```
(* © Orly Alter 2000 *)
```



```
(* SVD Analysis of Alpha Factor & CLB2 & CLN3 *)
```

```
(* Normalize Selected Data *)
```

```
(* Read Selected Data from Select_Data.txt *)

<< LinearAlgebra`MatrixManipulation`;
<< NumericalMath`TrigFit`;
<< Graphics`Graphics`;
<< Graphics`Arrow`;
Off[General::"spell"];

(* Define HardDrive *)

name = "Marzipan";

(* Alpha Factor & CLB2 & CLN3 *)

stream = StringJoin[name, ":Desktop Folder:PNAS Data:Select_Alpha&Cls.txt"];
matrix = ReadList[stream, Word, RecordLists -> True, NullWords -> True];
{genes, arrays} = Dimensions[matrix] - {2, 1}
Clear[stream];
```

```
{4579, 22}
```

```
genenames = TakeRows[
  TakeColumns[matrix, {1, 1}],
  {3, genes + 2}];
arraynames = TakeColumns[
  TakeRows[matrix, {1, 2}],
  {2, arrays + 1}];
matrix = TakeColumns[
  TakeRows[matrix, {3, genes + 2}],
    {2, arrays + 1}];
matrix = ToExpression[matrix];

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

```
(* Examine Raw Data *)
```

```
(* Calculate Singular Value Decomposition *)

correlation = Dot[Transpose[matrix], matrix] / (arrays - 1);
{eigenexpressions, eigengenes} = Eigensystem[correlation];
eigenexpressions = Sqrt[(arrays - 1) * eigenexpressions];
Clear[correlation];
eigengenes[[4]] = -eigengenes[[4]];
eigengenes[[6]] = -eigengenes[[6]];
eigengenes[[7]] = -eigengenes[[7]];
eigengenes[[11]] = -eigengenes[[11]];
eigenarrays = Dot[eigengenes, Transpose[matrix]];
Do[
 eigenarrays[[a]] = eigenarrays[[a]] / eigenexpressions[[a]],
 {a, 1, arrays}];
eigenarrays = Transpose[eigenarrays];
arraycorrelations = Dot[DiagonalMatrix[eigenexpressions], eigengenes];
genecorrelations = Dot[eigenarrays, DiagonalMatrix[eigenexpressions]];
genecorrelations = Transpose[genecorrelations];
fractions = eigenexpressions^2 / Sum[eigenexpressions[[a]]^2, {a, 1, arrays}];
entropy = -N[Sum[fractions[[a]] * Log[fractions[[a]]], {a, 1, arrays}] / Log[arrays]];
entropy = N[Round[100 * entropy] / 100]
```

```
0.25
```

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

```
fractions[[2]]
```

```
0.0946134
```

```
limit = 0.1;
```

```
Clear[gridx, framex, framey, sizes];
gridx = Table[a, {a, 0, limit, N[limit / 4]}];
framex = gridx;
sizes = Flatten[
  Table[
   Dimensions[
    Characters[
     ToString[framex[[a]]]
    ]
   ], {a, 1, 5}]];
Do[
 Do[framex[[a]] = StringJoin[ToString[framex[[a]]], " "],
    {b, 1, 5 - sizes[[a]]}],
   {a, 1, 5}];
framex = Table[{gridx[[a]], framex[[a]]}, {a, 1, 5}];
gridx = Table[{gridx[[a]], RGBColor[0, 0, 0]}, {a, 1, 5}];
framey = Table[{a + 1, arrays - a - 7}, {a, 0, 15 - 2}];
table = Table[fractions[[arrays - a]], {a, 7, arrays - 2}];
g = BarChart[
  table,
  BarOrientation -> Horizontal,
  PlotRange -> {{0, limit * 1.0001}, {0.5, 15 - 1 + 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 + 1.75}, {0, 0}, {0, 1}];
g1 = Show[g,
 AspectRatio -> 1.25,
 PlotRange -> All,
 DisplayFunction -> Identity];
```

```
gridx = Table[a, {a, 0, 1, 0.2}];
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, arrays - a}, {a, 0, arrays - 1}];
labelx = ColumnForm[
  {"(b) Eigenexpression Fraction", StringJoin["d = ", ToString[entropy]], " "}, Center];
g = BarChart[
  Table[fractions[[arrays - a]], {a, 0, arrays - 1}],
  BarOrientation -> Horizontal,
  PlotRange -> {{0, 1.0001}, {0.5, arrays + 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 + 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}];
g2 = Show[{g,
   Graphics[{RGBColor[1, 1, 0.8], Rectangle[{0.1, 0.6}, {0.98, 20.6}]}],
   Graphics[{Rectangle[{0.1, 0.6}, {0.98, 20.6}, g1]}]},
 AspectRatio -> 1.35,
 PlotRange -> All,
 DisplayFunction -> Identity];
```

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

contrast = 3.5;
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, arrays}, {j, 1, arrays}];
framex = Table[{a - 0.5, arraynames[[2, a]]}, {a, 1, arrays}];
framey = Table[{a + 1 - 0.5, arrays - a}, {a, 0, arrays - 1}];
labely = "Eigengenes";
labelx = ColumnForm[{"(a) Arrays", " ", " "}, Center];
g = Show[
 Graphics[
  RasterArray[
   Table[
    RGBColor[
     displaying[[i, j, 1]], displaying[[i, j, 2]], 0
     ],
    {i, arrays, 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,
 PlotRange -> All,
 DisplayFunction -> Identity];

(* Create Selected Eigengenes Graph Display *)

eigengenes1 = Chop[TrigFit[eigengenes[[1]], 2, {x, arrays - 1}], 0.05]
eigengenes4 = Chop[TrigFit[Drop[Drop[eigengenes[[4]], {19, 22}], {1}], 2, {x - 1, arrays - 5}], 0.05]
eigengenes5 = Chop[TrigFit[Drop[Drop[eigengenes[[5]], {19, 22}], {1}], 2, {x - 1, arrays - 5}], 0.05]
eigengenes6 = Chop[TrigFit[Drop[Drop[eigengenes[[6]], {19, 22}], {1}], 2, {x - 1, arrays - 5}], 0.1]
```

$$-0.211007$$

$$0.0904703 \sin\left[\frac{4}{17}\pi(-1+x)\right]$$

$$0.13624 \sin\left[\frac{2}{17}\pi(-1+x)\right] + 0.151972 \sin\left[\frac{4}{17}\pi(-1+x)\right]$$

$$0.134031 \cos\left[\frac{2}{17}\pi(-1+x)\right] + 0.121332 \cos\left[\frac{4}{17}\pi(-1+x)\right]$$

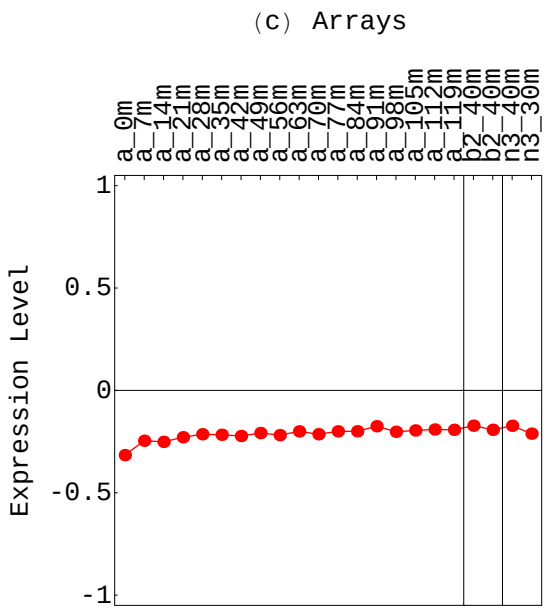
```
eigengenes7 = Chop[TrigFit[Drop[Drop[eigengenes[[7]], {19, 22}], {1}], 2, {x - 1, arrays - 5}], 0.05]
eigengenes9 = Chop[TrigFit[Drop[Drop[eigengenes[[9]], {19, 22}], {1}], 2, {x - 1, arrays - 5}], 0.15]
eigengenes11 = Chop[TrigFit[Drop[Drop[eigengenes[[11]], {19, 22}], {1}], 2, {x - 1, arrays - 5}], 0.15]
```

$$0.0788436 \cos\left[\frac{2}{17}\pi(-1+x)\right] + 0.0901957 \sin\left[\frac{4}{17}\pi(-1+x)\right]$$

$$0.195534 \cos\left[\frac{4}{17}\pi(-1+x)\right] - 0.15699 \sin\left[\frac{2}{17}\pi(-1+x)\right]$$

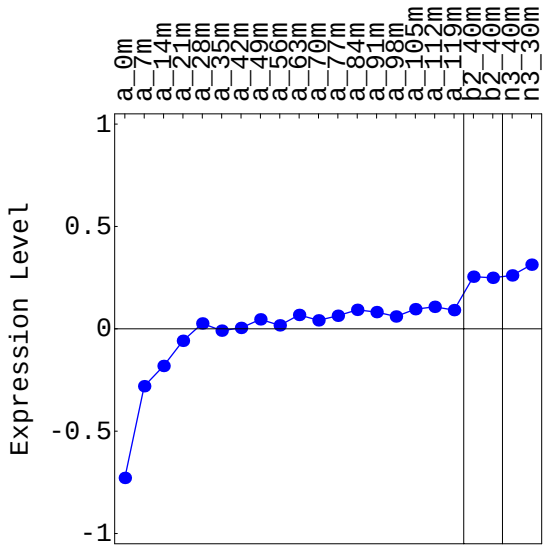
$$-0.172737 \sin\left[\frac{2}{17}\pi(-1+x)\right] + 0.179714 \sin\left[\frac{4}{17}\pi(-1+x)\right]$$

```
labelx = ColumnForm[{"(c) Arrays"}, Center];
labely = ColumnForm[{" ", "Expression Level"}, Center];
framex = Table[{a - 1, arraynames[[2, 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[0.022], points}],
   Graphics[{RGBColor[1, 0, 0], line}]},
 Frame -> True,
 FrameLabel -> {None, labely, labelx, None},
 GridLines -> {{{17.5, RGBColor[0, 0, 0]}, {19.5, RGBColor[0, 0, 0]}}, {{0, RGBColor[0, 0, 0]}}},
 FrameTicks -> {None, framey, framex, None},
 PlotRange -> {-1.05, 1.05},
 DisplayFunction -> Identity];
g = FullGraphics[g];
g[[1, 2]] = g[[1, 2]] /.
  Text[labely, {b_, c_}, {1., 0.}] ->
   Text[labely, {b - 5.4, c}, {0, 0}, {0, 1}];
g[[1, 2]] = g[[1, 2]] /.
  Text[labelx, {b_, c_}, {0., -1.}] ->
   Text[labelx, {b, c + 0.625}, {0, -1}, {1, 0}];
g[[1, 2]] = g[[1, 2]] /.
  Text[a_, {b_, c_}, {0., -1.}] ->
   Text[a, {b, c + 0.25}, {0, 0}, {0, 1}];
p1 = Show[g,
  AspectRatio -> 1.05,
  PlotRange -> All];
```

