```
(* © Orly Alter 2005 *)
```



```
(* Intersect Cell Cycle Expression Dataset and Its Cell Cycle- and Development-Binding Projections *)
```

```
arrays = 18;
partialgenenames = Intersection[genenames1, partialgenenames2, partialgenenames3];
partialgenes = Dimensions[partialgenenames][[1]]
list = Flatten[TakeColumns[partialgenenames, {1}]];
```

```
868
```

```
counter = Table[Flatten[Position[list, genenames1[[a, 1]]]],
   {a, 1, Dimensions[genenames1][[1]]}];
counter = ReplaceAll[counter, {} -> {Null}];
partial = AppendRows[counter, matrix1];
partial = Sort[partial, OrderedQ[{#1, #2}] &];
partialmatrix1 = TakeRows[
   TakeColumns[partial, {2, arrays + 1}],
   {1, partialgenes}];

counter = Table[Flatten[Position[list, partialgenenames2[[a, 1]]]],
   {a, 1, Dimensions[partialgenenames2][[1]]}];
counter = ReplaceAll[counter, {} -> {Null}];
partial = AppendRows[counter, partialmatrix2];
partial = Sort[partial, OrderedQ[{#1, #2}] &];
matrix2 = TakeRows[
   TakeColumns[partial, {2, arrays + 1}],
   {1, partialgenes}];

counter = Table[Flatten[Position[list, partialgenenames3[[a, 1]]]],
   {a, 1, Dimensions[partialgenenames3][[1]]}];
counter = ReplaceAll[counter, {} -> {Null}];
partial = AppendRows[counter, partialmatrix3];
partial = Sort[partial, OrderedQ[{#1, #2}] &];
matrix3 = TakeRows[
   TakeColumns[partial, {2, arrays + 1}],
   {1, partialgenes}];
```

```
(* Calculate HOEVD of Expression Dataset and Its Projections Onto Binding Datasets *)
```

```
(* Append Expression Dataset and Its Projections Onto Binding Datasets *)

tensor = AppendRows[
   partialmatrix1,
   matrix2,
   matrix3];
arraynames = AppendRows[arraynames1, arraynames1, arraynames1];
{genes, arrays} = Dimensions[tensor]
```

```
{868, 54}
```

```
(* Calculate SVD *)

{eigenarrays, eigenexpressions, eigengenes} = SingularValues[tensor];
eigengenes[[1]] = -eigengenes[[1]];
eigenarrays[[1]] = -eigenarrays[[1]];
eigengenes[[2]] = -eigengenes[[2]];
eigenarrays[[2]] = -eigenarrays[[2]];
eigenarrays = Transpose[eigenarrays];
fractions = eigenexpressions^2 /
   Sum[eigenexpressions[[a]]^2,
    {a, 1, Dimensions[eigenexpressions][[1]]}];
entropy = -N[Sum[fractions[[a]] * Log[fractions[[a]]],
      {a, 1, Dimensions[eigenexpressions][[1]]}] /
    Log[Dimensions[eigenexpressions][[1]]]];
entropy = N[Round[100 * entropy] / 100]
```

```
0.6
```

```
(* Create Fractions Bar Charts Displays *)

fractions[[3]]
```

```
0.0870328
```

```
limit = 0.1;
alsolimit = fractions[[3]];

Clear[gridx, framex, framey, sizes];
gridx = Table[a, {a, 0, limit, N[limit / 5]}];
framex = gridx;
sizes = Flatten[
   Table[
    Dimensions[
     Characters[
      ToString[framex[[a]]
      ]]], {a, 1, 6}]];
Do[
  Do[framex[[a]] = StringJoin[ToString[framex[[a]]], " "],
   {b, 1, 5 - sizes[[a]]}],
  {a, 1, 6}];
framex = Table[{gridx[[a]], framex[[a]]}, {a, 1, 6}];
gridx = Table[{gridx[[a]], RGBColor[0, 0, 0]}, {a, 1, 6}];
framey = Table[{a + 1, 12 - a}, {a, 0, 12 - 3}];
table = Table[fractions[[a]],
   {a, 12, 3, -1}];
g = BarChart[table,
   BarOrientation -> Horizontal,
   PlotRange -> {{0, alsolimit * 1.0001}, {0.5, 12 - 2 + 0.5}},
   AspectRatio -> 1,
   Axes -> False,
   Frame -> True,
   FrameTicks -> {None, framey, framex, None},
   FrameLabel -> {None, None, None, None},
   GridLines -> {gridx, None},
   DisplayFunction -> Identity];
g = FullGraphics[g];
g[[1, 2]] = g[[1, 2]] /.
   Text[a_, {b_, c_}, {0., -1.}] →
    Text[a, {b, c + 1.}, {0, 0}, {0, 1}];
g1 = Show[g,
   AspectRatio -> 1.25,
   PlotRange -> All,
   DisplayFunction → Identity];
```

```
fractions[[1]]
```

```
0.396389
```

```
limit = 0.4;
alsolimit = fractions[[1]];

gridx = Table[a, {a, 0, limit, N[limit / 5]}];
framex = gridx;
sizes = Flatten[
   Table[
    Dimensions[
     Characters[
      ToString[framex[[a]]
      ]]], {a, 1, 6}]];
Do[
  Do[framex[[a]] = StringJoin[ToString[framex[[a]]], " "],
   {b, 1, size - sizes[[a]]}],
  {a, 1, 6}];
framex = Table[{gridx[[a]], framex[[a]]}, {a, 1, 6}];
gridx = Table[{gridx[[a]], RGBColor[0, 0, 0]}, {a, 1, 6}];
framey = Table[{a + 1, Dimensions[eigenexpressions][[1]] - a},
   {a, 0, Dimensions[eigenexpressions][[1]] - 1}];
labelx = ColumnForm[
   {"(b) Eigenexpression Fraction", StringJoin["d = ", ToString[entropy]], " "},
   Center];
g = BarChart[
   Table[fractions[[Dimensions[eigenexpressions][[1]] - a]],
    {a, 0, Dimensions[eigenexpressions][[1]] - 1}],
   BarOrientation -> Horizontal,
   PlotRange -> {{0, limit * 1.0001}, {0.5, Dimensions[eigenexpressions][[1]] + 0.5}},
   AspectRatio -> 1,
   Axes -> False,
   Frame -> True,
   FrameTicks -> {None, framey, framex, None},
   FrameLabel -> {None, None, labelx, None},
   GridLines -> {gridx, None},
   DisplayFunction -> Identity];
g = FullGraphics[g];
g[[1, 2]] = g[[1, 2]] /.
   Text[labelx, {b_, c_}, {0., -1.}] →
    Text[labelx, {b, c + 2.9}, {0, -1}, {1, 0}];
g[[1, 2]] = g[[1, 2]] /.
   Text[a_, {b_, c_}, {0., -1.}] →
    Text[a, {b, c + 2}, {0, 0}, {0, 1}];
g2 = Show[{g,
    Graphics[{RGBColor[1, 1, 0.8], Rectangle[{0.05, 1.5}, {alsolimit, 35}]}],
    Graphics[{Rectangle[{0.05, 1.5}, {alsolimit, 35}, g1]}]},
   AspectRatio -> 1.35,
   PlotRange -> All,
   DisplayFunction → Identity];
```

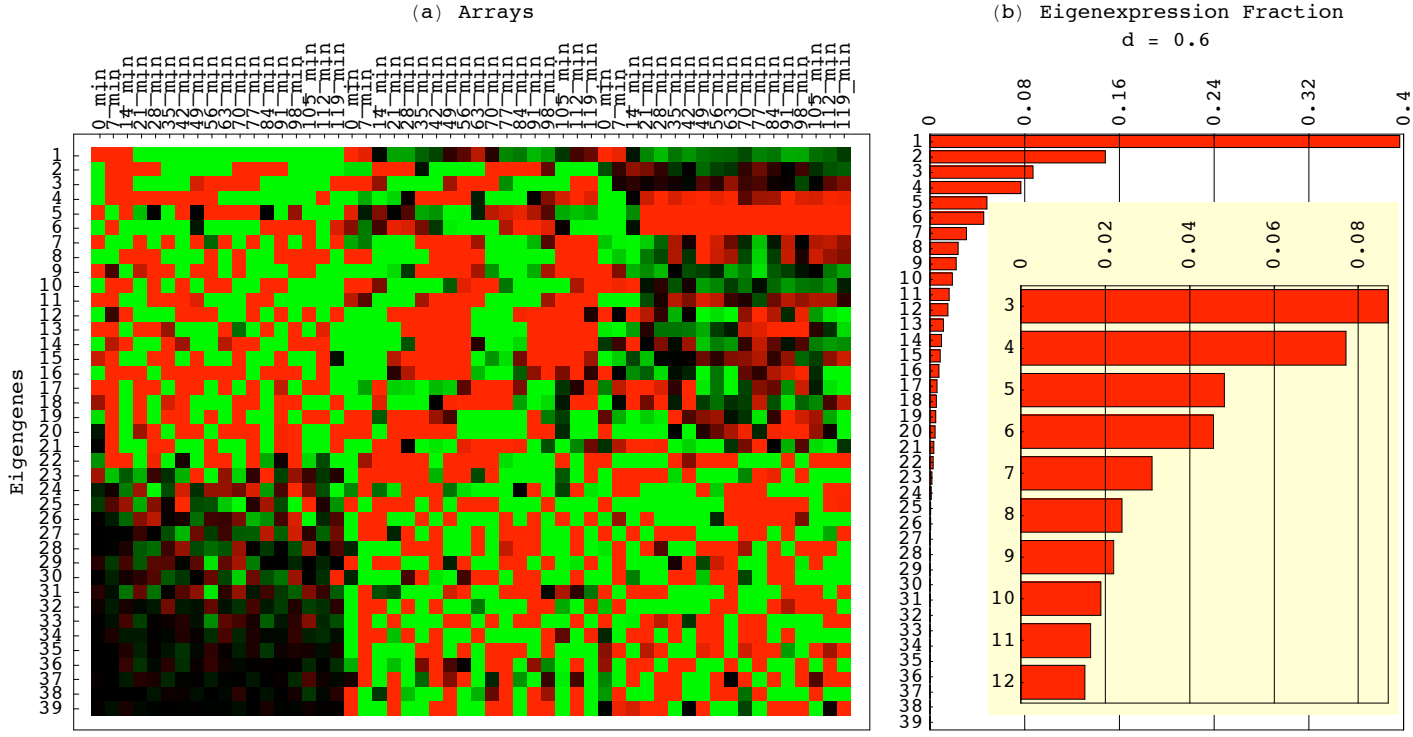
```
(* Create Eigengenes 2 D Red & Green Raster Display *)

contrast = 50;
displaying = Table[
   If[contrast * eigengenes[[i, j]] > 0,
    If[contrast * eigengenes[[i, j]] < 1, {contrast * eigengenes[[i, j]], 0}, {1, 0}],
    If[contrast * eigengenes[[i, j]] > -1, {0, -contrast * eigengenes[[i, j]]}, {0, 1}]],
   {i, 1, Dimensions[eigenexpressions][[1]]}, {j, 1, arrays}];
framex = Table[{a - 0.5, arraynames[[1, a]]}, {a, 1, arrays}];
framey = Table[{a + 1 - 0.5, Dimensions[eigenexpressions][[1]] - a},
   {a, 0, Dimensions[eigenexpressions][[1]] - 1}];
labely = "Eigengenes";
labelx = ColumnForm[{"(a) Arrays", " ", " "}, Center];

g = Show[
   Graphics[
    RasterArray[
     Table[
      RGBColor[displaying[[i, j, 1]], displaying[[i, j, 2]], 0],
      {i, Dimensions[eigenexpressions][[1]], 1, -1}, {j, 1, arrays}]]],
   AspectRatio -> 1,
   Frame -> True,
   FrameTicks -> {None, framey, framex, None},
   FrameLabel -> {None, labely, labelx, None},
   DisplayFunction -> Identity];
g = FullGraphics[g];
g[[1, 2]] = g[[1, 2]] /.
   Text[labely, {b_, c_}, {1., 0.}] →
    Text[labely, {b - 3, c}, {0, 0}, {0, 1}];
g[[1, 2]] = g[[1, 2]] /.
   Text[labelx, {b_, c_}, {0., -1.}] →
    Text[labelx, {b, c + 3}, {0, -1}, {1, 0}];
g[[1, 2]] = g[[1, 2]] /.
   Text[a_, {b_, c_}, {0., -1.}] →
    Text[a, {b, c + 2.7}, {0, 0}, {0, 1}];
g1 = Show[g,
   AspectRatio -> 1.05 * 39 / 54,
   PlotRange -> All,
   DisplayFunction → Identity];
```

```
(* Display Eigengenes and Fractions *)

Show[GraphicsArray[{g1, g2}],
  GraphicsSpacing -> -0.275];
```



```
(* Create Selected Eigengenes Graph Display *)

eigengenes2 = Chop[TrigFit[Drop[Drop[eigengenes[[2]], {19, arrays}], {1}], 2, {x - 1, arrays / 3 - 1}], 0.1]
eigengenes3 = Chop[TrigFit[Drop[Drop[eigengenes[[3]], {19, arrays}], {1}], 2, {x - 1, arrays / 3 - 1}], 0.1]
```

