_tmp, warnings = FALSE):   
## Possible convergence problem. Optimization process code: 1 (see ?optim).  
  
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## Mega FALSE FALSE FALSE TRUE  
## Mono TRUE FALSE FALSE FALSE  
## NK FALSE FALSE FALSE FALSE  
## Macro FALSE FALSE FALSE FALSE  
## Plasma FALSE FALSE FALSE TRUE  
## Neu FALSE FALSE FALSE FALSE

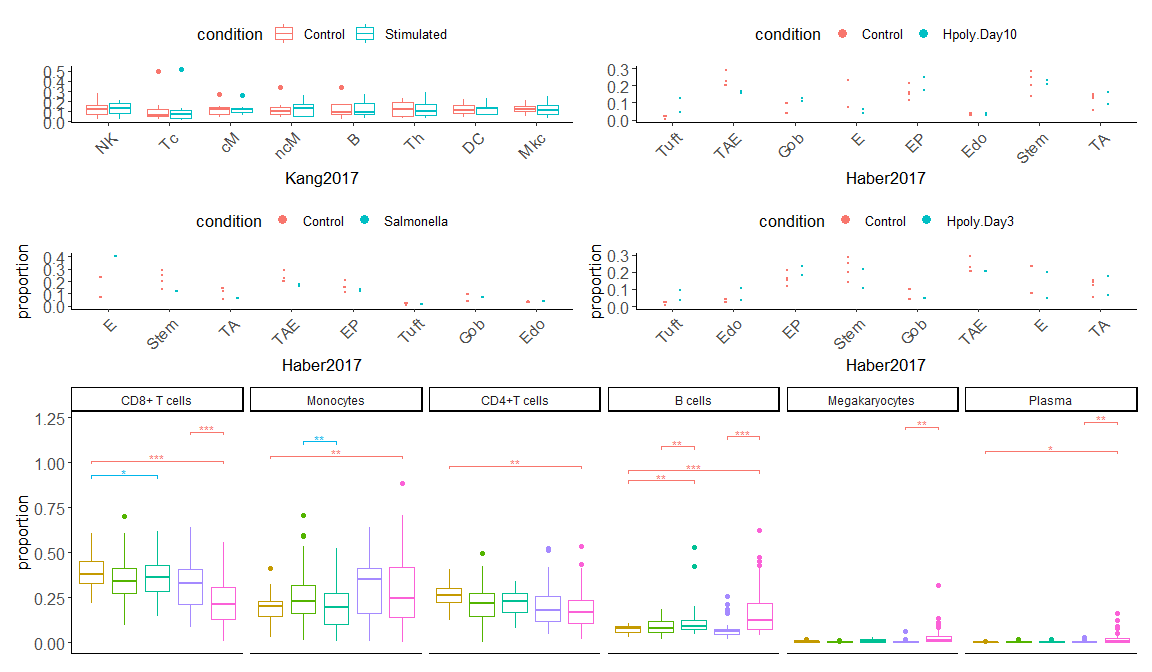
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## Bin width defaults to 1/30 of the range of the data. Pick better value with `binwidth`.  
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