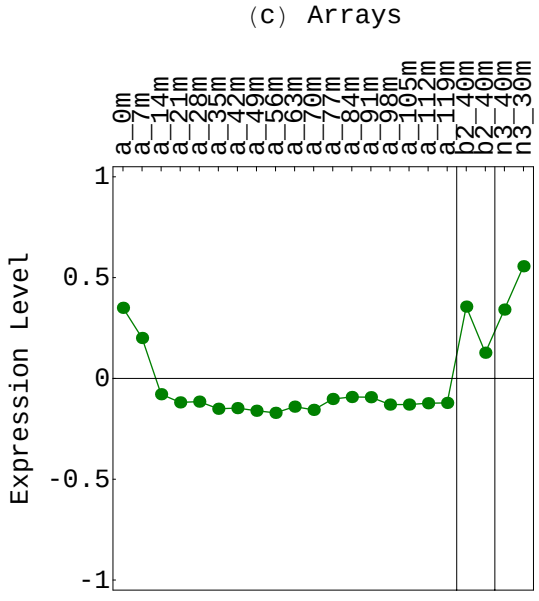


```
labelx = ColumnForm[{"(c) Arrays"}, Center];
labely = ColumnForm[{" ", "Expression Level"}, Center];
framex = Table[{a - 1, arraynames[[2, a]]}, {a, 1, arrays}];
framey = {-1, -0.5, 0, 0.5, 1};
coordinates = Table[{a - 1, eigengenes[[2, a]]},  {a, 1, arrays}];
points = Table[Point[coordinates[[a]]],  {a, 1, arrays}];
line = Line[coordinates];
g = Show[
  {Graphics[{RGBColor[0, 0, 1], PointSize[0.022], points}],
   Graphics[{RGBColor[0, 0, 1], line}]},
 Frame -> True,
 FrameLabel -> {None, labely, labelx, None},
 GridLines -> {{{17.5, RGBColor[0, 0, 0]}, {19.5, RGBColor[0, 0, 0]}}, {{0, RGBColor[0, 0, 0]}}},
 FrameTicks -> {None, framey, framex, None},
 PlotRange -> {-1.05, 1.05},
 DisplayFunction -> Identity];
g = FullGraphics[g];
g[[1, 2]] = g[[1, 2]] /.
  Text[labely, {b_, c_}, {1., 0.}] ->
   Text[labely, {b - 5.4, c}, {0, 0}, {0, 1}];
g[[1, 2]] = g[[1, 2]] /.
  Text[labelx, {b_, c_}, {0., -1.}] ->
   Text[labelx, {b, c + 0.625}, {0, -1}, {1, 0}];
g[[1, 2]] = g[[1, 2]] /.
  Text[a_, {b_, c_}, {0., -1.}] ->
   Text[a, {b, c + 0.25}, {0, 0}, {0, 1}];
p2 = Show[g,
  AspectRatio -> 1.05,
  PlotRange -> All];
```

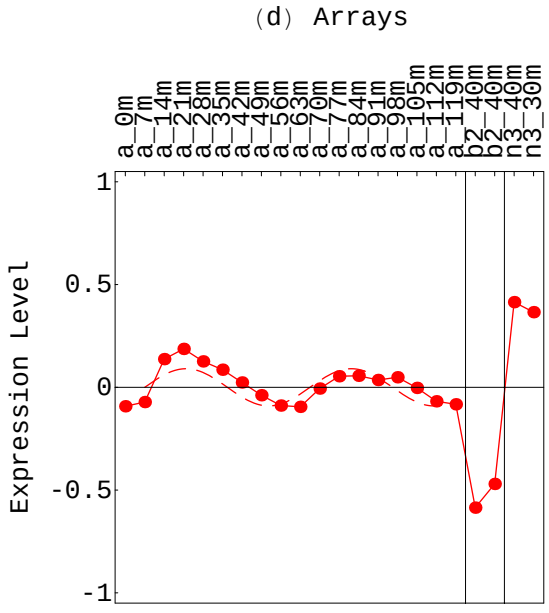
(c) Arrays



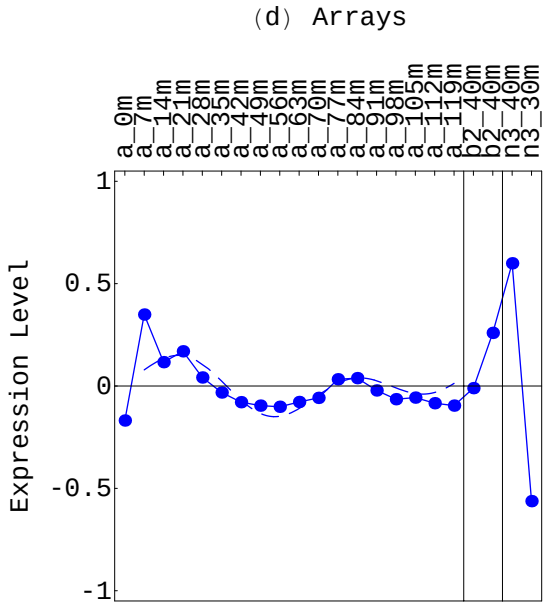
```
labelx = ColumnForm[{"(c) Arrays"}, Center];
labely = ColumnForm[{" ", "Expression Level"}, Center];
framex = Table[{a - 1, arraynames[[2, a]]}, {a, 1, arrays}];
framey = {-1, -0.5, 0, 0.5, 1};
coordinates = Table[{a - 1, eigengenes[[3, a]]},  {a, 1, arrays}];
points = Table[Point[coordinates[[a]]],  {a, 1, arrays}];
line = Line[coordinates];
g = Show[
  {Graphics[{RGBColor[0, 0.5, 0], PointSize[0.022], points}],
   Graphics[{RGBColor[0, 0.5, 0], line}]},
   Frame -> True,
 FrameLabel -> {None, labely, labelx, None},
 GridLines -> {{{17.5, RGBColor[0, 0, 0]}, {19.5, RGBColor[0, 0, 0]}}, {{0, RGBColor[0, 0, 0]}}},
 FrameTicks -> {None, framey, framex, None},
 PlotRange -> {-1.05, 1.05},
 DisplayFunction -> Identity];
g = FullGraphics[g];
g[[1, 2]] = g[[1, 2]] /.
  Text[labely, {b_, c_}, {1., 0.}] ->
   Text[labely, {b - 5.4, c}, {0, 0}, {0, 1}];
g[[1, 2]] = g[[1, 2]] /.
  Text[labelx, {b_, c_}, {0., -1.}] ->
   Text[labelx, {b, c + 0.625}, {0, -1}, {1, 0}];
g[[1, 2]] = g[[1, 2]] /.
  Text[a_, {b_, c_}, {0., -1.}] ->
   Text[a, {b, c + 0.25}, {0, 0}, {0, 1}];
p3 = Show[g,
  AspectRatio -> 1.05,
  PlotRange -> All];
```



```
graph = Plot[
  eigengenes4,
  {x, 1, arrays - 5},
  PlotStyle -> {RGBColor[1, 0, 0], Dashing[{0.03, 0.02}]},
  DisplayFunction -> Identity];
labelx = ColumnForm[{"(d) Arrays"}, Center];
labely = ColumnForm[{" ", "Expression Level"}, Center];
framex = Table[{a - 1, arraynames[[2, a]]}, {a, 1, arrays}];
framey = {-1, -0.5, 0, 0.5, 1};
coordinates = Table[{a - 1, eigengenes[[4, a]]},  {a, 1, arrays}];
points = Table[Point[coordinates[[a]]],  {a, 1, arrays}];
line = Line[coordinates];
g = Show[
  {Graphics[{RGBColor[1, 0, 0], PointSize[0.022], points}],
   Graphics[{RGBColor[1, 0, 0], line}],
   graph},
 Frame -> True,
 FrameLabel -> {None, labely, labelx, None},
 GridLines -> {{{17.5, RGBColor[0, 0, 0]}, {19.5, RGBColor[0, 0, 0]}}, {{0, RGBColor[0, 0, 0]}}},
 FrameTicks -> {None, framey, framex, None},
 PlotRange -> {-1.05, 1.05},
 DisplayFunction -> Identity];
g = FullGraphics[g];
g[[1, 2]] = g[[1, 2]] /.
  Text[labely, {b_, c_}, {1., 0.}] ->
   Text[labely, {b - 5.4, c}, {0, 0}, {0, 1}];
g[[1, 2]] = g[[1, 2]] /.
  Text[labelx, {b_, c_}, {0., -1.}] ->
   Text[labelx, {b, c + 0.625}, {0, -1}, {1, 0}];
g[[1, 2]] = g[[1, 2]] /.
  Text[a_, {b_, c_}, {0., -1.}] ->
   Text[a, {b, c + 0.25}, {0, 0}, {0, 1}];
p4 = Show[g,
  AspectRatio -> 1.05,
  PlotRange -> All];
```