$$0.307764 \, \text{Sin}\left[\frac{4}{17} \pi \, (-1 + x)\right]$$

$$0.29524 \, \text{Cos}\left[\frac{4}{17} \pi \, (-1 + x)\right]$$

```
eigengenes2 = Sqrt[2 / 17.] * Sin[4 * Pi * (x - 1) / 17];
eigengenes3 = Sqrt[2 / 17.] * Cos[4 * Pi * (x - 1) / 17];

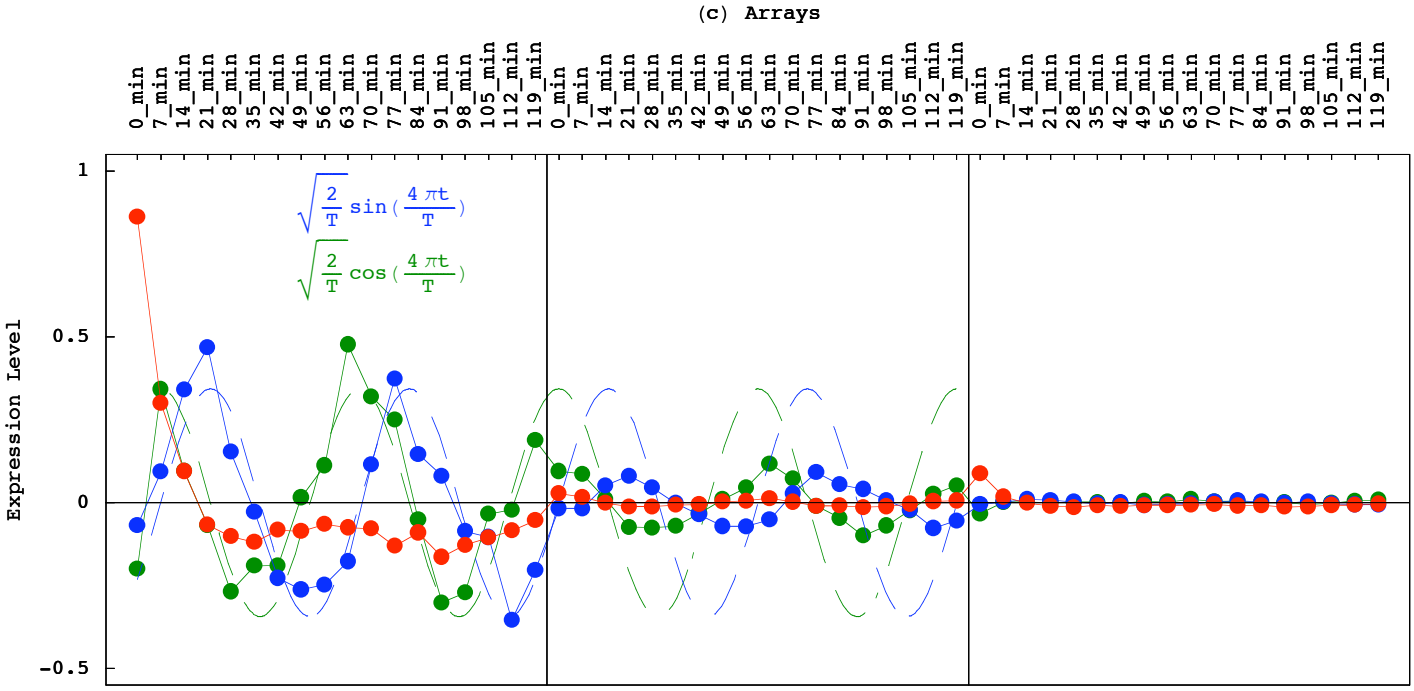
labelx = ColumnForm[{"(c) Arrays"}, Center];
labely = ColumnForm[{" ", "Expression Level"}, Center];
framex = Table[{a - 1, arraynames[[1, a]]}, {a, 1, arrays}];
framey = {-1, -0.5, 0, 0.5, 1};
coordinates = Table[{a - 1, eigengenes[[1, a]]}, {a, 1, arrays}];
points = Table[Point[coordinates[[a]]], {a, 1, arrays}];
line = Line[coordinates];
g = Show[
   {Graphics[{RGBColor[1, 0, 0], PointSize[0.011], points}],
    Graphics[{RGBColor[1, 0, 0], line}]},
   Frame -> True,
   FrameLabel -> {None, labely, labelx, None},
   GridLines -> {{{17.5, RGBColor[0, 0, 0]}, {35.5, RGBColor[0, 0, 0]}}, {{0, RGBColor[0, 0, 0]}}},
   FrameTicks -> {None, framey, framex, None},
   PlotRange -> {-0.55, 1.05},
   DisplayFunction -> Identity];
g = FullGraphics[g];
g[[1, 2]] = g[[1, 2]] /.
   Text[labely, {b_, c_}, {1., 0.}] →
    Text[labely, {b - 3.5, c}, {0, 0}, {0, 1}];
g[[1, 2]] = g[[1, 2]] /.
   Text[labelx, {b_, c_}, {0., -1.}] →
    Text[labelx, {b, c + 0.35}, {0, -1}, {1, 0}];
g[[1, 2]] = g[[1, 2]] /.
   Text[a_, {b_, c_}, {0., -1.}] →
    Text[a, {b, c + 0.175}, {0, 0}, {0, 1}];
p1 = Show[g,
   AspectRatio -> 1.05 / 2.25,
   PlotRange -> All,
   DisplayFunction → Identity];
```

```
graph = Plot[eigengenes2,
   {x, 0, arrays - arrays / 3 - 1},
   PlotStyle -> {RGBColor[0, 0, 1], Dashing[{0.03, 0.02}]},
   DisplayFunction -> Identity];
labelx = ColumnForm[{"(c) Arrays"}, Center];
labely = ColumnForm[{" ", "Expression Level"}, Center];
framex = Table[{a - 1, arraynames[[1, a]]}, {a, 1, arrays}];
framey = {-1, -0.5, 0, 0.5, 1};
coordinates = Table[{a - 1, eigengenes[[2, a]]}, {a, 1, arrays}];
points = Table[Point[coordinates[[a]]], {a, 1, arrays}];
line = Line[coordinates];
g = Show[
   {Graphics[{RGBColor[0, 0, 1], PointSize[0.011], points}],
    Graphics[{RGBColor[0, 0, 1], line}],
    graph,
    Graphics[{RGBColor[0, 0, 1], Text["√(2/T) sin(4πt/T)", {10.5, 0.9}]}]},
   Frame -> True,
   FrameLabel -> {None, labely, labelx, None},
   GridLines -> {{{17.5, RGBColor[0, 0, 0]}, {35.5, RGBColor[0, 0, 0]}}, {{0, RGBColor[0, 0, 0]}}},
   FrameTicks -> {None, framey, framex, None},
   PlotRange -> {-0.55, 1.05},
   DisplayFunction -> Identity];
g = FullGraphics[g];
g[[1, 2]] = g[[1, 2]] /.
   Text[labely, {b_, c_}, {1., 0.}] →
    Text[labely, {b - 3.5, c}, {0, 0}, {0, 1}];
g[[1, 2]] = g[[1, 2]] /.
   Text[labelx, {b_, c_}, {0., -1.}] →
    Text[labelx, {b, c + 0.35}, {0, -1}, {1, 0}];
g[[1, 2]] = g[[1, 2]] /.
   Text[a_, {b_, c_}, {0., -1.}] →
    Text[a, {b, c + 0.175}, {0, 0}, {0, 1}];
p2 = Show[g,
   AspectRatio -> 1.05 / 2.25,
   PlotRange -> All,
   DisplayFunction → Identity];
```

```
graph = Plot[eigengenes3,
   {x, 1, arrays - arrays / 3 - 1},
   PlotStyle -> {RGBColor[0, 0.5, 0], Dashing[{0.03, 0.02}]},
   DisplayFunction -> Identity];
labelx = ColumnForm[{"(c) Arrays"}, Center];
labely = ColumnForm[{" ", " "}, Center];
framex = Table[{a - 1, arraynames[[1, a]]}, {a, 1, arrays}];
framey = {-1, -0.5, 0, 0.5, 1};
coordinates = Table[{a - 1, eigengenes[[3, a]]}, {a, 1, arrays}];
points = Table[Point[coordinates[[a]]], {a, 1, arrays}];
line = Line[coordinates];
g = Show[
   {Graphics[{RGBColor[0, 0.5, 0], PointSize[0.011], points}],
    Graphics[{RGBColor[0, 0.5, 0], line}],
    graph,
    Graphics[{RGBColor[0, 0.5, 0], Text["√(2/T) cos(4πt/T)", {10.5, 0.7}]}]},
   Frame -> True,
   FrameLabel -> {None, labely, labelx, None},
   GridLines -> {{{17.5, RGBColor[0, 0, 0]}, {35.5, RGBColor[0, 0, 0]}}, {{0, RGBColor[0, 0, 0]}}},
   FrameTicks -> {None, framey, framex, None},
   PlotRange -> {-0.55, 1.05},
   DisplayFunction -> Identity];
g = FullGraphics[g];
g[[1, 2]] = g[[1, 2]] /.
   Text[labely, {b_, c_}, {1., 0.}] →
    Text[labely, {b - 3.5, c}, {0, 0}, {0, 1}];
g[[1, 2]] = g[[1, 2]] /.
   Text[labelx, {b_, c_}, {0., -1.}] →
    Text[labelx, {b, c + 0.35}, {0, -1}, {1, 0}];
g[[1, 2]] = g[[1, 2]] /.
   Text[a_, {b_, c_}, {0., -1.}] →
    Text[a, {b, c + 0.175}, {0, 0}, {0, 1}];
p3 = Show[g,
   AspectRatio -> 1.05 / 2.25,
   PlotRange -> All,
   DisplayFunction → Identity];
```

```
(* Display Selected Eigengenes *)

g3 = Show[{p3, p2, p1},
   DisplayFunction -> Identity];
Show[GraphicsArray[{g3}]];
```




```
(* Define Data *)

partialmatrix5 = tensor;
partialgenenames5 = partialgenenames;
arraynames5 = arraynames;
{genes5, arrays5} = Dimensions[partialmatrix5]
```

```
{868, 54}
```

```
(* Display Sorted Significant Eigenarrays *)

arraypatterns = Transpose[eigenarrays];

(* Center Eigenarrays *)

average = Table[1, {a, 1, genes}];
average = N[average / Sqrt[Dot[average, average]]];
arraypatterns = arraypatterns - N[Outer[Times, Dot[arraypatterns, average], average]];

(* Sort Eigenarrays *)

Do[
 arraypatterns[[a]] = Sort[arraypatterns[[a]], OrderedQ[{{#2}, {#1}}] &],
 {a, 1, 3}]

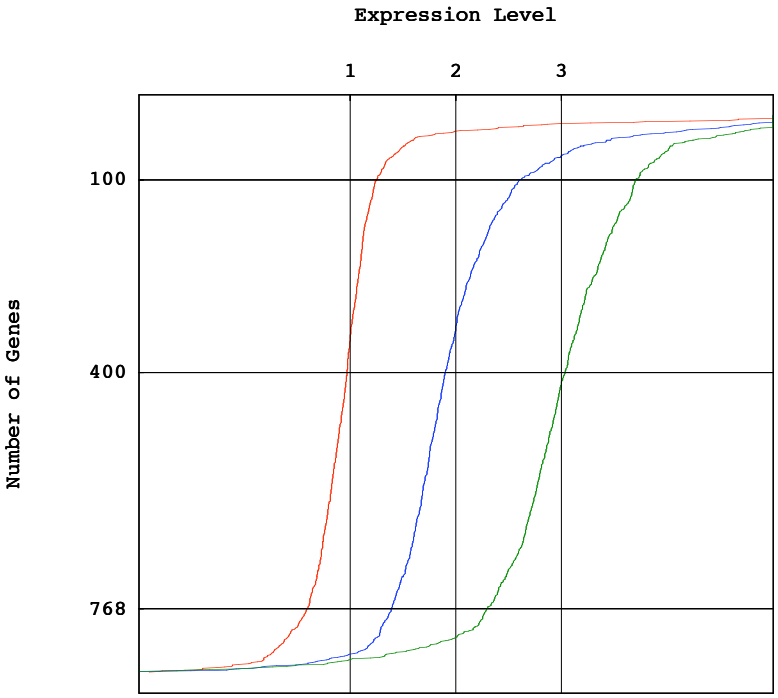
(* Create Sorted Eigenrrays Graph Display *)

p = Table[0, {a, 1, 3}];
color = {
   RGBColor[1, 0.5, 0],
   RGBColor[1, 0, 0],
   RGBColor[0, 0, 1],
   RGBColor[0, 0.5, 0]};
labelx = "Expression Level";
labely = ColumnForm[
   {"Number of Genes", " ", " ", " ", " ", " ", " ", " ", " ", " "},
   Center];
framex = Table[{0.04 * a, a}, {a, 1, 3}];
framey = {{-100, "100"}, {-400, "400"}, {-genes + 100, "768"}};

Do[{
   coordinates = Table[
     If[arraypatterns[[n, a]] + 0.04 * n < -0.04, -0.04,
      If[arraypatterns[[n, a]] + 0.04 * n > 0.2, 0.2,
       arraypatterns[[n, a]] + 0.04 * n]],
     {a, 1, genes}],
   coordinates = Table[{coordinates[[a]], -a + 1}, {a, 1, genes}],
   line = Line[coordinates],
   g = Show[
     Graphics[{color[[Mod[n, 5] + 1]], line}],
     Frame -> True,
     FrameLabel -> {None, labely, labelx, None},
     FrameTicks -> {None, framey, framex, None},
     GridLines -> {{{0.04 * n, RGBColor[0, 0, 0]}}, {{-100, RGBColor[0, 0, 0]},
        {-400, RGBColor[0, 0, 0]}, {-genes + 100, RGBColor[0, 0, 0]}}},
     PlotRange -> {{-0.04, 0.2}, {32.5, -genes + 1 - 32.5}},
     DisplayFunction -> Identity],
   g = FullGraphics[g],
   g[[1, 2]] = g[[1, 2]] /.
     Text[labely, {b_, c_}, {1., 0.}] →
      Text[labely, {b, c}, {0, 0}, {0, 1}],
   g[[1, 2]] = g[[1, 2]] /.
     Text[labelx, {b_, c_}, {0., -1.}] →
      Text[labelx, {b, c + 85}, {0, -1}, {1, 0}],
   p[[n]] = Show[g,
     AspectRatio → 2 / 1.2 / GoldenRatio,
     PlotRange -> All,
     DisplayFunction → Identity]
  }, {n, 1, 3}];
```

```
(* Display Sorted Eigenarrays *)

Show[Table[p[[a]], {a, 1, 3}],
  DisplayFunction → $DisplayFunction];
```



```
(* Estimate Significance of Association of Eigenarrays with the Cell Cycle *)

(* Use Cell Cycle Traditional or Microarray Classification of Yeast Genes *)

most = 100;
annotations = TakeColumns[partialgenenames5, {6}];
stages = {"M/G1", "G1", "S", "S/G2", "G2/M", "None"};
numbers = Flatten[Table[{Count[Flatten[annotations], stages[[a]]]}, {a, 1, Dimensions[stages][[1]]}]]
counter = Table[{a}, {a, 1, 3}];
probability = Table[{0}, {a, 1, Dimensions[counter][[1]]}];
parallelannotation = Table[{0}, {a, 1, Dimensions[counter][[1]]}];
parallelprobability = Table[{0}, {a, 1, Dimensions[counter][[1]]}];
antiannotation = Table[{0}, {a, 1, Dimensions[counter][[1]]}];
antiprobability = Table[{0}, {a, 1, Dimensions[counter][[1]]}];
```

```
{38, 77, 13, 23, 40, 677}
```

```
Do[{
  pattern = TakeColumns[Sort[
     AppendRows[TakeColumns[eigenarrays, counter[[c]]], annotations],
     OrderedQ[{{#2}, {#1}}] &], {2}],
  table = Table[{
     stages[[a]],
     numbers[[a]],
     Count[Flatten[TakeRows[pattern, {1, most}]], stages[[a]]]},
    {a, 1, Dimensions[stages][[1]]}],
  probability = Table[{
     Sum[N[Binomial[table[[a, 2]], b] * Binomial[genes - table[[a, 2]], most - b] /
         Binomial[genes, most]], {b, table[[a, 3]], most}],
     stages[[a]]},
    {a, 1, Dimensions[stages][[1]]}],
  parallelannotation[[c]] = {Sort[probability, OrderedQ[{{#1}, {#2}}] &][[1, 2]]},
  parallelprobability[[c]] = {ScientificForm[Sort[probability, OrderedQ[{{#1}, {#2}}] &][[1, 1]], 2]},
  table = Table[{
     stages[[a]],
     numbers[[a]],
     Count[Flatten[TakeRows[pattern, {genes - most + 1, genes}]], stages[[a]]]},
    {a, 1, Dimensions[stages][[1]]}],
  probability = Table[{
     Sum[N[Binomial[table[[a, 2]], b] * Binomial[genes - table[[a, 2]], most - b] /
         Binomial[genes, most]], {b, table[[a, 3]], most}],
     stages[[a]]},
    {a, 1, Dimensions[stages][[1]]}],
  antiannotation[[c]] = {Sort[probability, OrderedQ[{{#1}, {#2}}] &][[1, 2]]},
  antiprobability[[c]] = {ScientificForm[Sort[probability, OrderedQ[{{#1}, {#2}}] &][[1, 1]], 2]}},
 {c, 1, Dimensions[counter][[1]]}]
```

```
table1 = AppendRows[
   counter,
   parallelannotation,
   parallelprobability,
   antiannotation,
   antiprobability];
```

```
(* Estimate Significance of Association of Eigenarrays with the Pheromone Response *)

(* Use Pheromone Microarray Classification of Yeast Genes *)

most = 100;
annotations = TakeColumns[partialgenenames5, {7}];
stages = {"Up", "Down", "None"};
numbers = Flatten[Table[{Count[Flatten[annotations], stages[[a]]]}, {a, 1, Dimensions[stages][[1]]}]]
counter = Table[{a}, {a, 1, 3}];
probability = Table[{0}, {a, 1, Dimensions[counter][[1]]}];
parallelannotation = Table[{0}, {a, 1, Dimensions[counter][[1]]}];
parallelprobability = Table[{0}, {a, 1, Dimensions[counter][[1]]}];
antiannotation = Table[{0}, {a, 1, Dimensions[counter][[1]]}];
antiprobability = Table[{0}, {a, 1, Dimensions[counter][[1]]}];
```

```
{37, 50, 781}
```

```
Do[{
  pattern = TakeColumns[Sort[
     AppendRows[TakeColumns[eigenarrays, counter[[c]]], annotations],
     OrderedQ[{{#2}, {#1}}] &], {2}],
  table = Table[{
     stages[[a]],
     numbers[[a]],
     Count[Flatten[TakeRows[pattern, {1, most}]], stages[[a]]]},
    {a, 1, Dimensions[stages][[1]]}],
  probability = Table[{
     Sum[N[Binomial[table[[a, 2]], b] * Binomial[genes - table[[a, 2]], most - b] /
         Binomial[genes, most]], {b, table[[a, 3]], most}],
     stages[[a]]},
    {a, 1, Dimensions[stages][[1]]}],
  parallelannotation[[c]] = {Sort[probability, OrderedQ[{{#1}, {#2}}] &][[1, 2]]},
  parallelprobability[[c]] = {ScientificForm[Sort[probability, OrderedQ[{{#1}, {#2}}] &][[1, 1]], 2]},
  table = Table[{
     stages[[a]],
     numbers[[a]],
     Count[Flatten[TakeRows[pattern, {genes - most + 1, genes}]], stages[[a]]]},
    {a, 1, Dimensions[stages][[1]]}],
  probability = Table[{
     Sum[N[Binomial[table[[a, 2]], b] * Binomial[genes - table[[a, 2]], most - b] /
         Binomial[genes, most]], {b, table[[a, 3]], most}],
     stages[[a]]},
    {a, 1, Dimensions[stages][[1]]}],
  antiannotation[[c]] = {Sort[probability, OrderedQ[{{#1}, {#2}}] &][[1, 2]]},
  antiprobability[[c]] = {ScientificForm[Sort[probability, OrderedQ[{{#1}, {#2}}] &][[1, 1]], 2]}},
 {c, 1, Dimensions[counter][[1]]}]
```

```
table2 = AppendRows[
   counter,
   parallelannotation,
   parallelprobability,
   antiannotation,
   antiprobability];
```

```
(* Display Significance of Association of Eigenarrays with the Cellular Programs *)

headerx = {{
    ColumnForm[{" ", " ", " "}, Left],
    ColumnForm[{" ", " ", "Classification"}, Left],
    ColumnForm[{" ", " ", "Eigenarray"}, Left],
    ColumnForm[{"Most Likely", "Parallel", "Association"}, Left],
    ColumnForm[{"P-Value of", "Parallel", "Association"}, Left],
    ColumnForm[{"Most Likely", "Antiparallel", "Association"}, Left],
    ColumnForm[{"P-Value of", "Antiparallel", "Association"}, Left]},
   {" ", " ", " ", " ", " ", " ", " ", " "}};
spacerx = {{" ", " ", " ", " ", " ", " "}};
headery = Table[" ", {a, 1, 2 * Dimensions[counter][[1]] + 1}, {b, 1, 2}];
headery[[1]] = {"(a)", "Cell Cycle"};
headery[[Dimensions[counter][[1]] + 2]] = {"(b)", "Pheromone Response"};
association =
  AppendColumns[headerx,
   AppendRows[headery,
    AppendColumns[table1, spacerx, table2]]];
TableForm[association, TableSpacing → {1, 1}]
```

			Most Likely Parallel Association	P-Value of Parallel Association	Most Likely Antiparallel Association	P-Value of Antiparallel Association
	Classification	Eigenarray				
(a)	Cell Cycle	1	M/G1	$8.\times10^{-7}$	G1	8.3×10^{-20}
		2	G1	1.4×10^{-36}	G2/M	5.5×10^{-18}
		3	M/G1	3.1×10^{-16}	G1	4.8×10^{-12}
(b)	Pheromone Response	1	Up	5.3×10^{-18}	Down	5.5×10^{-23}
		2	Down	$8.\times10^{-4}$	Down	2.7×10^{-3}
		3	Up	1.8×10^{-3}	Down	1.6×10^{-9}

```
(* Examine Data and Its Projections Genes × Genes Correlations Tensor Matrices  *)

(* Read List of Cell Cycle-Regulated Genes *)

stream = "Desktop/Network_Decomposition/Data/Cycle_Genes.txt";
genelist = Import[stream, "Table"];
genelist = Drop[genelist, 1];
partialgenes = Dimensions[Intersection[genelist, partialgenenames5]][[1]]
Clear[stream];
```

```
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```