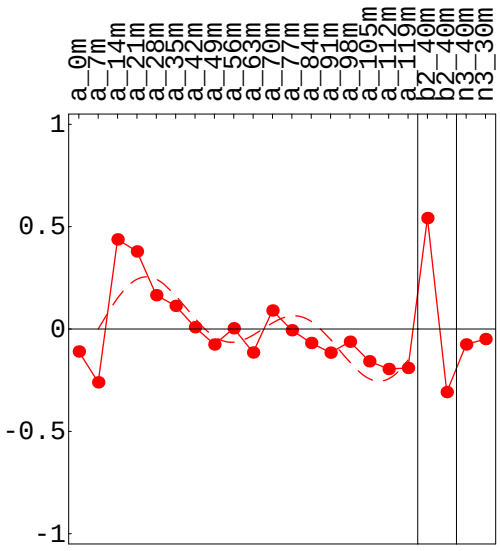


```
graph = Plot[
  eigengenes7,
  {x, 1, arrays - 5},
  PlotStyle -> {RGBColor[0, 0, 1], Dashing[{0.03, 0.02}]},
  DisplayFunction -> Identity];
labelx = ColumnForm[{"(d) Arrays"}, Center];
labely = ColumnForm[{" ", "Expression Level"}, Center];
framex = Table[{a - 1, arraynames[[2, a]]}, {a, 1, arrays}];
framey = {-1, -0.5, 0, 0.5, 1};
coordinates = Table[{a - 1, eigengenes[[7, a]]},  {a, 1, arrays}];
points = Table[Point[coordinates[[a]]],  {a, 1, arrays}];
line = Line[coordinates];
g = Show[
  {Graphics[{RGBColor[0, 0, 1], PointSize[0.022], points}],
   Graphics[{RGBColor[0, 0, 1], line}],
   graph},
   Frame -> True,
 FrameLabel -> {None, labely, labelx, None},
 GridLines -> {{{17.5, RGBColor[0, 0, 0]}, {19.5, RGBColor[0, 0, 0]}}, {{0, RGBColor[0, 0, 0]}}},
 FrameTicks -> {None, framey, framex, None},
 PlotRange -> {-1.05, 1.05},
 DisplayFunction -> Identity];
g = FullGraphics[g];
g[[1, 2]] = g[[1, 2]] /.
  Text[labely, {b_, c_}, {1., 0.}] ->
   Text[labely, {b - 5.4, c}, {0, 0}, {0, 1}];
g[[1, 2]] = g[[1, 2]] /.
  Text[labelx, {b_, c_}, {0., -1.}] ->
   Text[labelx, {b, c + 0.625}, {0, -1}, {1, 0}];
g[[1, 2]] = g[[1, 2]] /.
  Text[a_, {b_, c_}, {0., -1.}] ->
   Text[a, {b, c + 0.25}, {0, 0}, {0, 1}];
p7 = Show[g,
  AspectRatio -> 1.05,
  PlotRange -> All];
```



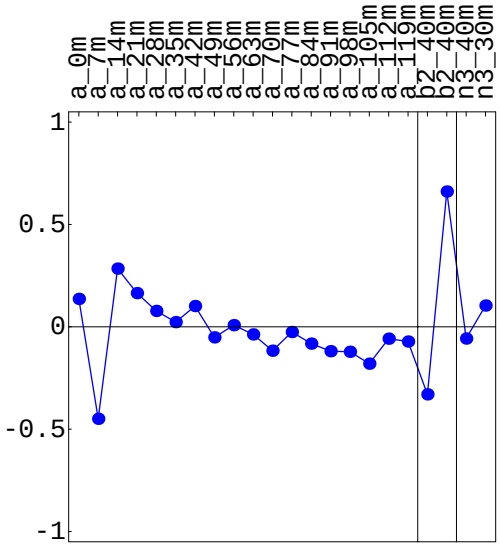
```
graph = Plot[
  eigengenes5,
  {x, 1, arrays - 5},
  PlotStyle -> {RGBColor[1, 0, 0], Dashing[{0.03, 0.02}]},
  DisplayFunction -> Identity];
labelx = ColumnForm[{"(e) Arrays"}, Center];
labely = ColumnForm[{" ", " "}, Center];
framex = Table[{a - 1, arraynames[[2, a]]}, {a, 1, arrays}];
framey = {-1, -0.5, 0, 0.5, 1};
coordinates = Table[{a - 1, eigengenes[[5, a]]},  {a, 1, arrays}];
points = Table[Point[coordinates[[a]]],  {a, 1, arrays}];
line = Line[coordinates];
g = Show[
  {Graphics[{RGBColor[1, 0, 0], PointSize[0.022], points}],
   Graphics[{RGBColor[1, 0, 0], line}],
   graph},
   Frame -> True,
 FrameLabel -> {None, labely, labelx, None},
 GridLines -> {{{17.5, RGBColor[0, 0, 0]}, {19.5, RGBColor[0, 0, 0]}}, {{0, RGBColor[0, 0, 0]}}},
 FrameTicks -> {None, framey, framex, None},
 PlotRange -> {-1.05, 1.05},
 DisplayFunction -> Identity];
g = FullGraphics[g];
g[[1, 2]] = g[[1, 2]] /.
  Text[labely, {b_, c_}, {1., 0.}] ->
   Text[labely, {b - 5.4, c}, {0, 0}, {0, 1}];
g[[1, 2]] = g[[1, 2]] /.
  Text[labelx, {b_, c_}, {0., -1.}] ->
   Text[labelx, {b, c + 0.625}, {0, -1}, {1, 0}];
g[[1, 2]] = g[[1, 2]] /.
  Text[a_, {b_, c_}, {0., -1.}] ->
   Text[a, {b, c + 0.25}, {0, 0}, {0, 1}];
p5 = Show[g,
  AspectRatio -> 1.05,
  PlotRange -> All];
```

(e) Arrays



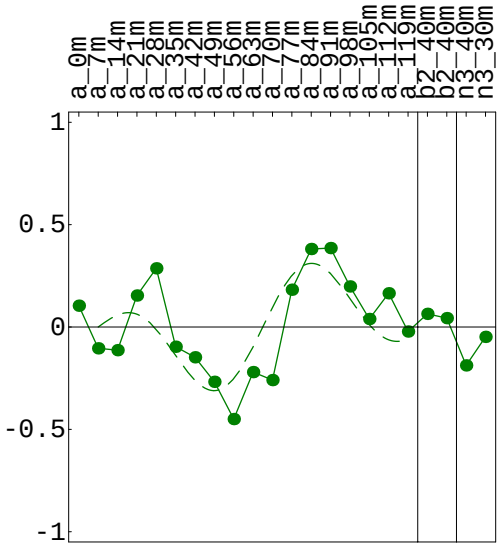
```
labelx = ColumnForm[{"(e) Arrays"}, Center];
labely = ColumnForm[{" ", " "}, Center];
framex = Table[{a - 1, arraynames[[2, a]]}, {a, 1, arrays}];
framey = {-1, -0.5, 0, 0.5, 1};
coordinates = Table[{a - 1, eigengenes[[8, a]]},  {a, 1, arrays}];
points = Table[Point[coordinates[[a]]],  {a, 1, arrays}];
line = Line[coordinates];
g = Show[
  {Graphics[{RGBColor[0, 0, 1], PointSize[0.022], points}],
   Graphics[{RGBColor[0, 0, 1], line}]},
   Frame -> True,
 FrameLabel -> {None, labely, labelx, None},
 GridLines -> {{{17.5, RGBColor[0, 0, 0]}, {19.5, RGBColor[0, 0, 0]}}, {{0, RGBColor[0, 0, 0]}}},
 FrameTicks -> {None, framey, framex, None},
 PlotRange -> {-1.05, 1.05},
 DisplayFunction -> Identity];
g = FullGraphics[g];
g[[1, 2]] = g[[1, 2]] /.
  Text[labely, {b_, c_}, {1., 0.}] ->
   Text[labely, {b - 5.4, c}, {0, 0}, {0, 1}];
g[[1, 2]] = g[[1, 2]] /.
  Text[labelx, {b_, c_}, {0., -1.}] ->
   Text[labelx, {b, c + 0.625}, {0, -1}, {1, 0}];
g[[1, 2]] = g[[1, 2]] /.
  Text[a_, {b_, c_}, {0., -1.}] ->
   Text[a, {b, c + 0.25}, {0, 0}, {0, 1}];
p8 = Show[g,
  AspectRatio -> 1.05,
  PlotRange -> All];
```

(e) Arrays



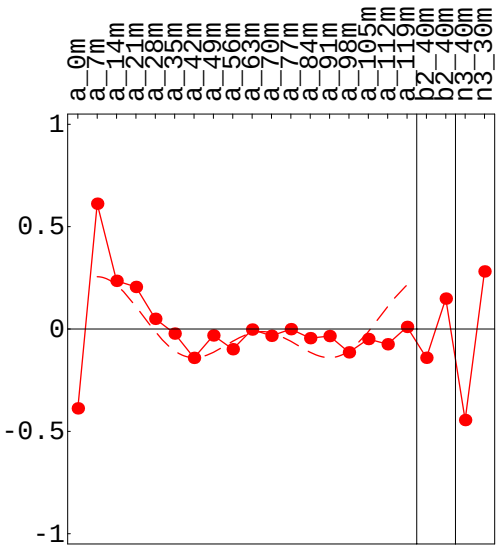
```
graph = Plot[
  eigengenes11,
  {x, 1, arrays - 5},
  PlotStyle -> {RGBColor[0, 0.5, 0], Dashing[{0.03, 0.02}]},
  DisplayFunction -> Identity];
labelx = ColumnForm[{"(e) Arrays"}, Center];
labely = ColumnForm[{" ", " "}, Center];
framex = Table[{a - 1, arraynames[[2, a]]}, {a, 1, arrays}];
framey = {-1, -0.5, 0, 0.5, 1};
coordinates = Table[{a - 1, eigengenes[[11, a]]},  {a, 1, arrays}];
points = Table[Point[coordinates[[a]]],  {a, 1, arrays}];
line = Line[coordinates];
g = Show[
  {Graphics[{RGBColor[0, 0.5, 0], PointSize[0.022], points}],
   Graphics[{RGBColor[0, 0.5, 0], line}],
   graph},
 Frame -> True,
 FrameLabel -> {None, labely, labelx, None},
 GridLines -> {{{17.5, RGBColor[0, 0, 0]}, {19.5, RGBColor[0, 0, 0]}}, {{0, RGBColor[0, 0, 0]}}},
 FrameTicks -> {None, framey, framex, None},
 PlotRange -> {-1.05, 1.05},
 DisplayFunction -> Identity];
g = FullGraphics[g];
g[[1, 2]] = g[[1, 2]] /.
  Text[labely, {b_, c_}, {1., 0.}] ->
   Text[labely, {b - 5.4, c}, {0, 0}, {0, 1}];
g[[1, 2]] = g[[1, 2]] /.
  Text[labelx, {b_, c_}, {0., -1.}] ->
   Text[labelx, {b, c + 0.625}, {0, -1}, {1, 0}];
g[[1, 2]] = g[[1, 2]] /.
  Text[a_, {b_, c_}, {0., -1.}] ->
   Text[a, {b, c + 0.25}, {0, 0}, {0, 1}];
p11 = Show[g,
  AspectRatio -> 1.05,
  PlotRange -> All];
```

(e) Arrays

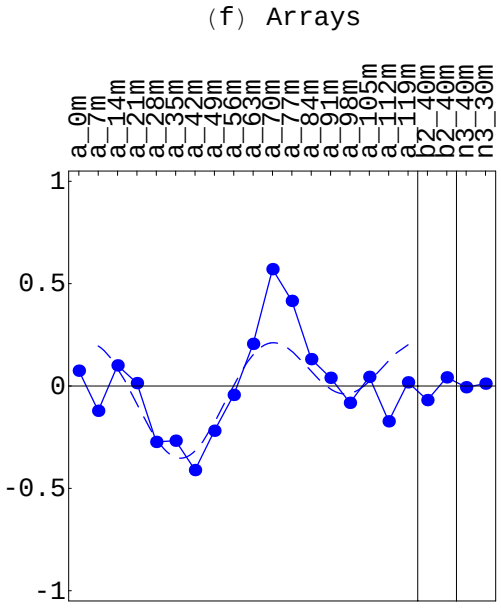


```
graph = Plot[
  eigengenes6,
  {x, 1, arrays - 5},
  PlotStyle -> {RGBColor[1, 0, 0], Dashing[{0.03, 0.02}]},
  DisplayFunction -> Identity];
labelx = ColumnForm[{"(f) Arrays"}, Center];
labely = ColumnForm[{" ", " "}, Center];
framex = Table[{a - 1, arraynames[[2, a]]}, {a, 1, arrays}];
framey = {-1, -0.5, 0, 0.5, 1};
coordinates = Table[{a - 1, eigengenes[[6, a]]},  {a, 1, arrays}];
points = Table[Point[coordinates[[a]]],  {a, 1, arrays}];
line = Line[coordinates];
g = Show[
  {Graphics[{RGBColor[1, 0, 0], PointSize[0.022], points}],
   Graphics[{RGBColor[1, 0, 0], line}],
   graph},
 Frame -> True,
 FrameLabel -> {None, labely, labelx, None},
 GridLines -> {{{17.5, RGBColor[0, 0, 0]}, {19.5, RGBColor[0, 0, 0]}}, {{0, RGBColor[0, 0, 0]}}},
 FrameTicks -> {None, framey, framex, None},
 PlotRange -> {-1.05, 1.05},
 DisplayFunction -> Identity];
g = FullGraphics[g];
g[[1, 2]] = g[[1, 2]] /.
  Text[labely, {b_, c_}, {1., 0.}] ->
   Text[labely, {b - 5.4, c}, {0, 0}, {0, 1}];
g[[1, 2]] = g[[1, 2]] /.
  Text[labelx, {b_, c_}, {0., -1.}] ->
   Text[labelx, {b, c + 0.625}, {0, -1}, {1, 0}];
g[[1, 2]] = g[[1, 2]] /.
  Text[a_, {b_, c_}, {0., -1.}] ->
   Text[a, {b, c + 0.25}, {0, 0}, {0, 1}];
p6 = Show[g,
  AspectRatio -> 1.05,
  PlotRange -> All];
```

(f) Arrays

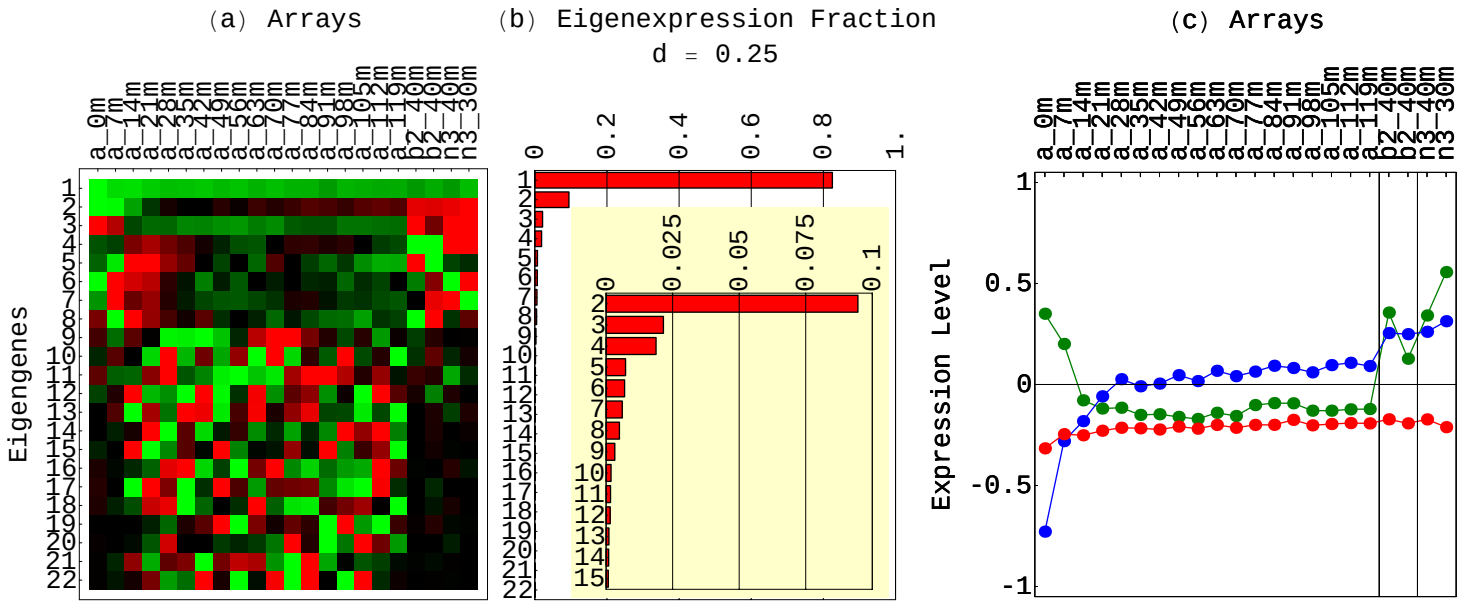


```
graph = Plot[
  eigengenes9,
  {x, 1, arrays - 5},
  PlotStyle -> {RGBColor[0, 0, 1], Dashing[{0.03, 0.02}]},
  DisplayFunction -> Identity];
labelx = ColumnForm[{"(f) Arrays"}, Center];
labely = ColumnForm[{" ", " "}, Center];
framex = Table[{a - 1, arraynames[[2, a]]}, {a, 1, arrays}];
framey = {-1, -0.5, 0, 0.5, 1};
coordinates = Table[{a - 1, eigengenes[[9, a]]},  {a, 1, arrays}];
points = Table[Point[coordinates[[a]]],  {a, 1, arrays}];
line = Line[coordinates];
g = Show[
  {Graphics[{RGBColor[0, 0, 1], PointSize[0.022], points}],
   Graphics[{RGBColor[0, 0, 1], line}],
   graph},
 Frame -> True,
 FrameLabel -> {None, labely, labelx, None},
 GridLines -> {{{17.5, RGBColor[0, 0, 0]}, {19.5, RGBColor[0, 0, 0]}}, {{0, RGBColor[0, 0, 0]}}},
 FrameTicks -> {None, framey, framex, None},
 PlotRange -> {-1.05, 1.05},
 DisplayFunction -> Identity];
g = FullGraphics[g];
g[[1, 2]] = g[[1, 2]] /.
  Text[labely, {b_, c_}, {1., 0.}] ->
   Text[labely, {b - 5.4, c}, {0, 0}, {0, 1}];
g[[1, 2]] = g[[1, 2]] /.
  Text[labelx, {b_, c_}, {0., -1.}] ->
   Text[labelx, {b, c + 0.625}, {0, -1}, {1, 0}];
g[[1, 2]] = g[[1, 2]] /.
  Text[a_, {b_, c_}, {0., -1.}] ->
   Text[a, {b, c + 0.25}, {0, 0}, {0, 1}];
p9 = Show[g,
  AspectRatio -> 1.05,
  PlotRange -> All];
```

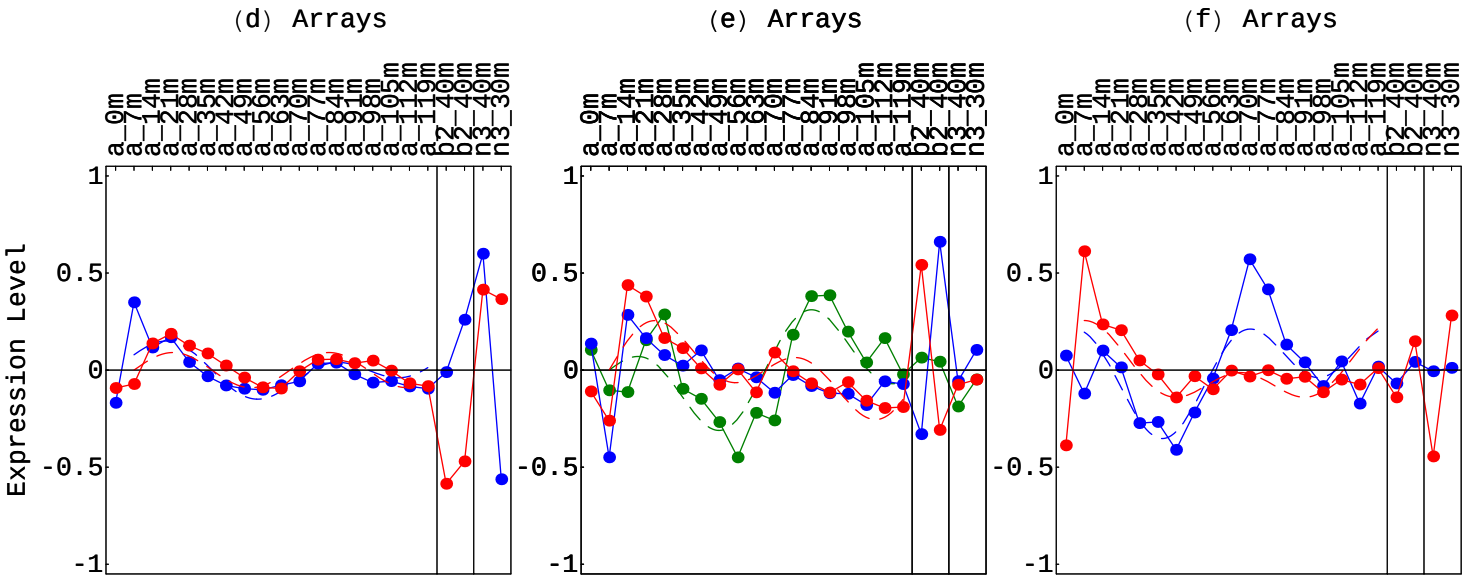



```
(* Display Selected Eigengenes *)

g3 = Show[{p3, p2, p1},
  DisplayFunction -> Identity];
g4 = Show[{p7, p4},
  DisplayFunction -> Identity];
g5 = Show[{p11, p8, p5},
  DisplayFunction -> Identity];
```

```
(* Display Eigengenes, Fractions and Selected Eigengenes *)

Show[GraphicsArray[{g1, g2, g3}],
 GraphicsSpacing -> -0.2];
```




```
Show[GraphicsArray[{g4, g5, g6}],
 GraphicsSpacing -> -0.15];
```




```
(* and Remove the Additive Constant *)

(* Reconstruct Data Without Additive Constant *)

eigenexpressions[[1]] = 0;
eigenexpressions[[2]] = 0;
eigenexpressions[[3]] = 0;
eigenexpressions[[10]] = 0;
Do[eigenexpressions[[a]] = 0,
 {a, 12, arrays}];
matrix = Dot[eigenarrays, DiagonalMatrix[eigenexpressions], eigengenes];
```

```
(* Remove the Multiplicative Constant *)
```

```
(* Calculate Singular Value Decomposition *)

normalization = Log[matrix^2];
correlation = Dot[Transpose[normalization], normalization] / (arrays - 1);
{eigenexpressions, eigengenes} = Eigensystem[correlation];
eigenexpressions = Sqrt[(arrays - 1) * eigenexpressions];
Clear[correlation];
eigengenes[[2]] = -eigengenes[[2]];
eigenarrays = Dot[eigengenes, Transpose[normalization]];
Do[
 eigenarrays[[a]] = eigenarrays[[a]] / eigenexpressions[[a]],
 {a, 1, arrays}];
eigenarrays = Transpose[eigenarrays];
fractions = eigenexpressions^2 / Sum[eigenexpressions[[a]]^2, {a, 1, arrays}];
entropy = -N[Sum[fractions[[a]] * Log[fractions[[a]]], {a, 1, arrays}] / Log[arrays]];
entropy = N[Round[100 * entropy] / 100]
```

```
0.22
```