```
list = Flatten[TakeColumns[genelist, {1}]];
counter = Table[Flatten[Position[list, partialgenenames5[[a, 1]]]],
   {a, 1, Dimensions[partialgenenames5][[1]]}];
counter = ReplaceAll[counter, {} -> {Null}];
partial = AppendRows[counter, partialgenenames5, eigenarrays];
partial = Sort[partial, OrderedQ[{#1, #2}] &];
partialgenenames = TakeRows[
   TakeColumns[partial, {2, 8}],
   {1, partialgenes}];
partialeigenarrays = TakeRows[
   TakeColumns[partial, {9, Dimensions[eigenexpressions][[1]] + 8}],
   {1, partialgenes}];

(* Calculate Tensor Matrices *)

partialeigenarrays = Transpose[partialeigenarrays];
tensormatrices = Table[0, {a, 1, 3}, {b, 1, 3}];
Do[
 Do[
  tensormatrices[[a, b]] = Outer[Times, partialeigenarrays[[a]], partialeigenarrays[[b]]],
  {a, 1, 3}],
 {b, 1, 3}]
tensormatrices = {
   tensormatrices[[1, 1]],
   tensormatrices[[2, 2]],
   tensormatrices[[3, 3]],
   -(tensormatrices[[1, 2]] + tensormatrices[[2, 1]]),
   (tensormatrices[[1, 3]] + tensormatrices[[3, 1]]),
   -(tensormatrices[[2, 3]] + tensormatrices[[3, 2]])};
partialeigenarrays = Transpose[partialeigenarrays];

(* Keep Only Correlations Above Diagonals in Tensor Matrices *)

Do[
  Do[
   Do[
    tensormatrices[[a, b, c]] = 0,
    {c, 1, b}],
   {b, 1, Dimensions[tensormatrices[[1]]][[1]]}],
  {a, 1, 6}];
```

```
(* Flatten Tensor Matrices Into Tensor Vectors *)

tensorvectors = Table[0, {partialgenes * (partialgenes - 1) / 2}, {6}];
Do[{
   n = 0,
   square = tensormatrices[[a]],
   Do[{
     line = square[[b]],
     Do[{
       n = n + 1,
       tensorvectors[[n, a]] = line[[c]]
      }, {c, b + 1, partialgenes}],
    }, {b, 1, partialgenes}]
  }, {a, 1, 6}];

(* Create Genes × Genes Annotation Matrices for Selected Genes *)

partialgenenames = Transpose[partialgenenames];
annotatematrices = Table[
   Table[0, {partialgenes}, {partialgenes}],
   {a, 1, 7}];
Do[
 annotatematrices[[a]] = Outer[Times, partialgenenames[[a]], partialgenenames[[a]]],
 {a, 1, 7}]

(* Keep Only Correlations Above Diagonals in Annotation Matrices *)

Do[
  Do[
   Do[
    annotatematrices[[a, b, c]] = 0,
    {c, 1, b}],
   {b, 1, partialgenes}],
  {a, 1, 7}];

(* Flatten Annotation Matrices Into Annotation Vectors *)

annotatevectors = Table[0, {partialgenes * (partialgenes - 1) / 2}, {7}];
Do[{
  n = 0,
  square = annotatematrices[[a]],
  Do[{
    line = square[[b]],
    Do[{
      n = n + 1,
      annotatevectors[[n, a]] = line[[c]]
     }, {c, b + 1, partialgenes}],
   }, {b, 1, partialgenes}]
 }, {a, 1, 7}]
partialgenenames = Transpose[partialgenenames];
```

```
(* Display Sorted Significant Tensor Matrices *)

arraypatterns = Transpose[tensorvectors];
genes = Dimensions[arraypatterns][[2]]
```

```
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```

```
(* Center Tensor Matrices *)

average = Table[1, {a, 1, genes}];
average = N[average / Sqrt[Dot[average, average]]];
arraypatterns = arraypatterns - N[Outer[Times, Dot[arraypatterns, average], average]];

(* Sort Tensor Matrices *)

Do[
 arraypatterns[[a]] = Sort[arraypatterns[[a]], OrderedQ[{{#2}, {#1}}] &],
 {a, 1, 6}]

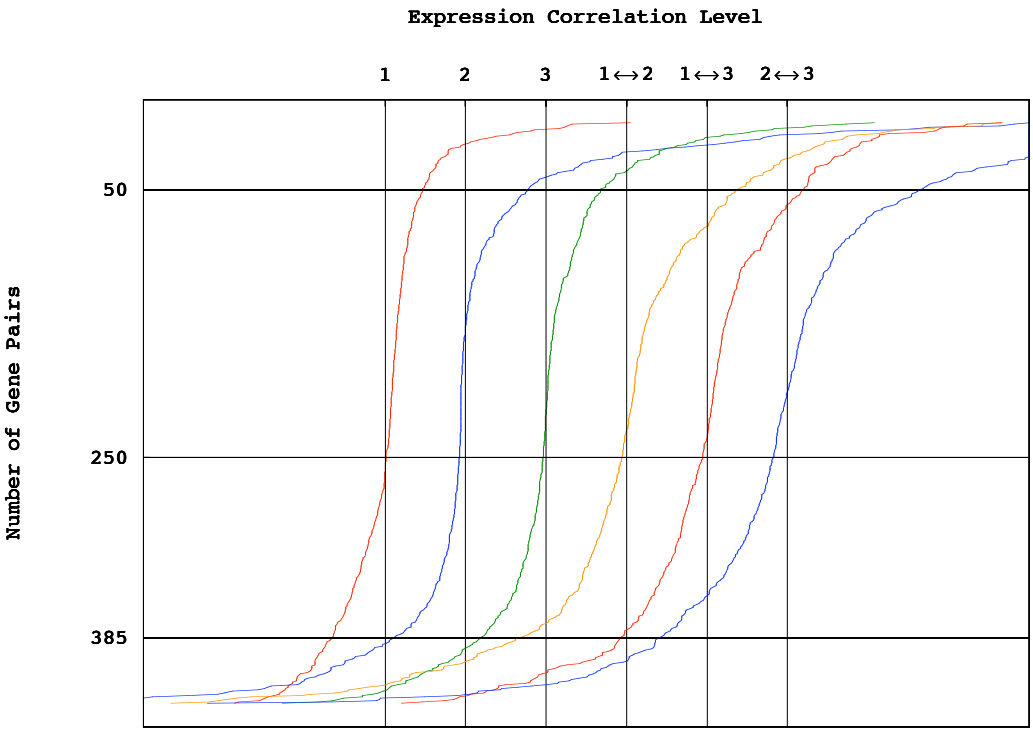
(* Create Sorted Tensor Matrices Graph Display *)

p = Table[0, {a, 1, 6}];
color = {
   RGBColor[1, 0.5, 0],
   RGBColor[1, 0, 0],
   RGBColor[0, 0, 1],
   RGBColor[0, 0.5, 0]};
labelx = "Expression Correlation Level";
labely = ColumnForm[
   {"Number of Gene Pairs", " ", " ", " ", " ", " ", " ", " ", " "},
   Center];
framex = {{0.006, 1}, {0.012, 2}, {0.018, 3}, {0.024, 1 ↔ 2}, {0.03`, 1 ↔ 3}, {0.036, 2 ↔ 3}};
framey = {{-50, "50"}, {-250, "250"}, {-genes + 50, "385"}};
```

```
Do[{
   coordinates = Table[
     If[arraypatterns[[n, a]] + 0.006 * n < -0.012, -0.012,
      If[arraypatterns[[n, a]] + 0.006 * n > 0.054, 0.054,
       arraypatterns[[n, a]] + 0.006 * n]],
     {a, 1, genes}],
   coordinates = Table[{coordinates[[a]], -a + 1}, {a, 1, genes}],
   line = Line[coordinates],
   g = Show[
     Graphics[{color[[Mod[n, 4] + 1]], line}],
     Frame -> True,
     FrameLabel -> {None, labely, labelx, None},
     FrameTicks -> {None, framey, framex, None},
     GridLines -> {{{0.006 * n, RGBColor[0, 0, 0]}}, {{-50, RGBColor[0, 0, 0]},
        {-250, RGBColor[0, 0, 0]}, {-genes + 50, RGBColor[0, 0, 0]}}},
     PlotRange -> {{-0.012, 0.054}, {17.5, -genes + 1 - 17.5}},
     DisplayFunction -> Identity],
   g = FullGraphics[g],
   g[[1, 2]] = g[[1, 2]] /.
     Text[labely, {b_, c_}, {1., 0.}] →
      Text[labely, {b, c}, {0, 0}, {0, 1}],
   g[[1, 2]] = g[[1, 2]] /.
     Text[labelx, {b_, c_}, {0., -1.}] →
      Text[labelx, {b, c + 42.5}, {0, -1}, {1, 0}],
   p[[n]] = Show[g,
     AspectRatio → 1.5 / 1.2 / GoldenRatio,
     PlotRange -> All,
     DisplayFunction → Identity]
  }, {n, 1, 6}];
```

```
(* Display Sorted Tensor Matrices *)

Show[Table[p[[a]], {a, 1, 6}],
  DisplayFunction → $DisplayFunction];
```



```
(* Estimate Significance of the Association of Tensor Matrices with the Cell Cycle *)

(* Use Cell Cycle Traditional or Microarray Classification of Yeast Genes *)

stages = {"M/G1", "G1", "S", "S/G2", "G2/M"};
stagematrix = Outer[Times, stages, stages];
stagevector =
  Table[0, {Dimensions[stages][[1]] * (Dimensions[stages][[1]] + 1) / 2}];
n = 0;
Do[
  Do[{
    n = n + 1,
    stagevector[[n]] = stagematrix[[a, b]]
   }, {b, 1, a}],
  {a, 1, Dimensions[stages][[1]]}];

most = 50;
annotations = TakeColumns[annotatevectors, {6}];
numbers = Flatten[Table[
   {Count[Flatten[annotations], stagevector[[a]]]},
   {a, 1, Dimensions[stagevector][[1]]}]]
counter = Table[{a}, {a, 1, 6}];
probability = Table[{0}, {a, 1, Dimensions[counter][[1]]}];
parallelannotation = Table[{0}, {a, 1, Dimensions[counter][[1]]}];
parallelprobability = Table[{0}, {a, 1, Dimensions[counter][[1]]}];
antiannotation = Table[{0}, {a, 1, Dimensions[counter][[1]]}];
antiprobability = Table[{0}, {a, 1, Dimensions[counter][[1]]}];

{21, 98, 91, 14, 28, 1, 21, 42, 6, 3, 28, 56, 8, 12, 6}

Do[{
  pattern = TakeColumns[Sort[
     AppendRows[TakeColumns[tensorvectors, counter[[c]]], annotations],
     OrderedQ[{{#2}, {#1}}] &], {2}],
  table = Table[{
     stagevector[[a]],
     numbers[[a]],
     Count[Flatten[TakeRows[pattern, {1, most}]], stagevector[[a]]]},
    {a, 1, Dimensions[stagevector][[1]]}],
  probability = Table[{
     Sum[N[Binomial[table[[a, 2]], b] * Binomial[genes - table[[a, 2]], most - b] /
         Binomial[genes, most]], {b, table[[a, 3]], most}],
     stagevector[[a]]},
    {a, 1, Dimensions[stagevector][[1]]}],
  parallelannotation[[c]] = {Sort[probability, OrderedQ[{{#1}, {#2}}] &][[1, 2]]},
  parallelprobability[[c]] = {ScientificForm[Sort[probability, OrderedQ[{{#1}, {#2}}] &][[1, 1]], 2]},
  table = Table[{
     stagevector[[a]],
     numbers[[a]],
     Count[Flatten[TakeRows[pattern, {genes - most + 1, genes}]], stagevector[[a]]]},
    {a, 1, Dimensions[stagevector][[1]]}],
  probability = Table[{
     Sum[N[Binomial[table[[a, 2]], b] * Binomial[genes - table[[a, 2]], most - b] /
         Binomial[genes, most]], {b, table[[a, 3]], most}],
     stagevector[[a]]},
    {a, 1, Dimensions[stagevector][[1]]}],
  antiannotation[[c]] = {Sort[probability, OrderedQ[{{#1}, {#2}}] &][[1, 2]]},
  antiprobability[[c]] = {ScientificForm[Sort[probability, OrderedQ[{{#1}, {#2}}] &][[1, 1]], 2]}},
 {c, 1, Dimensions[counter][[1]]}]
```

```
table1 = AppendRows[
   {{1}, {2}, {3}, {1 ↔ 2}, {1 ↔ 3}, {2 ↔ 3}} ,
   parallelannotation,
   parallelprobability,
   antiannotation,
   antiprobability];

table1 = ReplaceAll[table1, "M/G1"^2 -> "M/G1  M/G1"];
table1 = ReplaceAll[table1, "G1" "M/G1" -> "G1    M/G1"];
table1 = ReplaceAll[table1, "G1"^2 -> "G1    G1"];
table1 = ReplaceAll[table1, "M/G1" "S" -> "M/G1  S"];
table1 = ReplaceAll[table1, "G1" "S" -> "G1    S"];
table1 = ReplaceAll[table1, "S"^2 -> "S     S"];
table1 = ReplaceAll[table1, "M/G1" "S/G2" -> "M/G1  S/G2"];
table1 = ReplaceAll[table1, "G1" "S/G2" -> "G1    S/G2"];
table1 = ReplaceAll[table1, "S" "S/G2" -> "S     S/G2"];
table1 = ReplaceAll[table1, "S/G2"^2 -> "S/G2  S/G2"];
table1 = ReplaceAll[table1, "G2/M" "M/G1" -> "G2/M  M/G1"];
table1 = ReplaceAll[table1, "G1" "G2/M" -> "G1    G2/M"];
table1 = ReplaceAll[table1, "G2/M" "S" -> "G2/M  S"];
table1 = ReplaceAll[table1, "G2/M" "S/G2" -> "G2/M  S/G2"];
table1 = ReplaceAll[table1, "G2/M"^2 -> "G2/M  G2/M"];
```

```
(* Estimate Significance of the Association of Tensor Matrices with the Pheromone Response *)

(* Use Pheromone Microarray Classification of Yeast Genes *)

stages = {"Up", "Down", "None"};
stagematrix = Outer[Times, stages, stages];
stagevector =
  Table[0, {Dimensions[stages][[1]] * (Dimensions[stages][[1]] + 1) / 2}];
n = 0;
Do[
  Do[{
    n = n + 1,
    stagevector[[n]] = stagematrix[[a, b]]
   }, {b, 1, a}],
  {a, 1, Dimensions[stages][[1]]}];

most = 50;
annotations = TakeColumns[annotatevectors, {7}];
numbers = Flatten[Table[
   {Count[Flatten[annotations], stagevector[[a]]]},
   {a, 1, Dimensions[stagevector][[1]]}]]
counter = Table[{a}, {a, 1, 6}];
probability = Table[{0}, {a, 1, Dimensions[counter][[1]]}];
parallelannotation = Table[{0}, {a, 1, Dimensions[counter][[1]]}];
parallelprobability = Table[{0}, {a, 1, Dimensions[counter][[1]]}];
antiannotation = Table[{0}, {a, 1, Dimensions[counter][[1]]}];
antiprobability = Table[{0}, {a, 1, Dimensions[counter][[1]]}];

{28, 88, 55, 88, 121, 55}

Do[{
  pattern = TakeColumns[Sort[
     AppendRows[TakeColumns[tensorvectors, counter[[c]]], annotations],
     OrderedQ[{{#2}, {#1}}] &], {2}],
  table = Table[{
     stagevector[[a]],
     numbers[[a]],
     Count[Flatten[TakeRows[pattern, {1, most}]], stagevector[[a]]]},
    {a, 1, Dimensions[stagevector][[1]]}],
  probability = Table[{
     Sum[N[Binomial[table[[a, 2]], b] * Binomial[genes - table[[a, 2]], most - b] /
         Binomial[genes, most]], {b, table[[a, 3]], most}],
     stagevector[[a]]},
    {a, 1, Dimensions[stagevector][[1]]}],
  parallelannotation[[c]] = {Sort[probability, OrderedQ[{{#1}, {#2}}] &][[1, 2]]},
  parallelprobability[[c]] = {ScientificForm[Sort[probability, OrderedQ[{{#1}, {#2}}] &][[1, 1]], 2]},
  table = Table[{
     stagevector[[a]],
     numbers[[a]],
     Count[Flatten[TakeRows[pattern, {genes - most + 1, genes}]], stagevector[[a]]]},
    {a, 1, Dimensions[stagevector][[1]]}],
  probability = Table[{
     Sum[N[Binomial[table[[a, 2]], b] * Binomial[genes - table[[a, 2]], most - b] /
         Binomial[genes, most]], {b, table[[a, 3]], most}],
     stagevector[[a]]},
    {a, 1, Dimensions[stagevector][[1]]}],
  antiannotation[[c]] = {Sort[probability, OrderedQ[{{#1}, {#2}}] &][[1, 2]]},
  antiprobability[[c]] = {ScientificForm[Sort[probability, OrderedQ[{{#1}, {#2}}] &][[1, 1]], 2]}},
 {c, 1, Dimensions[counter][[1]]}]
```

```
table2 = AppendRows[
   {{1}, {2}, {3}, {1 ↔ 2}, {1 ↔ 3}, {2 ↔ 3}} ,
   parallelannotation,
   parallelprobability,
   antiannotation,
   antiprobability];

table2 = ReplaceAll[table2, "Up"^2 -> "Up    Up"];
table2 = ReplaceAll[table2, "Down" "Up" -> "Down  Up"];
table2 = ReplaceAll[table2, "Down"^2 -> "Down  Down"];
table2 = ReplaceAll[table2, "None" "Up" -> "None  Up"];
table2 = ReplaceAll[table2, "Down" "None" -> "Down  None"];
table2 = ReplaceAll[table2, "None"^2 -> "None  None"];
```

```
(* Display Significance of Association of Tensor Matrices with the Cellular Programs *)

headerx = {{
    ColumnForm[{" ", " ", " "}, Left],
    ColumnForm[{" ", " ", "Classification"}, Left],
    ColumnForm[{" ", " ", "Subnetwork"}, Left],
    ColumnForm[{"Most Likely", "Parallel", "Association"}, Left],
    ColumnForm[{"P-Value of", "Parallel", "Association"}, Left],
    ColumnForm[{"Most Likely", "Antiparallel", "Association"}, Left],
    ColumnForm[{"P-Value of", "Antiparallel", "Association"}, Left]},
   {" ", " ", " ", " ", " ", " ", " ", " ", " "}};
spacerx = {{" ", " ", " ", " ", " ", " "}};
headery = Table[" ", {a, 1, 7}, {b, 1, 2}];
headery[[1]] = {"(a)", "Cell Cycle"};
headery[[5]] = {"(b)", "Pheromone Response"};
association =
  AppendColumns[headerx,
   AppendRows[headery,
    AppendColumns[TakeRows[table1, 3], spacerx, TakeRows[table2, 3]]]];
TableForm[association, TableSpacing → {1, 1}]
headerx = {{" ", " ", " ", " ", " ", " ", " ", " ", " "},
   {" ", " ", "Coupling  ",
    "           ","            ","           ","            "},
   {" ", " ", " ", " ", " ", " ", " ", " ", " "}};
headery = ReplaceAll[headery, "(a)" -> "(c)"];
headery = ReplaceAll[headery, "(b)" -> "(d)"];
association =
  AppendColumns[headerx,
   AppendRows[headery,
    AppendColumns[TakeRows[table1, {4, 6}], spacerx, TakeRows[table2, {4, 6}]]]];
TableForm[association, TableSpacing → {1, 1}]
```