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

fractions[[2]]
```

```
0.0128277
```

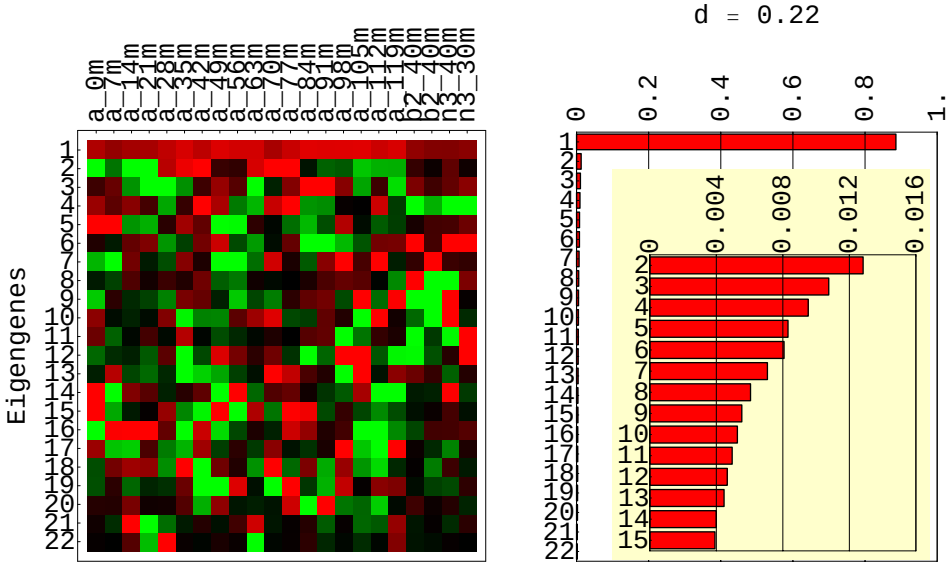
```
limit = 0.016;

Clear[gridx, framex, framey, sizes];
gridx = Table[a, {a, 0, limit, N[limit / 4]}];
framex = gridx;
sizes = Flatten[
  Table[
   Dimensions[
    Characters[
     ToString[framex[[a]]]
    ]
   ], {a, 1, 5}]];
Do[
 Do[framex[[a]] = StringJoin[ToString[framex[[a]]], " "],
    {b, 1, 5 - sizes[[a]]}],
   {a, 1, 5}];
framex = Table[{gridx[[a]], framex[[a]]}, {a, 1, 5}];
gridx = Table[{gridx[[a]], RGBColor[0, 0, 0]}, {a, 1, 5}];
framey = Table[{a + 1, arrays - a - 7}, {a, 0, 15 - 2}];
table = Table[fractions[[arrays - a]], {a, 7, arrays - 2}];
g = BarChart[
  table,
  BarOrientation -> Horizontal,
  PlotRange -> {{0, limit * 1.0001}, {0.5, 15 - 1 + 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 + 1.75}, {0, 0}, {0, 1}];
```

```
g1 = Show[g,
 AspectRatio -> 1.25,
 PlotRange -> All,
 DisplayFunction -> Identity];

gridx = Table[a, {a, 0, 1, 0.2}];
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, arrays - a}, {a, 0, arrays - 1}];
labelx = ColumnForm[
  {"(b) Eigenexpression Fraction", StringJoin["d = ", ToString[entropy]], " "}, Center];
g = BarChart[
  Table[fractions[[arrays - a]], {a, 0, arrays - 1}],
  BarOrientation -> Horizontal,
  PlotRange -> {{0, 1.0001}, {0.5, arrays + 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 + 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}];
g2 = Show[{g,
   Graphics[{RGBColor[1, 1, 0.8], Rectangle[{0.1, 0.6}, {0.98, 20.6}]}],
   Graphics[{Rectangle[{0.1, 0.6}, {0.98, 20.6}, g1]}]},
 AspectRatio -> 1.35,
 PlotRange -> All,
 DisplayFunction -> Identity];
```

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

contrast = 3.5;
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, arrays}, {j, 1, arrays}];
framex = Table[{a - 0.5, arraynames[[2, a]]}, {a, 1, arrays}];
framey = Table[{a + 1 - 0.5, arrays - a}, {a, 0, arrays - 1}];
labely = "Eigengenes";
labelx = ColumnForm[{"(a) Arrays", " ", " "}, Center];
g = Show[
 Graphics[
  RasterArray[
   Table[
    RGBColor[
     displaying[[i, j, 1]], displaying[[i, j, 2]], 0
     ],
    {i, arrays, 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,
 PlotRange -> All,
 DisplayFunction -> Identity];

(* Display Both Eigengenes & Fractions *)

Show[GraphicsArray[{g1, g2}],
 GraphicsSpacing -> -0.125];
```

(a) Arrays

(b) Eigenexpression Fraction
d = 0.22



```
(* Reconstruct the Data Without Multiplicative Constant *)

eigenexpressions[[1]] = 0;
normalization = Dot[eigenarrays, DiagonalMatrix[eigenexpressions], eigengenes];
normalization = Sqrt[Exp[normalization]];
matrix = Sign[matrix];
matrix = N[matrix * normalization];
Clear[normalization];
```

```
(* Examine Normalized Data *)
```

```
(* Calculate Singular Value Decomposition *)

correlation = Dot[Transpose[matrix], matrix] / (arrays - 1);
{eigenexpressions, eigengenes} = Eigensystem[correlation];
eigenexpressions = Sqrt[(arrays - 1) * eigenexpressions];
Clear[correlation];
eigengenes[[1]] = -eigengenes[[1]];
eigengenes[[3]] = -eigengenes[[3]];
eigenarrays = Dot[eigengenes, Transpose[matrix]];
Do[
 eigenarrays[[a]] = eigenarrays[[a]] / eigenexpressions[[a]],
 {a, 1, arrays}];
eigenarrays = Transpose[eigenarrays];
arraycorrelations = Dot[DiagonalMatrix[eigenexpressions], eigengenes];
genecorrelations = Dot[eigenarrays, DiagonalMatrix[eigenexpressions]];
genecorrelations = Transpose[genecorrelations];
fractions = eigenexpressions^2 / Sum[eigenexpressions[[a]]^2, {a, 1, arrays}];
entropy = -N[Sum[fractions[[a]] * Log[fractions[[a]]], {a, 1, arrays}] / Log[arrays]];
entropy = N[Round[100 * entropy] / 100]
```

```
0.62
```

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

fractions[[1]]
```

```
0.225307
```

```
limit = 0.25;
```

```
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, size - sizes[[a]]}],
   {a, 1, 6}];
framex = Table[{gridx[[a]], framex[[a]]}, {a, 1, 6}];
framey = Table[{a + 1, arrays - a}, {a, 0, arrays - 1}];
labelx = ColumnForm[
  {"(b) Eigenexpression Fraction", StringJoin["d = ", ToString[entropy]], " "}, Center];
g = BarChart[
  Table[fractions[[arrays - a]], {a, 0, arrays - 1}],
  BarOrientation -> Horizontal,
  PlotRange -> {{0, limit * 1.0001}, {0.5, arrays + 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 + 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}];
g2 = Show[g,
 AspectRatio -> 1.35,
 PlotRange -> All,
 DisplayFunction -> Identity];
```

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

contrast = 3.5;
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, arrays}, {j, 1, arrays}];
framex = Table[{a - 0.5, arraynames[[2, a]]}, {a, 1, arrays}];
framey = Table[{a + 1 - 0.5, arrays - a}, {a, 0, arrays - 1}];
labely = "Eigengenes";
labelx = ColumnForm[{"(a) Arrays", " ", " "}, Center];
g = Show[
 Graphics[
  RasterArray[
   Table[
    RGBColor[
     displaying[[i, j, 1]], displaying[[i, j, 2]], 0
     ],
    {i, arrays, 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,
 PlotRange -> All,
 DisplayFunction -> Identity];

(* Create Selected Eigengenes Graph Display *)

eigengenes1 = Chop[TrigFit[Drop[Drop[eigengenes[[1]], {19, 22}], {1}], 2, {x - 1, arrays - 5}], 0.1]
eigengenes2 = Chop[TrigFit[Drop[Drop[eigengenes[[2]], {19, 22}], {1}], 2, {x - 1, arrays - 5}], 0.1]
eigengenes3 = Chop[TrigFit[Drop[Drop[eigengenes[[3]], {19, 22}], {1}], 2, {x - 1, arrays - 5}], 0.1]
```