			Most Likely Parallel Association		P-Value of Parallel Association	Most Likely Antiparallel Association		P-Value of Antiparallel Association
	Classification	Subnetwork						
(a)	Cell Cycle	1	M/G1	M/G1	2.2×10^{-5}	M/G1	S	3.1×10^{-5}
		2	G1	G1	1.8×10^{-7}	G1	G2/M	2.4×10^{-8}
		3	G1	S	1.4×10^{-6}	M/G1	S	1.2×10^{-7}
(b)	Pheromone Response	1	Down	Down	7.5×10^{-16}	Down	Up	$2.\times10^{-27}$
		2	Down	None	1.6×10^{-2}	Down	Up	2.6×10^{-2}
		3	Down	Down	1.4×10^{-2}	Down	Up	2.1×10^{-6}
		Coupling						
(c)	Cell Cycle	1↔2	G1	G1	1.8×10^{-5}	G1	M/G1	6.2×10^{-9}
		1↔3	G1	S	1.4×10^{-6}	M/G1	S	1.2×10^{-7}
		2↔3	G1	S	1.1×10^{-5}	G1	G2/M	1.6×10^{-7}
(d)	Pheromone Response	1↔2	Down	Down	2.3×10^{-10}	Down	Up	2.7×10^{-10}
		1↔3	Down	Down	1.1×10^{-7}	Down	Up	3.6×10^{-14}
		2↔3	Down	Down	1.6×10^{-8}	Down	Up	3.9×10^{-5}

```
(* Display Data and Its Projections Genes × Genes Correlations Tensor Matrices  *)

(* Read List of Cell Cycle-Regulated Genes *)

stream = "Desktop/Network_Decomposition/Data/Cycle_Genes.txt";
genelist = Import[stream, "Table"];
genelist = Drop[genelist, 1];
partialgenes = Dimensions[Intersection[genelist, partialgenenames5]][[1]]
Clear[stream];
```

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```
list = Flatten[TakeColumns[genelist, {1}]];
counter = Table[Flatten[Position[list, partialgenenames5[[a, 1]]]],
   {a, 1, Dimensions[partialgenenames5][[1]]}];
counter = ReplaceAll[counter, {} -> {Null}];
partial = AppendRows[counter, partialgenenames5, eigenarrays, tensor];
partial = Sort[partial, OrderedQ[{#1, #2}] &];
partialgenenames = TakeRows[
   TakeColumns[partial, {2, 8}],
   {1, partialgenes}];
partialeigenarrays = TakeRows[
   TakeColumns[partial, {9, Dimensions[eigenexpressions][[1]] + 8}],
   {1, partialgenes}];
partialtensor = TakeRows[
   TakeColumns[partial, {Dimensions[eigenexpressions][[1]] + 8,
     Dimensions[eigenexpressions][[1]] + arrays + 7}],
   {1, partialgenes}];

(* Calculate Tensor Matrices *)

partialeigenarrays = Transpose[partialeigenarrays];
tensormatrices = Table[0, {a, 1, 3}, {b, 1, 3}];
Do[
 Do[
  tensormatrices[[a, b]] = Outer[Times, partialeigenarrays[[a]], partialeigenarrays[[b]]],
  {a, 1, 3}],
 {b, 1, 3}]
tensormatrices = {
   tensormatrices[[1, 1]],
   tensormatrices[[2, 2]],
   tensormatrices[[3, 3]],
   -(tensormatrices[[1, 2]] + tensormatrices[[2, 1]]),
   (tensormatrices[[1, 3]] + tensormatrices[[3, 1]]),
   -(tensormatrices[[2, 3]] + tensormatrices[[3, 2]])};
partialeigenarrays = Transpose[partialeigenarrays];

(* Keep Only Correlations Above Diagonals in Tensor Matrices *)

Do[
  Do[
   Do[
    tensormatrices[[a, b, c]] = 0,
    {c, 1, b}],
   {b, 1, Dimensions[tensormatrices[[1]]][[1]]}],
  {a, 1, 6}];
```

```
(* Set Correlations Cutoffs *)

cutoffs = Table[Sort[Flatten[Abs[tensormatrices[[a]]]], OrderedQ[{#2, #1}] &][[100]],
   {a, 1, 6}];

Do[
 tensormatrices[[a]] = Chop[tensormatrices[[a]], cutoffs[[a]]],
 {a, 1, 6}]

(* Select Cell Cycle-Regulated Genes With Correlations Above Cutoffs *)

int = Intersection[
   Position[Sign[tensormatrices[[1]]], Table[0, {a, 1, partialgenes}]],
   Position[Sign[tensormatrices[[2]]], Table[0, {a, 1, partialgenes}]],
   Position[Sign[tensormatrices[[3]]], Table[0, {a, 1, partialgenes}]],
   Position[Sign[tensormatrices[[4]]], Table[0, {a, 1, partialgenes}]],
   Position[Sign[tensormatrices[[5]]], Table[0, {a, 1, partialgenes}]],
   Position[Sign[tensormatrices[[6]]], Table[0, {a, 1, partialgenes}]]];

Do[{
  partialtensor = Drop[partialtensor, {Flatten[int][[a]]}],
  partialeigenarrays = Drop[partialeigenarrays, {Flatten[int][[a]]}],
  partialgenenames = Drop[partialgenenames, {Flatten[int][[a]]}]},
 {a, Dimensions[int][[1]], 1, -1}]
partialgenes = Dimensions[partialgenenames][[1]]
```

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```

```
(* Calculate Tensor Matrices For Selected Genes *)

partialeigenarrays = Transpose[partialeigenarrays];
tensormatrices = Table[0, {a, 1, 3}, {b, 1, 3}];
Do[
 Do[
  tensormatrices[[a, b]] = Outer[Times, partialeigenarrays[[a]], partialeigenarrays[[b]]],
  {a, 1, 3}],
 {b, 1, 3}]
tensormatrices = {
   tensormatrices[[1, 1]],
   tensormatrices[[2, 2]],
   tensormatrices[[3, 3]],
   -(tensormatrices[[1, 2]] + tensormatrices[[2, 1]]),
   (tensormatrices[[1, 3]] + tensormatrices[[3, 1]]),
   -(tensormatrices[[2, 3]] + tensormatrices[[3, 2]])};
partialeigenarrays = Transpose[partialeigenarrays];
```

```
(* Create Network Tensor Decomposition 2 D Red & Green Raster Display *)

(* Create Genes × Genes Correlations 2 D Red & Green Raster Display *)

framex = Table[{a - 0.5, partialgenenames[[a, 2]]}, {a, 1, partialgenes}];
framey = Table[{a + 1 - 0.5, partialgenes - a}, {a, 0, partialgenes - 1}];
labelx = "Genes";
labely = ColumnForm[{StyleForm["{", FontSize → 200], "Genes"}, Center];
labely = "Genes";
p = Table[0, {a, 1, 11}];

contrast = 1;
labelz = ColumnForm[
   {" ", " ", " ", " ", " ", " ", StyleForm[",", FontSize → 40, FontWeight -> Bold]},
   Left];
Do[{
  correlation = Dot[
    TakeColumns[partialtensor, {18 * (a - 1) + 1, 18 * a}],
    Transpose[TakeColumns[partialtensor, {18 * (a - 1) + 1, 18 * a}]]],
  displaying = Table[
    If[contrast * correlation[[i, j]] > 0,
     If[contrast * correlation[[i, j]] < 1, {contrast * correlation[[i, j]], 0}, {1, 0}],
     If[contrast * correlation[[i, j]] > -1, {0, -contrast * correlation[[i, j]]}, {0, 1}]],
    {i, 1, partialgenes}, {j, 1, partialgenes}],
  g = Show[
    Graphics[
     RasterArray[
      Table[
       RGBColor[displaying[[i, j, 1]], displaying[[i, j, 2]], 0],
       {i, partialgenes, 1, -1}, {j, 1, partialgenes}]]],
    AspectRatio -> 1,
    Frame -> True,
    FrameTicks -> {None, None, None, None},
    FrameLabel -> {None, labely, labelx, labelz},
    DisplayFunction -> Identity],
g = FullGraphics[g],
g[[1, 2]] = g[[1, 2]] /.
    Text[labely, {b_, c_}, {1., 0.}] →
     Text[labely, {b - 4, c}, {0, 0}, {0, 1}],
g[[1, 2]] = g[[1, 2]] /.
    Text[labelx, {b_, c_}, {0., -1.}] →
     Text[labelx, {b, c}, {0, -1}, {1, 0}],
p[[a]] = Show[g,
    AspectRatio → 0.95,
    PlotRange -> All,
    DisplayFunction → Identity]},
 {a, 1, 2}]
```

```
contrast = 5;
labelz = ColumnForm[{StyleForm[" ", FontSize → 40, FontWeight -> Bold]}, Left];
Do[{
  correlation = Dot[
    TakeColumns[partialtensor, {18 * (a - 1) + 1, 18 * a}],
    Transpose[TakeColumns[partialtensor, {18 * (a - 1) + 1, 18 * a}]]],
  displaying = Table[
    If[contrast * correlation[[i, j]] > 0,
     If[contrast * correlation[[i, j]] < 1, {contrast * correlation[[i, j]], 0}, {1, 0}],
     If[contrast * correlation[[i, j]] > -1, {0, -contrast * correlation[[i, j]]}, {0, 1}]],
    {i, 1, partialgenes}, {j, 1, partialgenes}],
  g = Show[
    Graphics[
     RasterArray[
      Table[
       RGBColor[displaying[[i, j, 1]], displaying[[i, j, 2]], 0],
       {i, partialgenes, 1, -1}, {j, 1, partialgenes}]]],
    AspectRatio -> 1,
    Frame -> True,
    FrameTicks -> {None, None, None, None},
    FrameLabel -> {None, labely, labelx, labelz},
    DisplayFunction -> Identity],
g = FullGraphics[g],
g[[1, 2]] = g[[1, 2]] /.
    Text[labely, {b_, c_}, {1., 0.}] →
     Text[labely, {b - 4, c}, {0, 0}, {0, 1}],
g[[1, 2]] = g[[1, 2]] /.
    Text[labelx, {b_, c_}, {0., -1.}] →
     Text[labelx, {b, c}, {0, -1}, {1, 0}],
p[[a]] = Show[g,
    AspectRatio → 0.95,
    PlotRange -> All,
    DisplayFunction → Identity]},
 {a, 3, 3}]
```

```
(* Create Genes × Genes Tensor Correlations 2 D Red & Green Raster Displays *)

contrast = 100;
labelz = ColumnForm[
   {" ", " ", " ", " ", " ", " ", StyleForm[",", FontSize → 40, FontWeight -> Bold]},
   Left];
Do[{
  correlation = tensormatrices[[a - 3]],
  displaying = Table[
    If[contrast * correlation[[i, j]] > 0,
     If[contrast * correlation[[i, j]] < 1, {contrast * correlation[[i, j]], 0}, {1, 0}],
     If[contrast * correlation[[i, j]] > -1, {0, -contrast * correlation[[i, j]]}, {0, 1}]],
    {i, 1, partialgenes}, {j, 1, partialgenes}],
  g = Show[
    Graphics[
     RasterArray[
      Table[
       RGBColor[displaying[[i, j, 1]], displaying[[i, j, 2]], 0],
       {i, partialgenes, 1, -1}, {j, 1, partialgenes}]]],
    AspectRatio -> 1,
    Frame -> True,
    FrameTicks -> {None, None, None, None},
    FrameLabel -> {None, labely, labelx, labelz},
    DisplayFunction -> Identity],
g = FullGraphics[g],
g[[1, 2]] = g[[1, 2]] /.
    Text[labely, {b_, c_}, {1., 0.}] →
     Text[labely, {b - 4, c}, {0, 0}, {0, 1}],
g[[1, 2]] = g[[1, 2]] /.
    Text[labelx, {b_, c_}, {0., -1.}] →
     Text[labelx, {b, c}, {0, -1}, {1, 0}],
p[[a]] = Show[g,
    AspectRatio → 0.95,
    PlotRange -> All,
    DisplayFunction → Identity]},
 {a, 4, 5}]
```

```
contrast = 100;
labelz = ColumnForm[
   {" ", " ", " ", " ", " ", " ", StyleForm[" ", FontSize → 40, FontWeight -> Bold]},
   Left];
Do[{
  correlation = tensormatrices[[a - 3]],
  displaying = Table[
    If[contrast * correlation[[i, j]] > 0,
     If[contrast * correlation[[i, j]] < 1, {contrast * correlation[[i, j]], 0}, {1, 0}],
     If[contrast * correlation[[i, j]] > -1, {0, -contrast * correlation[[i, j]]}, {0, 1}]],
    {i, 1, partialgenes}, {j, 1, partialgenes}],
  g = Show[
    Graphics[
     RasterArray[
      Table[
       RGBColor[displaying[[i, j, 1]], displaying[[i, j, 2]], 0],
       {i, partialgenes, 1, -1}, {j, 1, partialgenes}]]],
    AspectRatio -> 1,
    Frame -> True,
    FrameTicks -> {None, None, None, None},
    FrameLabel -> {None, labely, labelx, labelz},
    DisplayFunction -> Identity],
g = FullGraphics[g],
g[[1, 2]] = g[[1, 2]] /.
    Text[labely, {b_, c_}, {1., 0.}] →
     Text[labely, {b - 4, c}, {0, 0}, {0, 1}],
g[[1, 2]] = g[[1, 2]] /.
    Text[labelx, {b_, c_}, {0., -1.}] →
     Text[labelx, {b, c}, {0, -1}, {1, 0}],
p[[a]] = Show[g,
    AspectRatio → 0.95,
    PlotRange -> All,
    DisplayFunction → Identity]},
 {a, 6, 6}]
```

```
contrast = 100;
labelz = ColumnForm[
   {" ", " ", " ", " ", " ", " ", StyleForm[",", FontSize → 40, FontWeight -> Bold]},
   Left];
Do[{
  correlation = tensormatrices[[a - 3]],
  displaying = Table[
    If[contrast * correlation[[i, j]] > 0,
     If[contrast * correlation[[i, j]] < 1, {contrast * correlation[[i, j]], 0}, {1, 0}],
     If[contrast * correlation[[i, j]] > -1, {0, -contrast * correlation[[i, j]]}, {0, 1}]],
    {i, 1, partialgenes}, {j, 1, partialgenes}],
  g = Show[
    Graphics[
     RasterArray[
      Table[
       RGBColor[displaying[[i, j, 1]], displaying[[i, j, 2]], 0],
       {i, partialgenes, 1, -1}, {j, 1, partialgenes}]]],
    AspectRatio -> 1,
    Frame -> True,
    FrameTicks -> {None, None, None, None},
    FrameLabel -> {None, labely, labelx, labelz},
    DisplayFunction -> Identity],
g = FullGraphics[g],
g[[1, 2]] = g[[1, 2]] /.
    Text[labely, {b_, c_}, {1., 0.}] →
     Text[labely, {b - 4, c}, {0, 0}, {0, 1}],
g[[1, 2]] = g[[1, 2]] /.
    Text[labelx, {b_, c_}, {0., -1.}] →
     Text[labelx, {b, c}, {0, -1}, {1, 0}],
p[[a]] = Show[g,
    AspectRatio → 0.95,
    PlotRange -> All,
    DisplayFunction → Identity]},
 {a, 7, 8}]
```