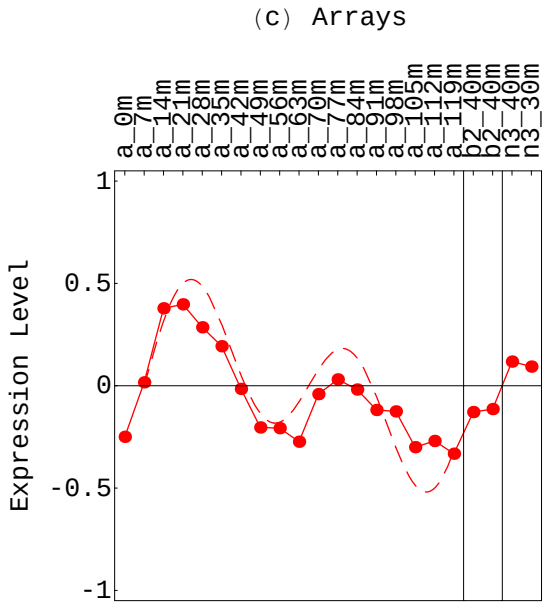
$$0.156573 \sin\left[\frac{2}{17}\pi(-1+x)\right] + 0.245919 \sin\left[\frac{4}{17}\pi(-1+x)\right]$$

$$0.268897 \cos\left[\frac{4}{17}\pi(-1+x)\right] - 0.101226 \sin\left[\frac{2}{17}\pi(-1+x)\right]$$

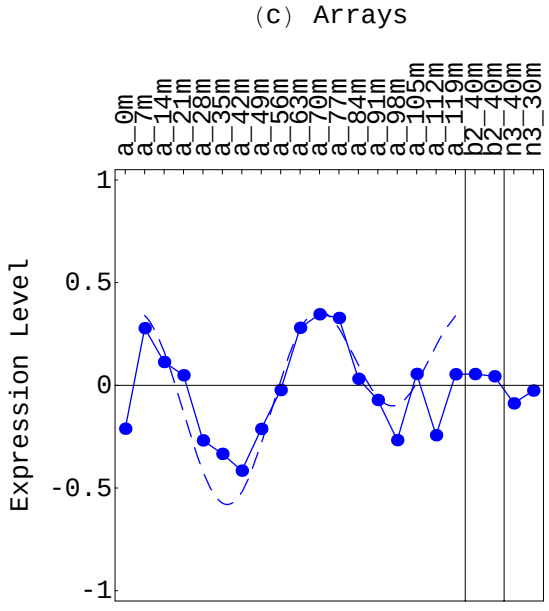
$$-0.112311 \cos\left[\frac{4}{17}\pi(-1+x)\right] - 0.237957 \sin\left[\frac{2}{17}\pi(-1+x)\right] + 0.164016 \sin\left[\frac{4}{17}\pi(-1+x)\right]$$

```
eigengenes1 = 0.34 * Sin[4 * Pi * (x - 1) / 17] + 0.24 * Sin[2 * Pi * (x - 1) / 17];
eigengenes2 = 0.34 * Cos[4 * Pi * (x - 1) / 17] - 0.24 * Sin[2 * Pi * (x - 1) / 17];
eigengenes3 = 0.34 * Sin[4 * Pi * (x - 1) / 17 - Pi / 4] - 0.24 * Sin[2 * Pi * (x - 1) / 17];
```

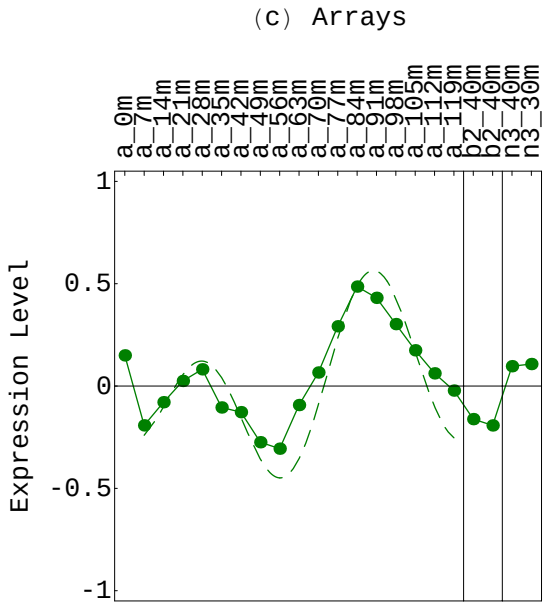
```
graph = Plot[
  eigengenes1,
  {x, 1, arrays - 5},
  PlotStyle -> {RGBColor[1, 0, 0], Dashing[{0.03, 0.02}]},
  DisplayFunction -> Identity];
labelx = ColumnForm[{"(c) Arrays"}, Center];
labely = ColumnForm[{" ", "Expression Level"}, Center];
framex = Table[{a - 1, arraynames[[2, a]]}, {a, 1, arrays}];
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[0.022], points}],
   Graphics[{RGBColor[1, 0, 0], line}],
   graph},
 Frame -> True,
 FrameLabel -> {None, labely, labelx, None},
 GridLines -> {{{17.5, RGBColor[0, 0, 0]}, {19.5, RGBColor[0, 0, 0]}}, {{0, RGBColor[0, 0, 0]}}},
 FrameTicks -> {None, framey, framex, None},
 PlotRange -> {-1.05, 1.05},
 DisplayFunction -> Identity];
g = FullGraphics[g];
g[[1, 2]] = g[[1, 2]] /.
  Text[labely, {b_, c_}, {1., 0.}] ->
   Text[labely, {b - 5.4, c}, {0, 0}, {0, 1}];
g[[1, 2]] = g[[1, 2]] /.
  Text[labelx, {b_, c_}, {0., -1.}] ->
   Text[labelx, {b, c + 0.625}, {0, -1}, {1, 0}];
g[[1, 2]] = g[[1, 2]] /.
  Text[a_, {b_, c_}, {0., -1.}] ->
   Text[a, {b, c + 0.25}, {0, 0}, {0, 1}];
p1 = Show[g,
  AspectRatio -> 1.05,
  PlotRange -> All];
```



```
graph = Plot[
  eigengenes2,
  {x, 1, arrays - 5},
  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[[2, 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[0.022], points}],
   Graphics[{RGBColor[0, 0, 1], line}],
   graph},
 Frame -> True,
 FrameLabel -> {None, labely, labelx, None},
 GridLines -> {{{17.5, RGBColor[0, 0, 0]}, {19.5, RGBColor[0, 0, 0]}}, {{0, RGBColor[0, 0, 0]}}},
 FrameTicks -> {None, framey, framex, None},
 PlotRange -> {-1.05, 1.05},  DisplayFunction -> Identity];
g = FullGraphics[g];
g[[1, 2]] = g[[1, 2]] /.
  Text[labely, {b_, c_}, {1., 0.}] ->
   Text[labely, {b - 5.4, c}, {0, 0}, {0, 1}];
g[[1, 2]] = g[[1, 2]] /.
  Text[labelx, {b_, c_}, {0., -1.}] ->
   Text[labelx, {b, c + 0.625}, {0, -1}, {1, 0}];
g[[1, 2]] = g[[1, 2]] /.
  Text[a_, {b_, c_}, {0., -1.}] ->
   Text[a, {b, c + 0.25}, {0, 0}, {0, 1}];
p2 = Show[g,
  AspectRatio -> 1.05,
  PlotRange -> All];
```



```
graph = Plot[
  eigengenes3,
  {x, 1, arrays - 5},
  PlotStyle -> {RGBColor[0, 0.5, 0], Dashing[{0.03, 0.02}]},
  DisplayFunction -> Identity];
labelx = ColumnForm[{"(c) Arrays"}, Center];
labely = ColumnForm[{" ", "Expression Level"}, Center];
framex = Table[{a - 1, arraynames[[2, 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[0.022], points}],
   Graphics[{RGBColor[0, 0.5, 0], line}],
   graph},
 Frame -> True,
 FrameLabel -> {None, labely, labelx, None},
 GridLines -> {{{17.5, RGBColor[0, 0, 0]}, {19.5, RGBColor[0, 0, 0]}}, {{0, RGBColor[0, 0, 0]}}},
 FrameTicks -> {None, framey, framex, None},
 PlotRange -> {-1.05, 1.05},  DisplayFunction -> Identity];
g = FullGraphics[g];
g[[1, 2]] = g[[1, 2]] /.
  Text[labely, {b_, c_}, {1., 0.}] ->
   Text[labely, {b - 5.4, c}, {0, 0}, {0, 1}];
g[[1, 2]] = g[[1, 2]] /.
  Text[labelx, {b_, c_}, {0., -1.}] ->
   Text[labelx, {b, c + 0.625}, {0, -1}, {1, 0}];
g[[1, 2]] = g[[1, 2]] /.
  Text[a_, {b_, c_}, {0., -1.}] ->
   Text[a, {b, c + 0.25}, {0, 0}, {0, 1}];
p3 = Show[g,
  AspectRatio -> 1.05,
  PlotRange -> All];
```




```
(* Display Selected Eigengenes *)

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