```
contrast = 100;
labelz = ColumnForm[
   {" ", " ", " ", " ", " ", " ", StyleForm[" ", FontSize → 40, FontWeight -> Bold]},
   Left];
Do[{
  correlation = tensormatrices[[a - 3]],
  displaying = Table[
    If[contrast * correlation[[i, j]] > 0,
     If[contrast * correlation[[i, j]] < 1, {contrast * correlation[[i, j]], 0}, {1, 0}],
     If[contrast * correlation[[i, j]] > -1, {0, -contrast * correlation[[i, j]]}, {0, 1}]],
    {i, 1, partialgenes}, {j, 1, partialgenes}],
  g = Show[
    Graphics[
     RasterArray[
      Table[
       RGBColor[displaying[[i, j, 1]], displaying[[i, j, 2]], 0],
       {i, partialgenes, 1, -1}, {j, 1, partialgenes}]]],
    AspectRatio -> 1,
    Frame -> True,
    FrameTicks -> {None, None, None, None},
    FrameLabel -> {None, labely, labelx, labelz},
    DisplayFunction -> Identity],
g = FullGraphics[g],
g[[1, 2]] = g[[1, 2]] /.
    Text[labely, {b_, c_}, {1., 0.}] →
     Text[labely, {b - 4, c}, {0, 0}, {0, 1}],
g[[1, 2]] = g[[1, 2]] /.
    Text[labelx, {b_, c_}, {0., -1.}] →
     Text[labelx, {b, c}, {0, -1}, {1, 0}],
p[[a]] = Show[g,
    AspectRatio → 0.95,
    PlotRange -> All,
    DisplayFunction → Identity]},
 {a, 9, 9}]
```

```
(* Create Coefficients of Tensor Correlations 2 D Red & Green Raster Displays *)

core = {
   Flatten[Dot[Transpose[eigenarrays], partialmatrix1, Transpose[partialmatrix1], eigenarrays]],
   Flatten[Dot[Transpose[eigenarrays], matrix2, Transpose[matrix2], eigenarrays]],
   Flatten[Dot[Transpose[eigenarrays], matrix3, Transpose[matrix3], eigenarrays]]};

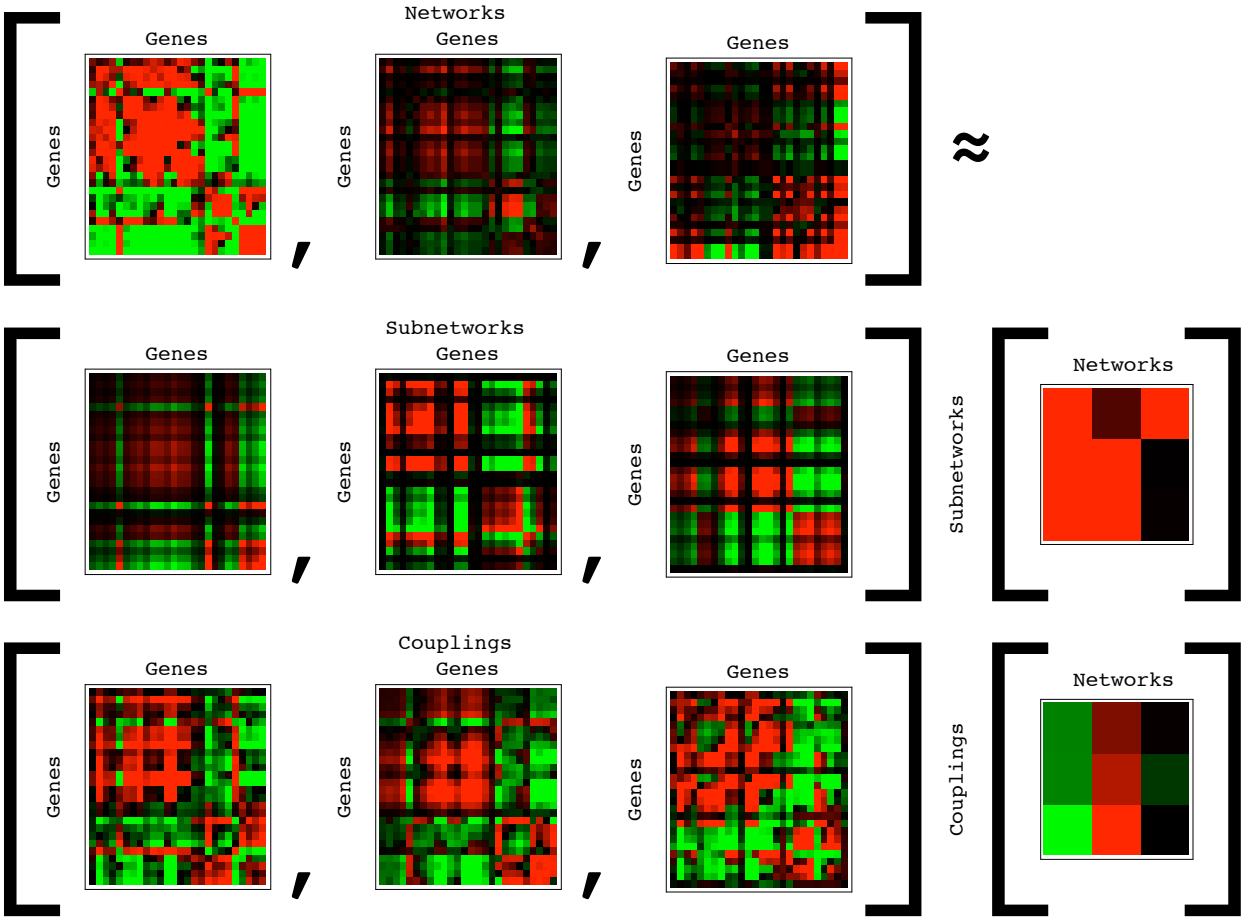
contrast = 0.25;
coefficients = Table[0, {3}];
Do[
 coefficients[[a]] = {
   core[[a]][[0 * 39 + 1]],
   core[[a]][[1 * 39 + 2]],
   core[[a]][[2 * 39 + 3]]},
 {a, 1, 3}]
coefficients = Transpose[coefficients];
displaying = Table[
   If[contrast * coefficients[[i, j]] > 0,
    If[contrast * coefficients[[i, j]] < 1, {contrast * coefficients[[i, j]], 0}, {1, 0}],
    If[contrast * coefficients[[i, j]] > -1, {0, -contrast * coefficients[[i, j]]}, {0, 1}]],
   {i, 1, 3}, {j, 1, 3}];
g = Show[
   Graphics[
    RasterArray[
     Table[
      RGBColor[displaying[[i, j, 1]], displaying[[i, j, 2]], 0],
      {i, 3, 1, -1}, {j, 1, 3}]]],
   AspectRatio -> 1,
   Frame -> True,
   FrameTicks -> {None, None, None, None},
   FrameLabel -> {None, None, None, None},
   DisplayFunction -> Identity];
g = FullGraphics[g];
g[[1, 2]] = g[[1, 2]] /.
   Text[labely, {b_, c_}, {1., 0.}] →
    Text[labely, {b - 3, c}, {0, 0}, {0, 1}];
g[[1, 2]] = g[[1, 2]] /.
   Text[labelx, {b_, c_}, {0., -1.}] →
    Text[labelx, {b, c + 3}, {0, -1}, {1, 0}];
p[[10]] = Show[g,
   AspectRatio → 1.05,
   PlotRange -> All,
   DisplayFunction → Identity];
```

```
contrast = 0.25;
coefficients = Table[0, {3}];
Do[
 coefficients[[a]] = {
   -core[[a]][[0 * 39 + 2]],
   core[[a]][[0 * 39 + 3]],
   -core[[a]][[1 * 39 + 3]]},
 {a, 1, 3}]
coefficients = Transpose[coefficients];
displaying = Table[
   If[contrast * coefficients[[i, j]] > 0,
    If[contrast * coefficients[[i, j]] < 1, {contrast * coefficients[[i, j]], 0}, {1, 0}],
    If[contrast * coefficients[[i, j]] > -1, {0, -contrast * coefficients[[i, j]]}, {0, 1}]],
   {i, 1, 3}, {j, 1, 3}];
g = Show[
   Graphics[
    RasterArray[
     Table[
      RGBColor[displaying[[i, j, 1]], displaying[[i, j, 2]], 0],
      {i, 3, 1, -1}, {j, 1, 3}]]],
   AspectRatio -> 1,
   Frame -> True,
   FrameTicks -> {None, None, None, None},
   FrameLabel -> {None, None, None, None},
   DisplayFunction -> Identity];
g = FullGraphics[g];
g[[1, 2]] = g[[1, 2]] /.
   Text[labely, {b_, c_}, {1., 0.}] →
    Text[labely, {b - 3, c}, {0, 0}, {0, 1}];
g[[1, 2]] = g[[1, 2]] /.
   Text[labelx, {b_, c_}, {0., -1.}] →
    Text[labelx, {b, c + 3}, {0, -1}, {1, 0}];
p[[11]] = Show[g,
   AspectRatio → 1.05,
   PlotRange -> All,
   DisplayFunction → Identity];
```

```
(* Display Network Decompsoition *)

approx = Show[Graphics[
            Text[StyleForm["≈", FontSize → 40, FontWeight -> Bold], {0, 0}]
   ], DisplayFunction -> Identity];
plus = Show[Graphics[
            Text[StyleForm["+", FontSize → 40, FontWeight -> Bold], {0, 0}]
   ], DisplayFunction -> Identity];
right = Show[Graphics[
            Text[StyleForm["]", FontSize → 160], {0, 0}]
   ], DisplayFunction -> Identity];
left = Show[Graphics[
            Text[StyleForm["[", FontSize → 160], {0, 0}]
   ], DisplayFunction -> Identity];
labelx0 = Show[Graphics[
            Text[StyleForm["Networks"], {0, 0}]
   ], DisplayFunction -> Identity];
labelx1 = Show[Graphics[
            Text[StyleForm["Subnetworks"], {0, 0}]
   ], DisplayFunction -> Identity];
labely1 = Show[Graphics[
            Text[StyleForm["Subnetworks"], {0, 0}, {0, 0}, {0, 1}]
   ], DisplayFunction -> Identity];
labelx2 = Show[Graphics[
            Text[StyleForm["Couplings"], {0, 0}]
   ], DisplayFunction -> Identity];
labely2 = Show[Graphics[
            Text[StyleForm["Couplings"], {0, 0}, {0, 0}, {0, 1}]
   ], DisplayFunction -> Identity];

Show[{
   Graphics[{Rectangle[{0.1, 0}, {2.1, 1}, left]}],
   Graphics[{Rectangle[{1.2, 0}, {2.2, 1}, p[[7]]]}],
   Graphics[{Rectangle[{2.2, 0}, {3.2, 1}, p[[8]]]}],
   Graphics[{Rectangle[{3.2, 0}, {4.2, 1}, p[[9]]]}],
   Graphics[{Rectangle[{3.2, 0}, {5.2, 1}, right]}],
   Graphics[{Rectangle[{4.1, 0.5}, {5.75, 0.975}, labelx0]}],
   Graphics[{Rectangle[{0.25, 0.5}, {5, 1.15}, labelx2]}],
   Graphics[{Rectangle[{3.7, 0}, {5, 1}, labely2]}],
   Graphics[{Rectangle[{3.5, 0}, {5.5, 1}, left]}],
   Graphics[{Rectangle[{4.1, 0.3}, {5.7, 0.7}, p[[11]]]}],
   Graphics[{Rectangle[{4.3, 0}, {6.3, 1}, right]}],
   Graphics[{Rectangle[{0.1, 0.75}, {2.1, 1.75}, left]}],
   Graphics[{Rectangle[{1.2, 0.75}, {2.2, 1.75}, p[[4]]]}],
   Graphics[{Rectangle[{2.2, 0.75}, {3.2, 1.75}, p[[5]]]}],
   Graphics[{Rectangle[{3.2, 0.75}, {4.2, 1.75}, p[[6]]]}],
   Graphics[{Rectangle[{3.2, 0.75}, {5.2, 1.75}, right]}],
   Graphics[{Rectangle[{4.1, 1.25}, {5.75, 1.725}, labelx0]}],
   Graphics[{Rectangle[{0.25, 1.25}, {5, 1.9}, labelx1]}],
   Graphics[{Rectangle[{3.7, 0.75}, {5, 1.75}, labely1]}],
   Graphics[{Rectangle[{3.5, 0.75}, {5.5, 1.75}, left]}],
   Graphics[{Rectangle[{4.1, 1.05}, {5.7, 1.45}, p[[10]]]}],
   Graphics[{Rectangle[{4.3, 0.75}, {6.3, 1.75}, right]}],
   Graphics[{Rectangle[{5.25, 0.75}, {5.75, 1.75}, plus]}],
   Graphics[{Rectangle[{0.1, 1.5}, {2.1, 2.5}, left]}],
   Graphics[{Rectangle[{1.2, 1.5}, {2.2, 2.5}, p[[1]]]}],
   Graphics[{Rectangle[{2.2, 1.5}, {3.2, 2.5}, p[[2]]]}],
   Graphics[{Rectangle[{3.2, 1.5}, {4.2, 2.5}, p[[3]]]}],
   Graphics[{Rectangle[{3.2, 1.5}, {5.2, 2.5}, right]}],
   Graphics[{Rectangle[{0.25, 2}, {5, 2.65}, labelx0]}],
   Graphics[{Rectangle[{4.15, 1.5}, {4.65, 2.5}, approx]}]
  }, PlotRange -> All];
```


Genes
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Subnetworks
Networks
Genes
Genes
Couplings
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Genes
Genes
Couplings
Networks

```
(* Create Coefficients of Tensor Correlations Bar Chart Display *)

core = {
   Flatten[Dot[Transpose[eigenarrays], partialmatrix1, Transpose[partialmatrix1], eigenarrays]],
   Flatten[Dot[Transpose[eigenarrays], matrix2, Transpose[matrix2], eigenarrays]],
   Flatten[Dot[Transpose[eigenarrays], matrix3, Transpose[matrix3], eigenarrays]]};

coefficients = Table[0, {3}];
Do[
 coefficients[[a]] = {
   core[[a]][[0 * 39 + 1]],
   core[[a]][[1 * 39 + 2]],
   core[[a]][[2 * 39 + 3]]},
 {a, 1, 3}]
coefficients = Chop[coefficients /
    Sum[eigenexpressions[[a]]^2, {a, 1, Dimensions[eigenexpressions][[1]]}]];

labelx = ColumnForm[{" ", " ",
    StyleForm["1", FontSize → 24, FontColor -> RGBColor[1, 0, 0]]}, Center];
gridx = Table[a, {a, -0.1, 0.4, 0.1}];
framex = gridx;
framex[[2]] = "0";
sizes = Flatten[
   Table[
    Dimensions[
     Characters[
      ToString[framex[[a]]
      ]]], {a, 1, Dimensions[framex][[1]]}]];
Do[
  Do[framex[[a]] = StringJoin[ToString[framex[[a]]], " "],
   {b, 1, size - sizes[[a]]}],
  {a, 1, Dimensions[framex][[1]]}];
framex = Table[{gridx[[a]], framex[[a]]}, {a, 1, Dimensions[framex][[1]]}];
gridx = Table[{gridx[[a]], RGBColor[0, 0, 0]}, {a, 1, Dimensions[gridx][[1]]}];
framey = {{1, "    3"}, {2, "    2"}, {3, "    1"}};
g = BarChart[
   Table[coefficients[[1]][[Dimensions[coefficients][[1]] - a]],
    {a, 0, Dimensions[coefficients][[1]] - 1}],
   BarOrientation -> Horizontal,
   PlotRange -> {{0, 0.4 * 1.0001}, {0.5, 3 + 0.5}},
   AspectRatio -> 1,
   Axes -> False,
   Frame -> True,
   FrameTicks -> {None, framey, framex, None},
   FrameLabel -> {None, None, labelx, None},
   GridLines -> {gridx, None},
   DisplayFunction -> Identity];
g = FullGraphics[g];
g[[1, 2]] = g[[1, 2]] /.
   Text[labelx, {b_, c_}, {0., -1.}] →
    Text[labelx, {b, c + 0.75}, {0, -1}, {1, 0}];
g[[1, 2]] = g[[1, 2]] /.
   Text[a_, {b_, c_}, {0., -1.}] →
    Text[a, {b, c + 0.35}, {0, 0}, {0, 1}];
g1 = Show[g,
   AspectRatio -> 1.5,
   PlotRange -> All,
   DisplayFunction → Identity];
```

```
labelx = ColumnForm[{"Networks", " ",
    StyleForm["2", FontSize → 24, FontColor -> RGBColor[0, 0, 1]]}, Center];
gridx = Table[a, {a, 0, 0.008, 0.002}];
framex = gridx;
framex[[1]] = "0";
sizes = Flatten[
   Table[
    Dimensions[
     Characters[
      ToString[framex[[a]]
      ]]], {a, 1, Dimensions[framex][[1]]}]];
Do[
  Do[framex[[a]] = StringJoin[ToString[framex[[a]]], " "],
   {b, 1, size - sizes[[a]]}],
  {a, 1, Dimensions[framex][[1]]}];
framex = Table[{gridx[[a]], framex[[a]]}, {a, 1, Dimensions[framex][[1]]}];
gridx = Table[{gridx[[a]], RGBColor[0, 0, 0]}, {a, 1, Dimensions[gridx][[1]]}];
framey = {{1, "     "}, {2, "     "}, {3, "     "}};
g = BarChart[
   Table[coefficients[[2]][[Dimensions[coefficients][[1]] - a]],
    {a, 0, Dimensions[coefficients][[1]] - 1}],
   BarOrientation -> Horizontal,
   BarStyle → {RGBColor[0, 0, 1]},
   PlotRange -> {{0, 0.008 * 1.0001}, {0.5, 3 + 0.5}},
   AspectRatio -> 1,
   Axes -> False,
   Frame -> True,
   FrameTicks -> {None, framey, framex, None},
   FrameLabel -> {None, None, labelx, None},
   GridLines -> {gridx, None},
   DisplayFunction -> Identity];
g = FullGraphics[g];
g[[1, 2]] = g[[1, 2]] /.
   Text[labelx, {b_, c_}, {0., -1.}] →
    Text[labelx, {b, c + 0.75}, {0, -1}, {1, 0}];
g[[1, 2]] = g[[1, 2]] /.
   Text[a_, {b_, c_}, {0., -1.}] →
    Text[a, {b, c + 0.35}, {0, 0}, {0, 1}];
g2 = Show[g,
   AspectRatio -> 1.5,
   PlotRange -> All,
   DisplayFunction → Identity];
```

```
labelx = ColumnForm[{" ", " ",
    StyleForm["3", FontSize → 24, FontColor -> RGBColor[0, 0.5, 0]]}, Center];
gridx = Table[a, {a, -0.001, 0.004, 0.001}];
framex = gridx;
framex[[2]] = "0";
sizes = Flatten[
   Table[
    Dimensions[
     Characters[
      ToString[framex[[a]]
      ]]], {a, 1, Dimensions[framex][[1]]}]];
Do[
  Do[framex[[a]] = StringJoin[ToString[framex[[a]]], " "],
   {b, 1, size - sizes[[a]]}],
  {a, 1, Dimensions[framex][[1]]}];
framex = Table[{gridx[[a]], framex[[a]]}, {a, 1, Dimensions[framex][[1]]}];
gridx = Table[{gridx[[a]], RGBColor[0, 0, 0]}, {a, 1, Dimensions[gridx][[1]]}];
framey = {{1, "     "}, {2, "     "}, {3, "     "}};
g = BarChart[
   Table[coefficients[[3]][[Dimensions[coefficients][[1]] - a]],
    {a, 0, Dimensions[coefficients][[1]] - 1}],
   BarOrientation -> Horizontal,
   BarStyle → {RGBColor[0, 0.5, 0]},
   PlotRange -> {{0, 0.004 * 1.0001}, {0.5, 3 + 0.5}},
   AspectRatio -> 1,
   Axes -> False,
   Frame -> True,
   FrameTicks -> {None, framey, framex, None},
   FrameLabel -> {None, None, labelx, None},
   GridLines -> {gridx, None},
   DisplayFunction -> Identity];
g = FullGraphics[g];
g[[1, 2]] = g[[1, 2]] /.
   Text[labelx, {b_, c_}, {0., -1.}] →
    Text[labelx, {b, c + 0.75}, {0, -1}, {1, 0}];
g[[1, 2]] = g[[1, 2]] /.
   Text[a_, {b_, c_}, {0., -1.}] →
    Text[a, {b, c + 0.35}, {0, 0}, {0, 1}];
g3 = Show[g,
   AspectRatio -> 1.5,
   PlotRange -> All,
   DisplayFunction → Identity];

coefficients = Table[0, {3}];
Do[
 coefficients[[a]] = {
   -core[[a]][[0 * 39 + 2]],
   core[[a]][[0 * 39 + 3]],
   -core[[a]][[1 * 39 + 3]]},
 {a, 1, 3}]
coefficients = Chop[coefficients /
    Sum[eigenexpressions[[a]]^2, {a, 1, Dimensions[eigenexpressions][[1]]}]];
size = 6;
```

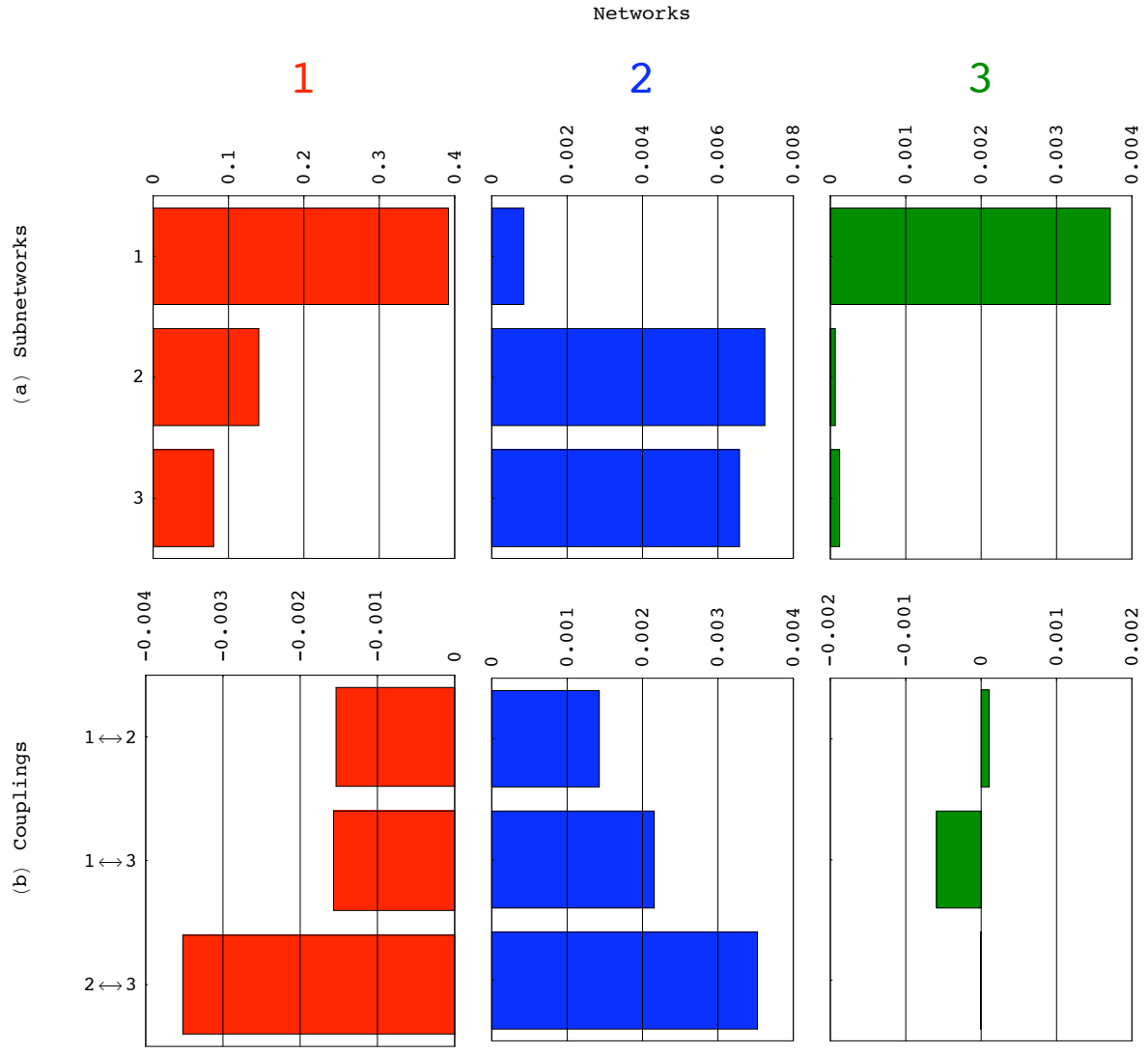
```
labelx = ColumnForm[{" ", " ", " "}, Center];
gridx = Table[a, {a, -0.004, 0, 0.001}];
framex = gridx;
framex[[5]] = "0";
sizes = Flatten[
   Table[
    Dimensions[
     Characters[
      ToString[framex[[a]]
      ]]], {a, 1, Dimensions[framex][[1]]}]];
Do[
  Do[framex[[a]] = StringJoin[ToString[framex[[a]]], " "],
   {b, 1, size - sizes[[a]]}],
  {a, 1, Dimensions[framex][[1]]}];
framex = Table[{gridx[[a]], framex[[a]]}, {a, 1, Dimensions[framex][[1]]}];
gridx = Table[{gridx[[a]], RGBColor[0, 0, 0]}, {a, 1, Dimensions[gridx][[1]]}];
framey = {{1, 2 ↔ 3}, {2, 1 ↔ 3}, {3, 1 ↔ 2}};
g = BarChart[
   Table[coefficients[[1]][[Dimensions[coefficients][[1]] - a]],
    {a, 0, Dimensions[coefficients][[1]] - 1}],
   BarOrientation -> Horizontal,
   PlotRange -> {{-0.004, 0.0000001}, {0.5, 3 + 0.5}},
   AspectRatio -> 1,
   Axes -> False,
   Frame -> True,
   FrameTicks -> {None, framey, framex, None},
   FrameLabel -> {None, None, labelx, None},
   GridLines -> {gridx, None},
   DisplayFunction -> Identity];
g = FullGraphics[g];
g[[1, 2]] = g[[1, 2]] /.
   Text[labelx, {b_, c_}, {0., -1.}] →
    Text[labelx, {b, c + 0.75}, {0, -1}, {1, 0}];
g[[1, 2]] = g[[1, 2]] /.
   Text[a_, {b_, c_}, {0., -1.}] →
    Text[a, {b, c + 0.35}, {0, 0}, {0, 1}];
g4 = Show[g,
   AspectRatio -> 1.5,
   PlotRange -> All,
   DisplayFunction → Identity];
```

```
labelx = ColumnForm[{" ", " ", " "}, Center];
gridx = Table[a, {a, 0, 0.004, 0.001}];
framex = gridx;
framex[[1]] = "0";
sizes = Flatten[
   Table[
    Dimensions[
     Characters[
      ToString[framex[[a]]
      ]]], {a, 1, Dimensions[framex][[1]]}]];
Do[
  Do[framex[[a]] = StringJoin[ToString[framex[[a]]], " "],
   {b, 1, size - sizes[[a]]}],
  {a, 1, Dimensions[framex][[1]]}];
framex = Table[{gridx[[a]], framex[[a]]}, {a, 1, Dimensions[framex][[1]]}];
gridx = Table[{gridx[[a]], RGBColor[0, 0, 0]}, {a, 1, Dimensions[gridx][[1]]}];
framey = {{1, "     "}, {2, "     "}, {3, "     "}};
g = BarChart[
   Table[coefficients[[2]][[Dimensions[coefficients][[1]] - a]],
    {a, 0, Dimensions[coefficients][[1]] - 1}],
   BarOrientation -> Horizontal,
   BarStyle → {RGBColor[0, 0, 1]},
   PlotRange -> {{0, 0.004 * 1.0001}, {0.5, 3 + 0.5}},
   AspectRatio -> 1,
   Axes -> False,
   Frame -> True,
   FrameTicks -> {None, framey, framex, None},
   FrameLabel -> {None, None, labelx, None},
   GridLines -> {gridx, None},
   DisplayFunction -> Identity];
g = FullGraphics[g];
g[[1, 2]] = g[[1, 2]] /.
   Text[labelx, {b_, c_}, {0., -1.}] →
    Text[labelx, {b, c + 0.75}, {0, -1}, {1, 0}];
g[[1, 2]] = g[[1, 2]] /.
   Text[a_, {b_, c_}, {0., -1.}] →
    Text[a, {b, c + 0.35}, {0, 0}, {0, 1}];
g5 = Show[g,
   AspectRatio -> 1.5,
   PlotRange -> All,
   DisplayFunction → Identity];
```

```
labelx = ColumnForm[{" ", " ", " "}, Center];
gridx = Table[a, {a, -0.002, 0.002, 0.001}];
framex = gridx;
framex[[3]] = "0";
sizes = Flatten[
   Table[
    Dimensions[
     Characters[
      ToString[framex[[a]]
      ]]], {a, 1, Dimensions[framex][[1]]}]];
Do[
  Do[framex[[a]] = StringJoin[ToString[framex[[a]]], " "],
   {b, 1, size - sizes[[a]]}],
  {a, 1, Dimensions[framex][[1]]}];
framex = Table[{gridx[[a]], framex[[a]]}, {a, 1, Dimensions[framex][[1]]}];
gridx = Table[{gridx[[a]], RGBColor[0, 0, 0]}, {a, 1, Dimensions[gridx][[1]]}];
framey = {{1, "     "}, {2, "     "}, {3, "     "}};
g = BarChart[
   Table[coefficients[[3]][[Dimensions[coefficients][[1]] - a]],
    {a, 0, Dimensions[coefficients][[1]] - 1}],
   BarOrientation -> Horizontal,
   BarStyle → {RGBColor[0, 0.5, 0]},
   PlotRange -> {{-0.002, 0.002 * 1.0001}, {0.5, 3 + 0.5}},
   AspectRatio -> 1,
   Axes -> False,
   Frame -> True,
   FrameTicks -> {None, framey, framex, None},
   FrameLabel -> {None, None, labelx, None},
   GridLines -> {gridx, None},
   DisplayFunction -> Identity];
g = FullGraphics[g];
g[[1, 2]] = g[[1, 2]] /.
   Text[labelx, {b_, c_}, {0., -1.}] →
    Text[labelx, {b, c + 0.75}, {0, -1}, {1, 0}];
g[[1, 2]] = g[[1, 2]] /.
   Text[a_, {b_, c_}, {0., -1.}] →
    Text[a, {b, c + 0.35}, {0, 0}, {0, 1}];
g6 = Show[g,
   AspectRatio -> 1.5,
   PlotRange -> All,
   DisplayFunction → Identity];
```

```
(* Display Coefficients of Tensor Correlations Bar Chart *)

labely = "(a) Subnetworks      ";
p1 = Show[GraphicsArray[{{g1, g2, g3}}],
    Frame → True,
    FrameStyle → {RGBColor[1, 1, 1]},
    FrameLabel -> {None, labely, None, None},
    GraphicsSpacing → -0.125,
    DisplayFunction → Identity];
labely = "(b) Couplings        ";
p2 = Show[GraphicsArray[{{g4, g5, g6}}],
    Frame → True,
    FrameStyle → {RGBColor[1, 1, 1]},
    FrameLabel -> {None, labely, None, None},
    GraphicsSpacing → -0.125,
    DisplayFunction → Identity];
Show[GraphicsArray[{{p1}, {p2}}],
  GraphicsSpacing → -0.225];
```



```
(* Create Genes × Genes Tensor Correlations Network Displays *)

(* Keep Only Correlations Above Diagonals in Tensor Matrices *)

Do[
  Do[
   Do[
    tensormatrices[[a, b, c]] = 0,
    {c, 1, b}],
   {b, 1, Dimensions[tensormatrices[[1]]][[1]]}],
  {a, 1, 6}];

(* Cutoff Correlations in Tensor Matrices *)

Do[
 tensormatrices[[a]] = Chop[tensormatrices[[a]], cutoffs[[a]]],
 {a, 1, 6}]

Do[
  Do[
   Do[
    tensormatrices[[a, b, c]] = 0,
    {c, 1, b}],
   {b, 1, Dimensions[tensormatrices[[1]]][[1]]}],
  {a, 1, 6}];

sizes = Flatten[
   Table[
    Dimensions[
     Characters[
      ToString[partialgenenames[[a, 2]]
      ]]],
    {a, 1, partialgenes}]];
size = Sort[sizes, OrderedQ[{#2, #1}] &][[1]];
Do[
  Do[partialgenenames[[a, 2]] = StringJoin[ToString[partialgenenames[[a, 2]]], " "],
   {b, 1, size - sizes[[a]]}],
  {a, 1, partialgenes}];
```

```
(* Define Display Parameters *)

Clear[x, y, z];
R[theta_] = {{Cos[theta], Sin[theta]}, {-Sin[theta], Cos[theta]}};
polypoints[theta_, x_] = Flatten[Transpose[Dot[R[theta], Transpose[{{0, x}}]]]];
redline[y_, z_] = Graphics[{RGBColor[1, 0, 0],
    Line[{polypoints[2 * y * Pi / partialgenes, 1], polypoints[2 * z * Pi / partialgenes, 1]}]}];
greenline[y_, z_] = Graphics[{RGBColor[0, 0.5, 0],
    Line[{polypoints[2 * y * Pi / partialgenes, 1], polypoints[2 * z * Pi / partialgenes, 1]}]}];
blueline[y_, z_] = Graphics[{RGBColor[0, 0, 1],
    Line[{polypoints[2 * y * Pi / partialgenes, 1], polypoints[2 * z * Pi / partialgenes, 1]}]}];
orangeline[y_, z_] = Graphics[{RGBColor[1, 0.5, 0],
    Line[{polypoints[2 * y * Pi / partialgenes, 1], polypoints[2 * z * Pi / partialgenes, 1]}]}];

color1[stage_] =
  If[stage == "Up", RGBColor[0, 0, 0],
   If[stage == "Down", RGBColor[0.5, 0.5, 0.5], RGBColor[1, 1, 1]]
  ];
color2[stage_] =
  If[stage == "M/G1", RGBColor[1, 1, 0],
   If[stage == "G1", RGBColor[0, 0.5, 0],
    If[stage == "S", RGBColor[0, 0, 1],
     If[stage == "S/G2", RGBColor[1, 0, 0],
      If[stage == "G2/M", RGBColor[1, 0.5, 0], RGBColor[1, 1, 1]]
     ]]]];

circle1 = Table[
   Graphics[{
     color1[partialgenenames[[a, 7]]],
     Disk[{0, 0}, 1.35,
      {-2 * (a + 0.5) * Pi / partialgenes + Pi / 2., -2 * (a - 0.5) * Pi / partialgenes + Pi / 2.}]}],
   {a, partialgenes, 1, -1}];
circle2 = Table[
   Graphics[{
     color2[partialgenenames[[a, 6]]],
     Disk[{0, 0}, 1.3,
      {-2 * (a + 0.5) * Pi / partialgenes + Pi / 2., -2 * (a - 0.5) * Pi / partialgenes + Pi / 2.}]}],
   {a, partialgenes, 1, -1}];
circle3 = Graphics[{RGBColor[1, 1, 1], Disk[{0, 0}, 1.25]}];
circle4 = Table[
   Graphics[{
     RGBColor[0, 0, 0],
     Disk[polypoints[2 * a * Pi / partialgenes, 1], 0.02]}], {a, 1, partialgenes}];
circle5 = Table[
   Graphics[{
     RGBColor[0, 0, 0],
     Text[partialgenenames[[a, 2]], polypoints[2 * a * Pi / partialgenes, 1.15],
      {0, 0}, polypoints[2 * a * Pi / partialgenes, 1.15]]}],
   {a, 1, partialgenes}];
```