```
(* Create Formulas Display *)
```

```
p1 = Show[Graphics[{RGBColor[1, 0, 0], Text["  Sqrt[2/T] Sin[4 π t/T] + Sqrt[1/T] Sin[2 π t/T]", {605, 1}]}],
  AspectRatio -> 120 / 750,
  PlotRange -> {{0, 750}, {-1.55, 1.55}}];
```

$$\sqrt{\frac{2}{T}}\sin\left(\frac{4\pi t}{T}\right)+\sqrt{\frac{1}{T}}\sin\left(\frac{2\pi t}{T}\right)$$

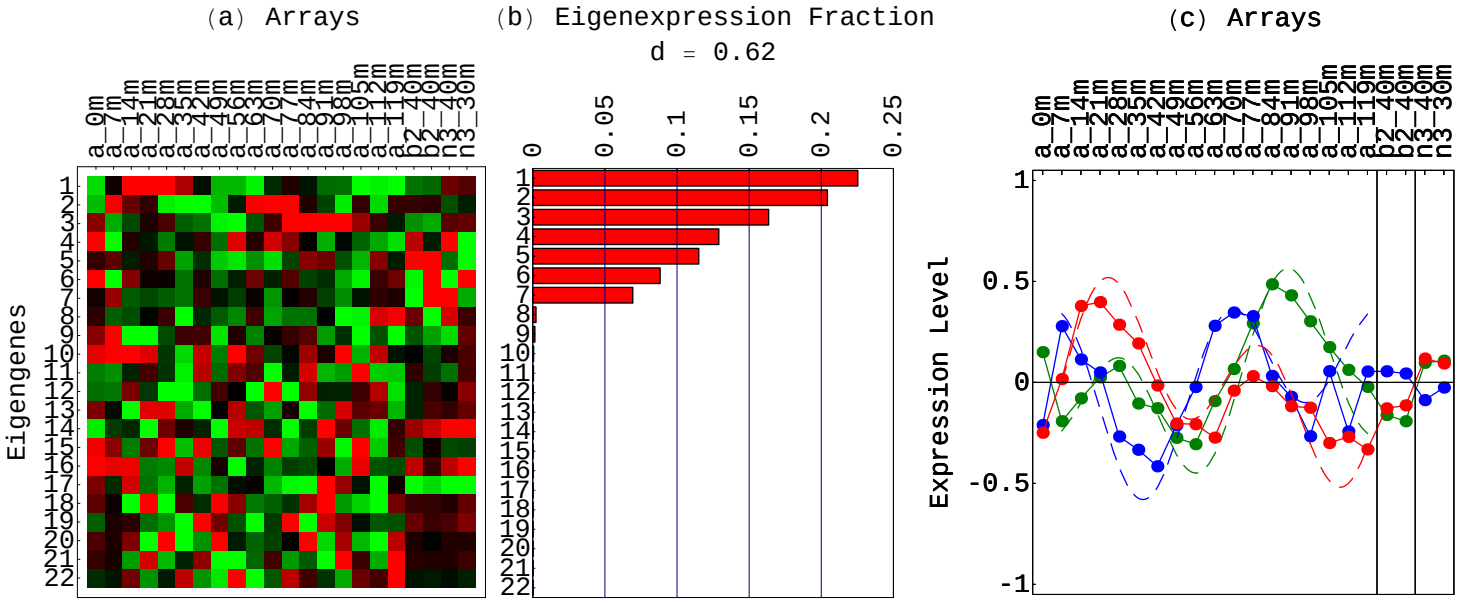
```
p2 = Show[Graphics[{RGBColor[0, 0, 1], Text["  Sqrt[2/T] Cos[4 π t/T] - Sqrt[1/T] Sin[2 π t/T]", {605, 0}]}],
  AspectRatio -> 120 / 750,
  PlotRange -> {{0, 750}, {-1.55, 1.55}}];
```

$$\sqrt{\frac{2}{T}}\cos\left(\frac{4\pi t}{T}\right)-\sqrt{\frac{1}{T}}\sin\left(\frac{2\pi t}{T}\right)$$

```
p3 = Show[Graphics[{RGBColor[0, 0.5, 0], Text["Sqrt[2/T] Sin[4 π t/T - π/4] - Sqrt[1/T] Sin[2 π t/T]", {605, -1}]}],
  AspectRatio -> 120 / 750,
  PlotRange -> {{0, 750}, {-1.55, 1.55}}];
```

$$\sqrt{\frac{2}{T}}\sin\left(\frac{4\pi t}{T}-\frac{\pi}{4}\right)-\sqrt{\frac{1}{T}}\sin\left(\frac{2\pi t}{T}\right)$$

```
(* Display Eigengenes, Fractions, Selected Eigengenes and Formulas *)

Show[GraphicsArray[{g1, g2, g3}],
 GraphicsSpacing -> -0.2];
```




```
Show[{p1, p2, p3},
  AspectRatio -> 120 / 750,
  PlotRange -> {{0, 750}, {-1.55, 1.55}}];
```

$$\sqrt{\frac{2}{T}}\sin\left(\frac{4\pi t}{T}\right)+\sqrt{\frac{1}{T}}\sin\left(\frac{2\pi t}{T}\right)$$

$$\sqrt{\frac{2}{T}}\cos\left(\frac{4\pi t}{T}\right)-\sqrt{\frac{1}{T}}\sin\left(\frac{2\pi t}{T}\right)$$

$$\sqrt{\frac{2}{T}}\sin\left(\frac{4\pi t}{T}-\frac{\pi}{4}\right)-\sqrt{\frac{1}{T}}\sin\left(\frac{2\pi t}{T}\right)$$

```
(* Rotate Eigengenes & Eigenarrays in Degenerate Subspace *)

(* Degenerate Subspace Assumption *)

eigenexpression =
 Sqrt[eigenexpressions[[1]]^2 + eigenexpressions[[2]]^2 + eigenexpressions[[3]]^2] / Sqrt[3];
eigenexpressions[[1]] = eigenexpression;
eigenexpressions[[2]] = eigenexpression;
eigenexpressions[[3]] = eigenexpression;
Clear[eigenexpression];

fractions = eigenexpressions^2 / Sum[eigenexpressions[[a]]^2, {a, 1, arrays}];

(* First Rotation *)

eigenarrays = Transpose[eigenarrays];

Clear[x];
x = x /. NSolve[
   (x * eigengenes[[2, 20]] + Sqrt[1 - x^2] * eigengenes[[1, 20]]) -
    (x * eigengenes[[2, 21]] + Sqrt[1 - x^2] * eigengenes[[1, 21]]) == 0, x][[1]]
```

```
0.869386
```

```
eigengenes1 = Table[eigengenes[[1, a]], {a, 1, arrays}];
eigengenes2 = Table[eigengenes[[2, a]], {a, 1, arrays}];
eigengenes[[2]] = x * eigengenes2 + Sqrt[1 - x^2] * eigengenes1;
eigengenes[[1]] = -Sqrt[1 - x^2] * eigengenes2 + x * eigengenes1;
Clear[eigengenes1, eigengenes2];
eigenarrays1 = Table[eigenarrays[[1, a]], {a, 1, genes}];
eigenarrays2 = Table[eigenarrays[[2, a]], {a, 1, genes}];
eigenarrays[[2]] = x * eigenarrays2 + Sqrt[1 - x^2] * eigenarrays1;
eigenarrays[[1]] = -Sqrt[1 - x^2] * eigenarrays2 + x * eigenarrays1;
Clear[x, eigenarrays1, eigenarrays2];

(* Second Rotation *)

Clear[x];
x = x /. NSolve[
   (x * eigengenes[[1, 20]] + Sqrt[1 - x^2] * eigengenes[[3, 20]]) -
    (x * eigengenes[[1, 21]] + Sqrt[1 - x^2] * eigengenes[[3, 21]]) == 0, x][[1]]
```

```
-0.735103
```

```
eigengenes1 = Table[eigengenes[[1, a]], {a, 1, arrays}];
eigengenes3 = Table[eigengenes[[3, a]], {a, 1, arrays}];
eigengenes[[1]] = Sqrt[1 - x^2] * eigengenes1 - x * eigengenes3;
eigengenes[[3]] = -x * eigengenes1 - Sqrt[1 - x^2] * eigengenes3;
Clear[eigengenes1, eigengenes3];
eigenarrays1 = Table[eigenarrays[[1, a]], {a, 1, genes}];
eigenarrays3 = Table[eigenarrays[[3, a]], {a, 1, genes}];
eigenarrays[[1]] = Sqrt[1 - x^2] * eigenarrays1 - x * eigenarrays3;
eigenarrays[[3]] = -x * eigenarrays1 - Sqrt[1 - x^2] * eigenarrays3;
Clear[x, eigenarrays1, eigenarrays3];

eigenarrays = Transpose[eigenarrays];
```

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

fractions[[1]]
```

```
0.197346
```

```
limit = 0.25;

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, size - sizes[[a]]}],
   {a, 1, 6}];
framex = Table[{gridx[[a]], framex[[a]]}, {a, 1, 6}];
framey = Table[{a + 1, arrays - a}, {a, 0, arrays - 1}];
labelx = ColumnForm[
  {"(b) Eigenexpression Fraction", StringJoin["d = ", ToString[entropy]], " "}, Center];
g = BarChart[
  Table[fractions[[arrays - a]], {a, 0, arrays - 1}],
  BarOrientation -> Horizontal,
  PlotRange -> {{0, limit * 1.0001}, {0.5, arrays + 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 + 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}];
g2 = Show[g,
 AspectRatio -> 1.35,
 PlotRange -> All,
 DisplayFunction -> Identity];
```

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

contrast = 3.5;
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, arrays}, {j, 1, arrays}];
framex = Table[{a - 0.5, arraynames[[2, a]]}, {a, 1, arrays}];
framey = Table[{a + 1 - 0.5, arrays - a}, {a, 0, arrays - 1}];
labely = "Eigengenes";
labelx = ColumnForm[{"(a) Arrays", " ", " "}, Center];
g = Show[
 Graphics[
  RasterArray[
   Table[
    RGBColor[
     displaying[[i, j, 1]], displaying[[i, j, 2]], 0
     ],
    {i, arrays, 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,
 PlotRange -> All,
 DisplayFunction -> Identity];

(* Create Selected Eigengenes Graph Display *)

eigengenes1 = Chop[TrigFit[Drop[Drop[eigengenes[[1]], {19, 22}], {1}], 2, {x - 1, arrays - 5}], 0.1]
eigengenes2 = Chop[TrigFit[Drop[Drop[eigengenes[[2]], {19, 22}], {1}], 2, {x - 1, arrays - 5}], 0.1]
eigengenes3 = Chop[TrigFit[Drop[Drop[eigengenes[[3]], {19, 22}], {1}], 2, {x - 1, arrays - 5}], 0.1]
```

$$-0.18596 \cos\left[\frac{4}{17}\pi(-1+x)\right] + 0.233424 \sin\left[\frac{4}{17}\pi(-1+x)\right]$$

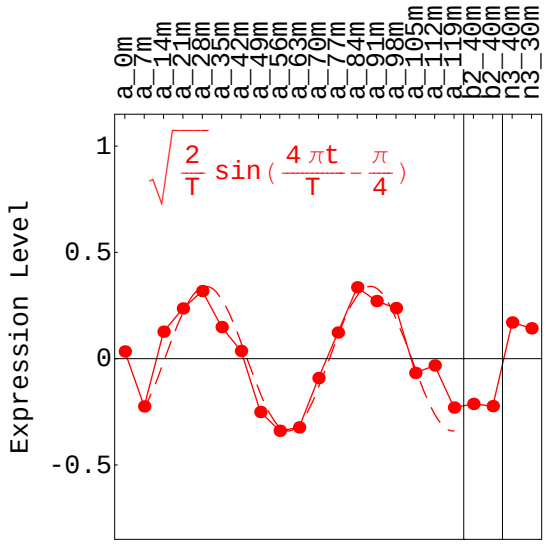
$$0.22261 \cos\left[\frac{4}{17}\pi(-1+x)\right] + 0.204797 \sin\left[\frac{4}{17}\pi(-1+x)\right]$$

$$0.100832 \cos\left[\frac{2}{17}\pi(-1+x)\right] + 0.298157 \sin\left[\frac{2}{17}\pi(-1+x)\right]$$