```
(* Display First Genes × Genes Tensor Correlations Network *)

int1 = Position[Sign[tensormatrices[[1]]], 1];
int2 = Position[Sign[tensormatrices[[1]]], -1];

redtable = Table[redline[int1[[a, 1]], int1[[a, 2]]], {a, 1, Dimensions[int1][[1]]}];
greentable = Table[greenline[int2[[a, 1]], int2[[a, 2]]], {a, 1, Dimensions[int2][[1]]}];
p = Show[
   {circle1, circle2, circle3, circle4, circle5, redtable, greentable,
    Graphics[{RGBColor[0, 0, 0], Text[StyleForm["(a)", FontSize → 24], {-1.1, 1.1}]}]},
   AspectRatio -> 1,
   PlotRange -> {{-1.25, 1.25}, {-1.25, 1.25}},
   Frame → False,
   FrameTicks -> False,
   FrameLabel -> {None, None, None, None},
   GridLines -> {None, None},
   DisplayFunction -> Identity];
p = FullGraphics[p];
p[[1, 2]] = p[[1, 2]] /.
   Text[labely, {b_, c_}, {1., 0.}] →
    Text[labely, {-1.18, 0}, {0, 0}, {0, 1}];
p1 = Show[p,
   AspectRatio -> 1.,
   PlotRange -> All,
   DisplayFunction → Identity];

(* Display Second Genes × Genes Tensor Correlations Network *)

int1 = Position[Sign[tensormatrices[[2]]], 1];
int2 = Position[Sign[tensormatrices[[2]]], -1];

redtable = Table[redline[int1[[a, 1]], int1[[a, 2]]], {a, 1, Dimensions[int1][[1]]}];
greentable = Table[greenline[int2[[a, 1]], int2[[a, 2]]], {a, 1, Dimensions[int2][[1]]}];
p = Show[
   {circle1, circle2, circle3, circle4, circle5, redtable, greentable,
    Graphics[{RGBColor[0, 0, 0], Text[StyleForm["(b)", FontSize → 24], {-1.1, 1.1}]}]},
   AspectRatio -> 1,
   PlotRange -> {{-1.25, 1.25}, {-1.25, 1.25}},
   Frame → False,
   FrameTicks -> False,
   FrameLabel -> {None, None, None, None},
   GridLines -> {None, None},
   DisplayFunction -> Identity];
p = FullGraphics[p];
p[[1, 2]] = p[[1, 2]] /.
   Text[labely, {b_, c_}, {1., 0.}] →
    Text[labely, {-1.18, 0}, {0, 0}, {0, 1}];
p2 = Show[p,
   AspectRatio -> 1.,
   PlotRange -> All,
   DisplayFunction → Identity];
```

```
(* Display Third Genes × Genes Tensor Correlations Network *)

int1 = Position[Sign[tensormatrices[[3]]], 1];
int2 = Position[Sign[tensormatrices[[3]]], -1];

redtable = Table[redline[int1[[a, 1]], int1[[a, 2]]], {a, 1, Dimensions[int1][[1]]}];
greentable = Table[greenline[int2[[a, 1]], int2[[a, 2]]], {a, 1, Dimensions[int2][[1]]}];
p = Show[
   {circle1, circle2, circle3, circle4, circle5, redtable, greentable,
    Graphics[{RGBColor[0, 0, 0], Text[StyleForm["(c)", FontSize → 24], {-1.1, 1.1}]}]},
   AspectRatio -> 1,
   PlotRange -> {{-1.25, 1.25}, {-1.25, 1.25}},
   Frame → False,
   FrameTicks -> False,
   FrameLabel -> {None, None, None, None},
   GridLines -> {None, None},
   DisplayFunction -> Identity];
p = FullGraphics[p];
p[[1, 2]] = p[[1, 2]] /.
   Text[labely, {b_, c_}, {1., 0.}] →
    Text[labely, {-1.18, 0}, {0, 0}, {0, 1}];
p3 = Show[p,
   AspectRatio -> 1.,
   PlotRange -> All,
   DisplayFunction → Identity];

(* Display Fourth Genes × Genes Tensor Correlations Network *)

int1 = Position[Sign[tensormatrices[[4]]], 1];
int2 = Position[Sign[tensormatrices[[4]]], -1];

redtable = Table[redline[int1[[a, 1]], int1[[a, 2]]], {a, 1, Dimensions[int1][[1]]}];
greentable = Table[greenline[int2[[a, 1]], int2[[a, 2]]], {a, 1, Dimensions[int2][[1]]}];
p = Show[
   {circle1, circle2, circle3, circle4, circle5, redtable, greentable,
    Graphics[{RGBColor[0, 0, 0], Text[StyleForm["(d)", FontSize → 24], {-1.1, 1.1}]}]},
   AspectRatio -> 1,
   PlotRange -> {{-1.25, 1.25}, {-1.25, 1.25}},
   Frame → False,
   FrameTicks -> False,
   FrameLabel -> {None, None, None, None},
   GridLines -> {None, None},
   DisplayFunction -> Identity];
p = FullGraphics[p];
p[[1, 2]] = p[[1, 2]] /.
   Text[labely, {b_, c_}, {1., 0.}] →
    Text[labely, {-1.18, 0}, {0, 0}, {0, 1}];
p4 = Show[p,
   AspectRatio -> 1.,
   PlotRange -> All,
   DisplayFunction → Identity];
```

```
(* Display Fifth Genes × Genes Tensor Correlations Network *)

int1 = Position[Sign[tensormatrices[[5]]], 1];
int2 = Position[Sign[tensormatrices[[5]]], -1];

redtable = Table[redline[int1[[a, 1]], int1[[a, 2]]], {a, 1, Dimensions[int1][[1]]}];
greentable = Table[greenline[int2[[a, 1]], int2[[a, 2]]], {a, 1, Dimensions[int2][[1]]}];
p = Show[
   {circle1, circle2, circle3, circle4, circle5, redtable, greentable,
    Graphics[{RGBColor[0, 0, 0], Text[StyleForm["(e)", FontSize → 24], {-1.1, 1.1}]}]},
   AspectRatio -> 1,
   PlotRange -> {{-1.25, 1.25}, {-1.25, 1.25}},
   Frame → False,
   FrameTicks -> False,
   FrameLabel -> {None, None, None, None},
   GridLines -> {None, None},
   DisplayFunction -> Identity];
p = FullGraphics[p];
p[[1, 2]] = p[[1, 2]] /.
   Text[labely, {b_, c_}, {1., 0.}] →
    Text[labely, {-1.18, 0}, {0, 0}, {0, 1}];
p5 = Show[p,
   AspectRatio -> 1.,
   PlotRange -> All,
   DisplayFunction → Identity];
```

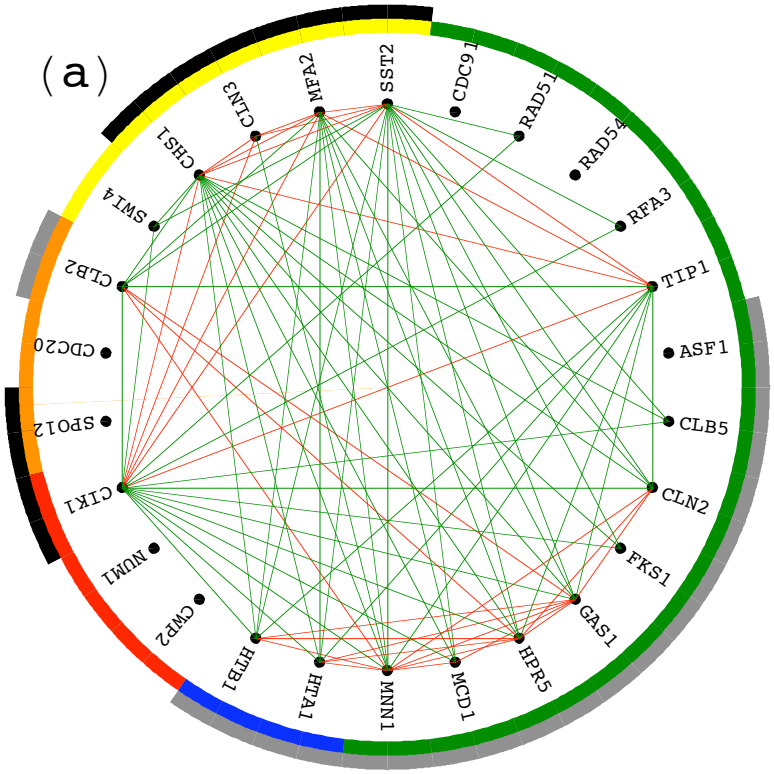
```
(* Display Sixth Genes × Genes Tensor Correlations Network *)

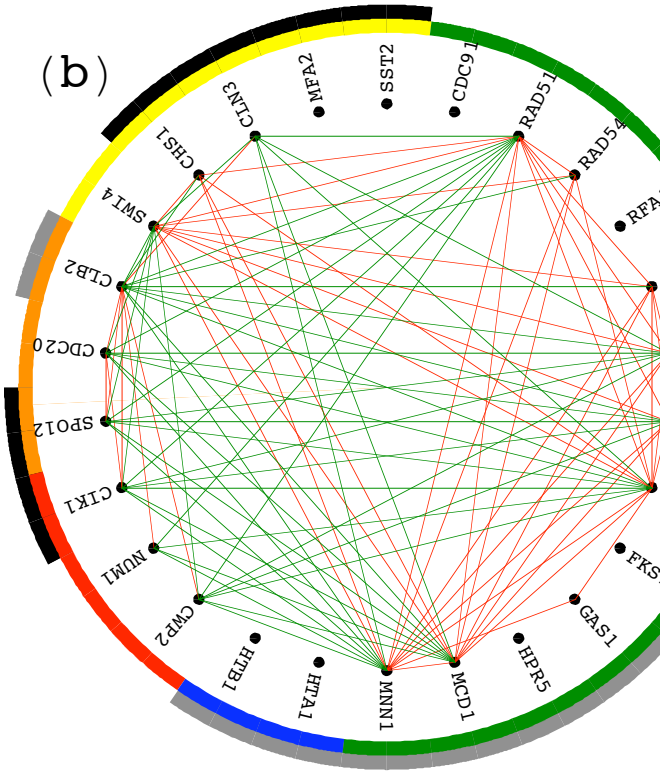
int1 = Position[Sign[tensormatrices[[6]]], 1];
int2 = Position[Sign[tensormatrices[[6]]], -1];

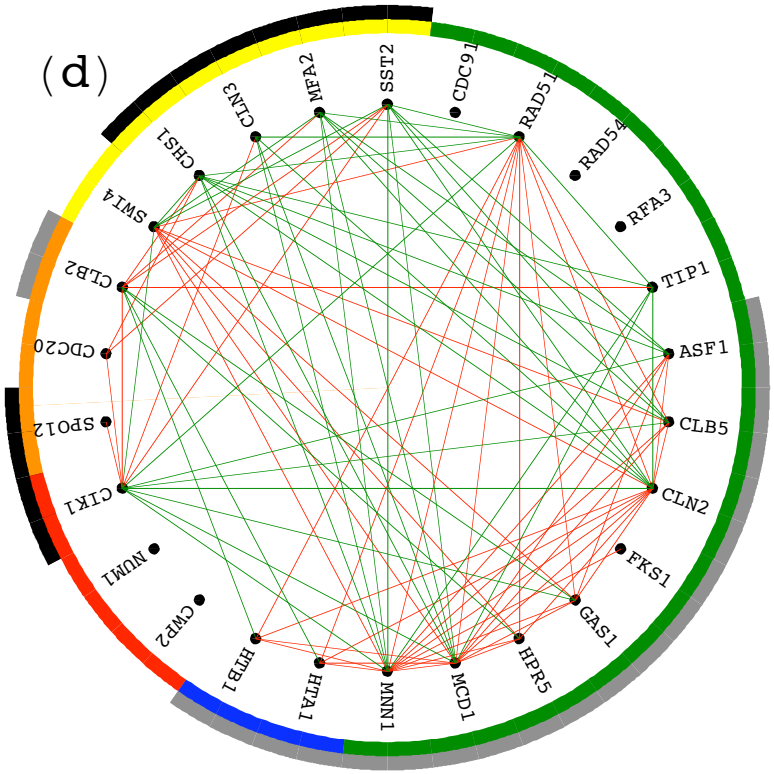
redtable = Table[redline[int1[[a, 1]], int1[[a, 2]]], {a, 1, Dimensions[int1][[1]]}];
greentable = Table[greenline[int2[[a, 1]], int2[[a, 2]]], {a, 1, Dimensions[int2][[1]]}];
p = Show[
   {circle1, circle2, circle3, circle4, circle5, redtable, greentable,
    Graphics[{RGBColor[0, 0, 0], Text[StyleForm["(f)", FontSize → 24], {-1.1, 1.1}]}]},
   AspectRatio -> 1,
   PlotRange -> {{-1.25, 1.25}, {-1.25, 1.25}},
   Frame → False,
   FrameTicks -> False,
   FrameLabel -> {None, None, None, None},
   GridLines -> {None, None},
   DisplayFunction -> Identity];
p = FullGraphics[p];
p[[1, 2]] = p[[1, 2]] /.
   Text[labely, {b_, c_}, {1., 0.}] →
    Text[labely, {-1.18, 0}, {0, 0}, {0, 1}];
p6 = Show[p,
   AspectRatio -> 1.,
   PlotRange -> All,
   DisplayFunction → Identity];
```

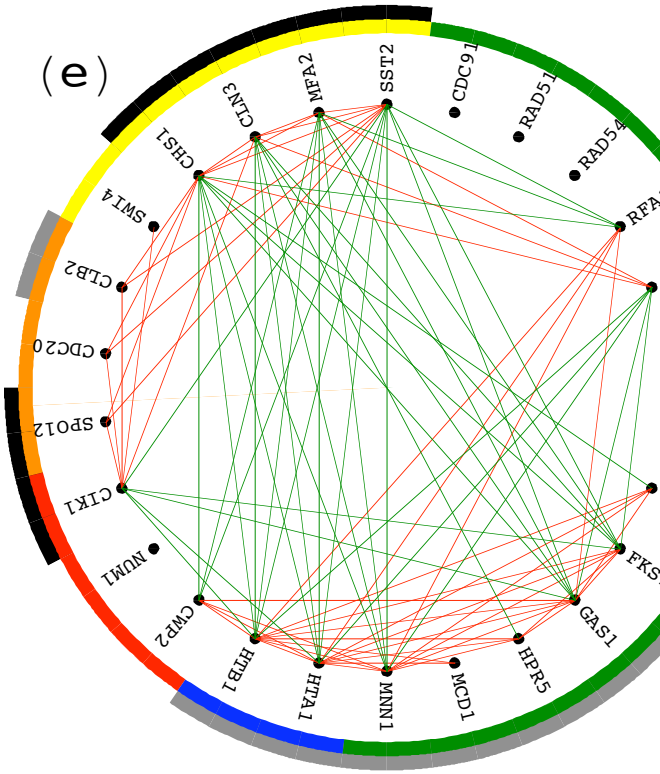
```
(* Display Selected Genes × Genes Tensor Correlations Networks *)

Show[GraphicsArray[{{p1, p2, p3}, {p4, p5, p6}}],
  GraphicsSpacing → 0];
```









```
(* Compare Genes × Genes Eigencorrelations Networks Using Logic *)

(* Display Parallel Intersection of Fourth AND First AND Second Networks *)

int1 = Intersection[
   Position[Sign[tensormatrices[[1]]], 1],
   Position[Sign[tensormatrices[[2]]], 1],
   Position[Sign[tensormatrices[[4]]], 1]];
int2 = Intersection[
   Position[Sign[tensormatrices[[1]]], -1],
   Position[Sign[tensormatrices[[2]]], -1],
   Position[Sign[tensormatrices[[4]]], -1]];

redtable = Table[redline[int1[[a, 1]], int1[[a, 2]]], {a, 1, Dimensions[int1][[1]]}];
greentable = Table[greenline[int2[[a, 1]], int2[[a, 2]]], {a, 1, Dimensions[int2][[1]]}];
p = Show[
   {circle1, circle2, circle3, circle4, circle5, redtable, greentable,
    Graphics[{RGBColor[0, 0, 0], Text[StyleForm["(a)", FontSize → 24], {-1.1, 1.1}]}]},
   AspectRatio -> 1,
   PlotRange -> {{-1.25, 1.25}, {-1.25, 1.25}},
   Frame → False,
   FrameTicks -> False,
   FrameLabel -> {None, None, None, None},
   GridLines -> {None, None},
   DisplayFunction -> Identity];
p = FullGraphics[p];
p[[1, 2]] = p[[1, 2]] /.
   Text[labely, {b_, c_}, {1., 0.}] →
    Text[labely, {-1.18, 0}, {0, 0}, {0, 1}];
p1 = Show[p,
   AspectRatio -> 1.,
   PlotRange -> All,
   DisplayFunction → Identity];
```

```
(* Display Antiparallel Intersection of Fourth AND [First AND Second] Networks *)

int1 = Intersection[
   Position[Sign[tensormatrices[[1]]], 1],
   Position[Sign[tensormatrices[[2]]], 1],
   Position[Sign[tensormatrices[[4]]], -1]];
int2 = Intersection[
   Position[Sign[tensormatrices[[1]]], -1],
   Position[Sign[tensormatrices[[2]]], -1],
   Position[Sign[tensormatrices[[4]]], 1]];

orangetable = Table[orangeline[int1[[a, 1]], int1[[a, 2]]], {a, 1, Dimensions[int1][[1]]}];
bluetable = Table[blueline[int2[[a, 1]], int2[[a, 2]]], {a, 1, Dimensions[int2][[1]]}];
p = Show[
   {circle1, circle2, circle3, circle4, circle5, orangetable, bluetable,
    Graphics[{RGBColor[0, 0, 0], Text[StyleForm["(b)", FontSize → 24], {-1.1, 1.1}]}]},
   AspectRatio -> 1,
   PlotRange -> {{-1.25, 1.25}, {-1.25, 1.25}},
   Frame → False,
   FrameTicks -> False,
   FrameLabel -> {None, None, None, None},
   GridLines -> {None, None},
   DisplayFunction -> Identity];
p = FullGraphics[p];
p[[1, 2]] = p[[1, 2]] /.
   Text[labely, {b_, c_}, {1., 0.}] →
    Text[labely, {-1.18, 0}, {0, 0}, {0, 1}];
p2 = Show[p,
   AspectRatio -> 1.,
   PlotRange -> All,
   DisplayFunction → Identity];

(* Display Parallel Intersection of Fifth AND First AND Third Networks *)

int1 = Intersection[
   Position[Sign[tensormatrices[[1]]], 1],
   Position[Sign[tensormatrices[[3]]], 1],
   Position[Sign[tensormatrices[[5]]], 1]];
int2 = Intersection[
   Position[Sign[tensormatrices[[1]]], -1],
   Position[Sign[tensormatrices[[3]]], -1],
   Position[Sign[tensormatrices[[5]]], -1]];

redtable = Table[redline[int1[[a, 1]], int1[[a, 2]]], {a, 1, Dimensions[int1][[1]]}];
greentable = Table[greenline[int2[[a, 1]], int2[[a, 2]]], {a, 1, Dimensions[int2][[1]]}];
p = Show[
   {circle1, circle2, circle3, circle4, circle5, redtable, greentable,
    Graphics[{RGBColor[0, 0, 0], Text[StyleForm["(c)", FontSize → 24], {-1.1, 1.1}]}]},
   AspectRatio -> 1,
   PlotRange -> {{-1.25, 1.25}, {-1.25, 1.25}},
   Frame → False,
   FrameTicks -> False,
   FrameLabel -> {None, None, None, None},
   GridLines -> {None, None},
   DisplayFunction -> Identity];
p = FullGraphics[p];
p[[1, 2]] = p[[1, 2]] /.
   Text[labely, {b_, c_}, {1., 0.}] →
    Text[labely, {-1.18, 0}, {0, 0}, {0, 1}];
p3 = Show[p,
   AspectRatio -> 1.,
   PlotRange -> All,
   DisplayFunction → Identity];
```

```
(* Display Antiparallel Intersection of Fifth AND [First AND Third] Networks *)

int1 = Intersection[
   Position[Sign[tensormatrices[[1]]], 1],
   Position[Sign[tensormatrices[[3]]], 1],
   Position[Sign[tensormatrices[[5]]], -1]];
int2 = Intersection[
   Position[Sign[tensormatrices[[1]]], -1],
   Position[Sign[tensormatrices[[3]]], -1],
   Position[Sign[tensormatrices[[5]]], 1]];

orangetable = Table[orangeline[int1[[a, 1]], int1[[a, 2]]], {a, 1, Dimensions[int1][[1]]}];
bluetable = Table[blueline[int2[[a, 1]], int2[[a, 2]]], {a, 1, Dimensions[int2][[1]]}];
p = Show[
   {circle1, circle2, circle3, circle4, circle5, orangetable, bluetable,
    Graphics[{RGBColor[0, 0, 0], Text[StyleForm["(d)", FontSize → 24], {-1.1, 1.1}]}]},
   AspectRatio -> 1,
   PlotRange -> {{-1.25, 1.25}, {-1.25, 1.25}},
   Frame → False,
   FrameTicks -> False,
   FrameLabel -> {None, None, None, None},
   GridLines -> {None, None},
   DisplayFunction -> Identity];
p = FullGraphics[p];
p[[1, 2]] = p[[1, 2]] /.
   Text[labely, {b_, c_}, {1., 0.}] →
    Text[labely, {-1.18, 0}, {0, 0}, {0, 1}];
p4 = Show[p,
   AspectRatio -> 1.,
   PlotRange -> All,
   DisplayFunction → Identity];
```

```
(* Display Parallel Intersection of Sixth AND Second AND Third Networks *)

int1 = Intersection[
   Position[Sign[tensormatrices[[2]]], 1],
   Position[Sign[tensormatrices[[3]]], 1],
   Position[Sign[tensormatrices[[6]]], 1]];
int2 = Intersection[
   Position[Sign[tensormatrices[[2]]], -1],
   Position[Sign[tensormatrices[[3]]], -1],
   Position[Sign[tensormatrices[[6]]], -1]];

redtable = Table[redline[int1[[a, 1]], int1[[a, 2]]], {a, 1, Dimensions[int1][[1]]}];
greentable = Table[greenline[int2[[a, 1]], int2[[a, 2]]], {a, 1, Dimensions[int2][[1]]}];
p = Show[
   {circle1, circle2, circle3, circle4, circle5, redtable, greentable,
    Graphics[{RGBColor[0, 0, 0], Text[StyleForm["(e)", FontSize → 24], {-1.1, 1.1}]}]},
   AspectRatio -> 1,
   PlotRange -> {{-1.25, 1.25}, {-1.25, 1.25}},
   Frame → False,
   FrameTicks -> False,
   FrameLabel -> {None, None, None, None},
   GridLines -> {None, None},
   DisplayFunction -> Identity];
p = FullGraphics[p];
p[[1, 2]] = p[[1, 2]] /.
   Text[labely, {b_, c_}, {1., 0.}] →
    Text[labely, {-1.18, 0}, {0, 0}, {0, 1}];
p5 = Show[p,
   AspectRatio -> 1.,
   PlotRange -> All,
   DisplayFunction → Identity];
```

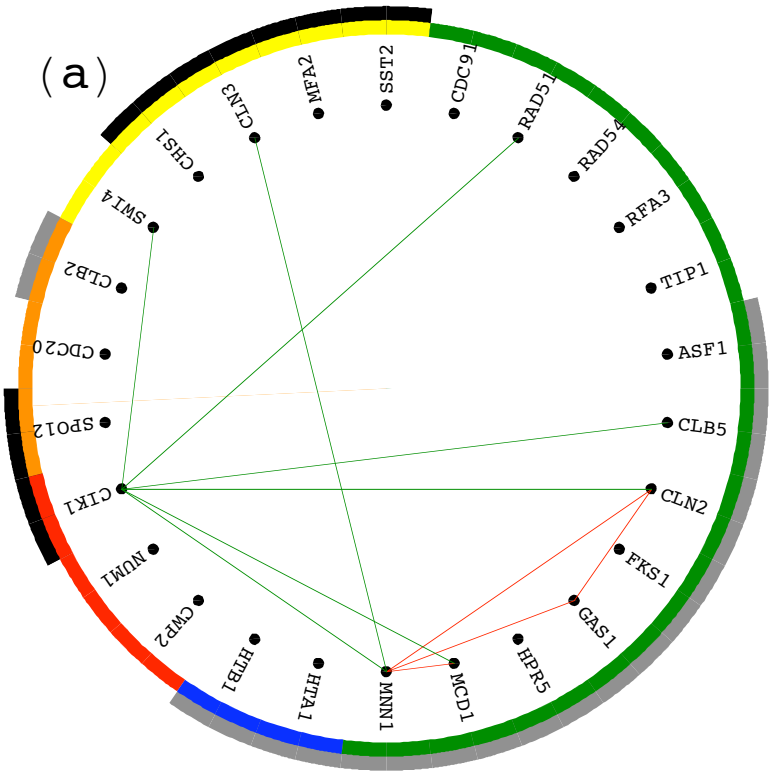
```
(* Display Antiparallel Intersection of Sixth AND [Second AND Third] Networks *)

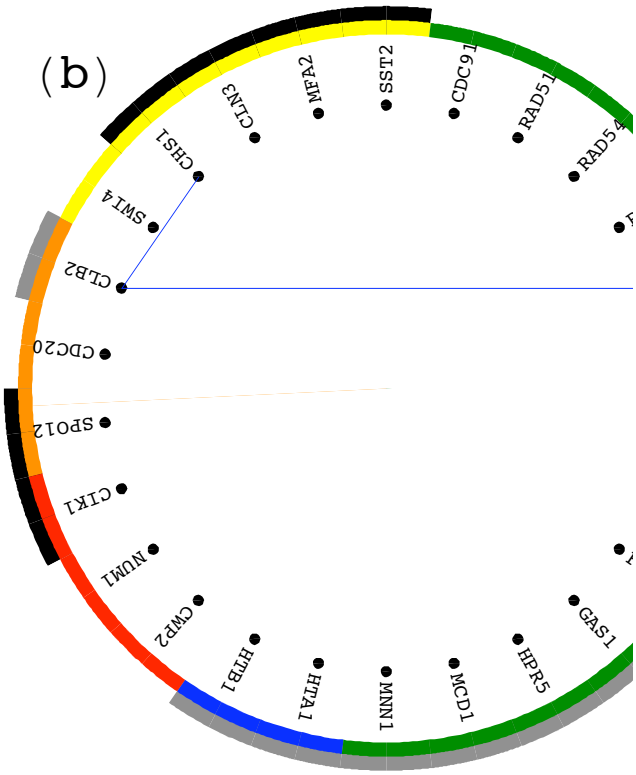
int1 = Intersection[
   Position[Sign[tensormatrices[[2]]], 1],
   Position[Sign[tensormatrices[[3]]], 1],
   Position[Sign[tensormatrices[[6]]], -1]];
int2 = Intersection[
   Position[Sign[tensormatrices[[2]]], -1],
   Position[Sign[tensormatrices[[3]]], -1],
   Position[Sign[tensormatrices[[6]]], 1]];

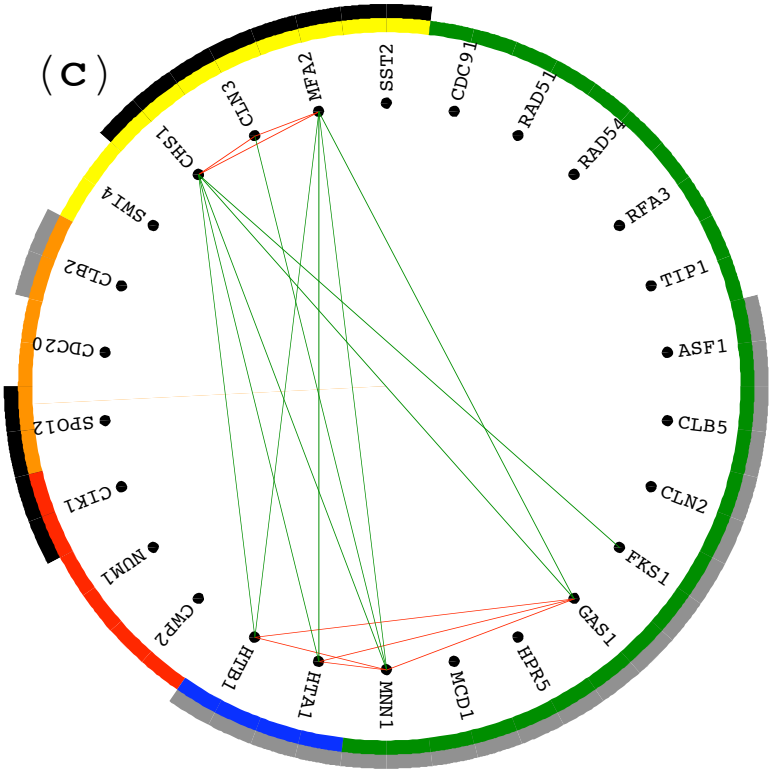
orangetable = Table[orangeline[int1[[a, 1]], int1[[a, 2]]], {a, 1, Dimensions[int1][[1]]}];
bluetable = Table[blueline[int2[[a, 1]], int2[[a, 2]]], {a, 1, Dimensions[int2][[1]]}];
p = Show[
   {circle1, circle2, circle3, circle4, circle5, orangetable, bluetable,
    Graphics[{RGBColor[0, 0, 0], Text[StyleForm["(f)", FontSize → 24], {-1.1, 1.1}]}]},
   AspectRatio -> 1,
   PlotRange -> {{-1.25, 1.25}, {-1.25, 1.25}},
   Frame → False,
   FrameTicks -> False,
   FrameLabel -> {None, None, None, None},
   GridLines -> {None, None},
   DisplayFunction -> Identity];
p = FullGraphics[p];
p[[1, 2]] = p[[1, 2]] /.
   Text[labely, {b_, c_}, {1., 0.}] →
    Text[labely, {-1.18, 0}, {0, 0}, {0, 1}];
p6 = Show[p,
   AspectRatio -> 1.,
   PlotRange -> All,
   DisplayFunction → Identity];

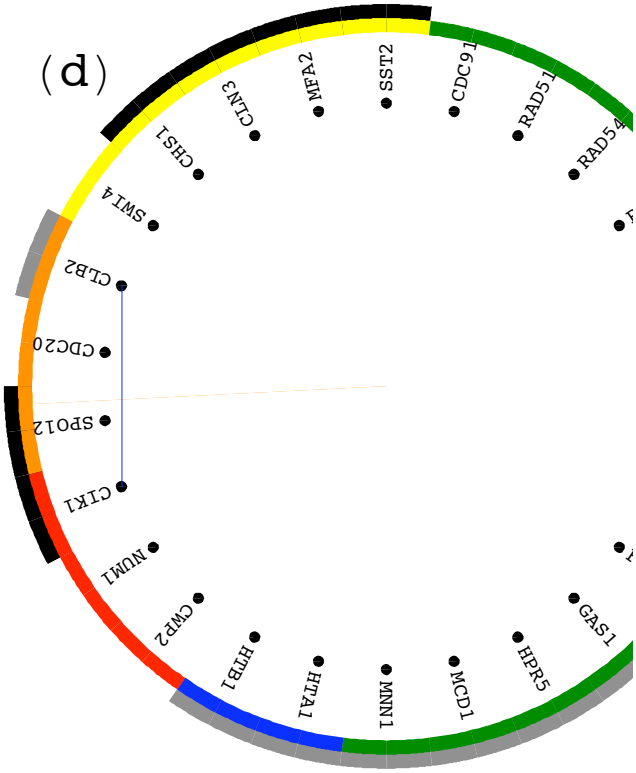
(* Display Selected Intersections of Genes × Genes Tensor Correlations Networks *)

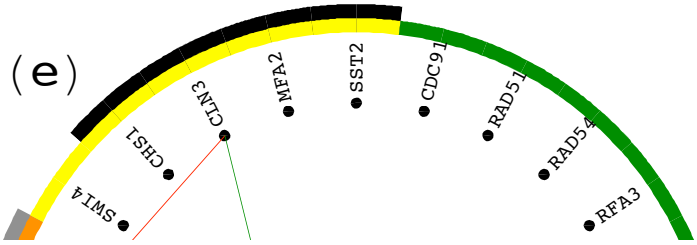
Show[GraphicsArray[{{p1, p2}, {p3, p4}, {p5}}],
  GraphicsSpacing → 0];
```

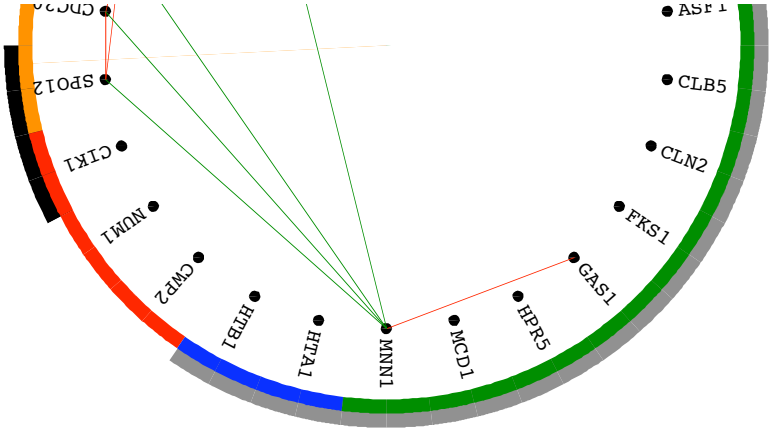

(a)
SST2
CDC91
RAD51
RAD54
RFA3
TIP1
ASF1
CLB5
CLN2
FKS1
GAS1
HPR5
MCD1
MNN1
HTA1
HTB1
CWP2
NUM1
CIK1
SPO12
CDC20
CLB2
SWI4
CHS1
CLN3
MFA2


(b)
SST2
CDC91
RAD51
RAD54
GAS1
HPR5
MCD1
MNN1
HTA1
HTB1
CWP2
NUM1
CIK1
SPO12
CDC20
CLB2
SWI4
CHS1
CLN3
MFA2


(c)
SST2
CDC91
RAD51
RAD54
RFA3
TIP1
ASF1
CLB5
CLN2
FKS1
GAS1
HPR5
MCD1
MNN1
HTA1
HTB1
CWP2
NUM1
CIK1
SPO12
CDC20
CLB2
SWI4
CHS1
CLN3
MFA2


(d)
SST2
CDC91
RAD51
RAD54
GAS1
HPR5
MCD1
MNN1
HTA1
HTB1
CWP2
NUM1
CIK1
SPO12
CDC20
CLB2
SWI4
CHS1
CLN3
MFA2


(e)
SST2
CDC91
RAD51
RAD54
RFA3
CLN3
CHS1
SWI4
MFA2


ASP1
CLB5
CLN2
FKS1
GAS1
HPR5
MCD1
MNN1
HTA1
HTB1
CWP2
NUM1
CIK1
SPO12