```
eigengenes1 = 0.34 * Sin[4 * Pi * (x - 1) / 17 - Pi / 4];
eigengenes2 = 0.34 * Cos[4 * Pi * (x - 1) / 17 - Pi / 4];
eigengenes3 = 0.34 * Sin[2 * Pi * (x - 1) / 17 + Pi / 8];
```

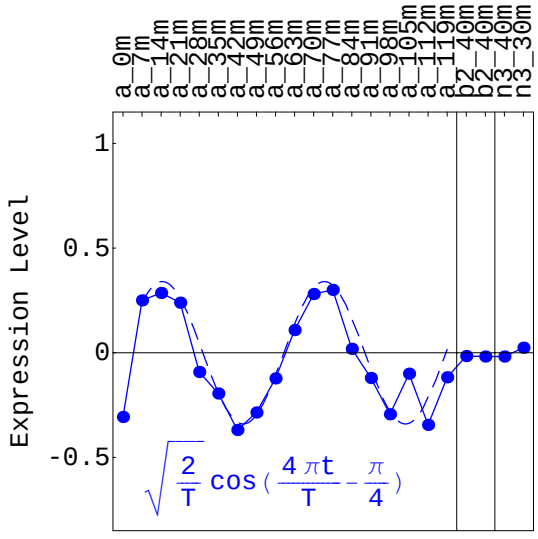
```
graph = Plot[
  eigengenes1,
  {x, 1, arrays - 5},
  PlotStyle -> {RGBColor[1, 0, 0], Dashing[{0.03, 0.02}]},
  DisplayFunction -> Identity];
labelx = ColumnForm[{"(c) Arrays"}, Center];
labely = ColumnForm[{" ", "Expression Level"}, Center];
framex = Table[{a - 1, arraynames[[2, a]]}, {a, 1, arrays}];
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[0.022], points}],
   Graphics[{RGBColor[1, 0, 0], line}],
   graph,
   Graphics[{RGBColor[1, 0, 0], Text["sqrt(2/T) sin(4 π t/T - π/4)", {8, 0.9}]}]},
 Frame -> True,
 FrameLabel -> {None, labely, labelx, None},
 GridLines -> {{{17.5, RGBColor[0, 0, 0]}, {19.5, RGBColor[0, 0, 0]}}, {{0, RGBColor[0, 0, 0]}}},
 FrameTicks -> {None, framey, framex, None},
 PlotRange -> {-0.85, 1.15},
 DisplayFunction -> Identity];
g = FullGraphics[g];
g[[1, 2]] = g[[1, 2]] /.
  Text[labely, {b_, c_}, {1., 0.}] ->
   Text[labely, {b - 5.4, c}, {0, 0}, {0, 1}];
g[[1, 2]] = g[[1, 2]] /.
  Text[labelx, {b_, c_}, {0., -1.}] ->
   Text[labelx, {b, c + 0.625}, {0, -1}, {1, 0}];
g[[1, 2]] = g[[1, 2]] /.
  Text[a_, {b_, c_}, {0., -1.}] ->
   Text[a, {b, c + 0.25}, {0, 0}, {0, 1}];
p1 = Show[g,
  AspectRatio -> 1.05,
  PlotRange -> All];
```

(c) Arrays

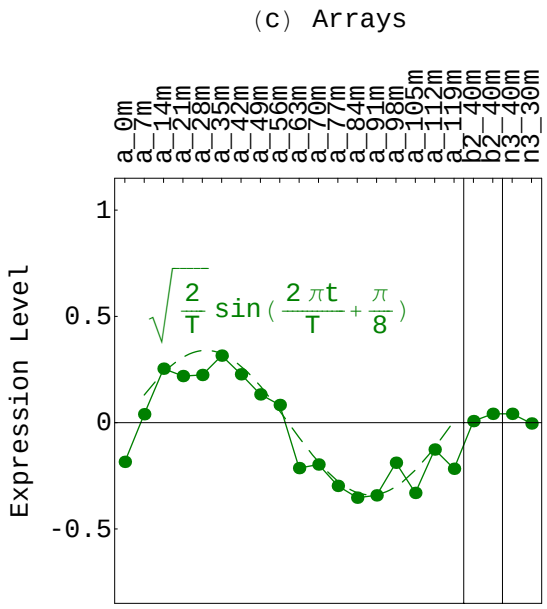


```
graph = Plot[
  eigengenes2,
  {x, 1, arrays - 5},
  PlotStyle -> {RGBColor[0, 0, 1], Dashing[{0.03, 0.02}]},
  DisplayFunction -> Identity];
labelx = ColumnForm[{"(c) Arrays"}, Center];
labely = ColumnForm[{" ", "Expression Level"}, Center];
framex = Table[{a - 1, arraynames[[2, a]]}, {a, 1, arrays}];
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[0.022], points}],
   Graphics[{RGBColor[0, 0, 1], line}],
   graph,
   Graphics[{RGBColor[0, 0, 1], Text["Sqrt[2/T] Cos[4 Pi t/T - Pi/4]", {8, -0.6}]}]},
 Frame -> True,
 FrameLabel -> {None, labely, labelx, None},
 GridLines -> {{{17.5, RGBColor[0, 0, 0]}, {19.5, RGBColor[0, 0, 0]}}, {{0, RGBColor[0, 0, 0]}}},
 FrameTicks -> {None, framey, framex, None},
 PlotRange -> {-0.85, 1.15},
 DisplayFunction -> Identity];
g = FullGraphics[g];
g[[1, 2]] = g[[1, 2]] /.
  Text[labely, {b_, c_}, {1., 0.}] ->
   Text[labely, {b - 5.4, c}, {0, 0}, {0, 1}];
g[[1, 2]] = g[[1, 2]] /.
  Text[labelx, {b_, c_}, {0., -1.}] ->
   Text[labelx, {b, c + 0.625}, {0, -1}, {1, 0}];
g[[1, 2]] = g[[1, 2]] /.
  Text[a_, {b_, c_}, {0., -1.}] ->
   Text[a, {b, c + 0.25}, {0, 0}, {0, 1}];
p2 = Show[g,
  AspectRatio -> 1.05,
  PlotRange -> All];
```

(c) Arrays

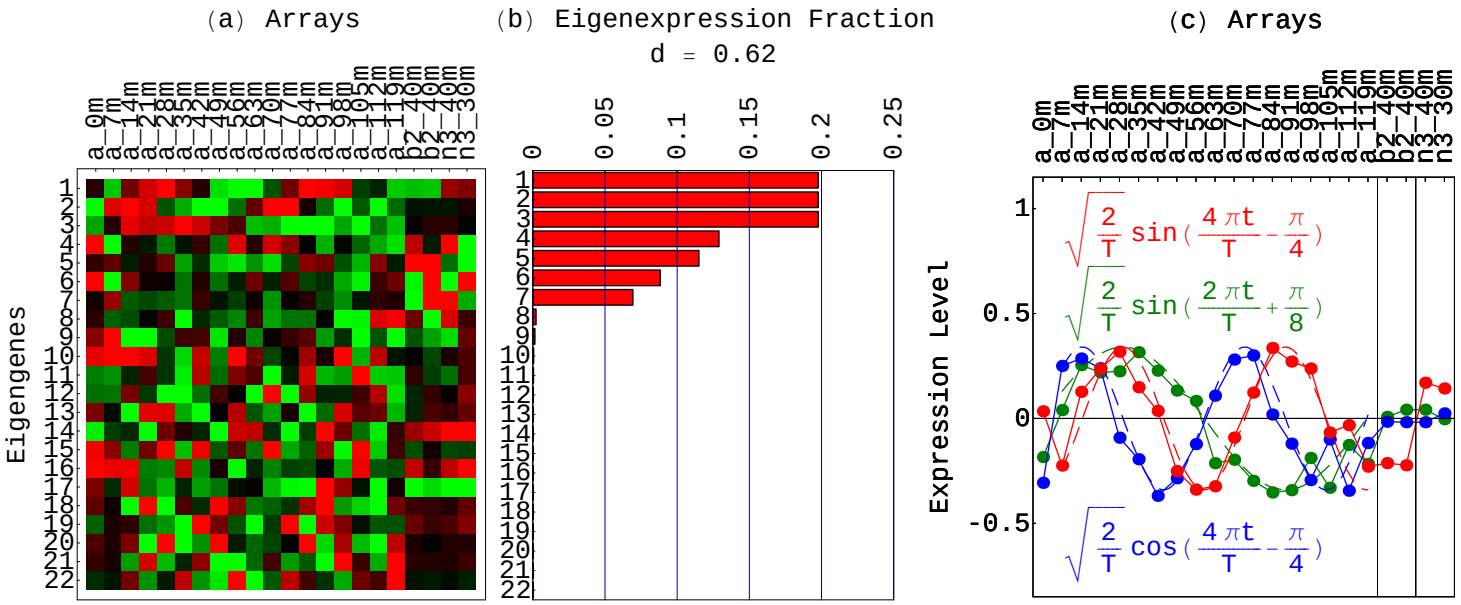


```
graph = Plot[
  eigengenes3,
  {x, 1, arrays - 5},
  PlotStyle -> {RGBColor[0, 0.5, 0], Dashing[{0.03, 0.02}]},
  DisplayFunction -> Identity];
labelx = ColumnForm[{"(c) Arrays"}, Center];
labely = ColumnForm[{" ", "Expression Level"}, Center];
framex = Table[{a - 1, arraynames[[2, a]]}, {a, 1, arrays}];
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[0.022], points}],
   Graphics[{RGBColor[0, 0.5, 0], line}],
   graph,
   Graphics[{RGBColor[0, 0.5, 0], Text["sqrt(2/T) sin(2 π t/T + π/8)", {8, 0.55}]}]},
 Frame -> True,
 FrameLabel -> {None, labely, labelx, None},
 GridLines -> {{{17.5, RGBColor[0, 0, 0]}, {19.5, RGBColor[0, 0, 0]}}, {{0, RGBColor[0, 0, 0]}}},
 FrameTicks -> {None, framey, framex, None},
 PlotRange -> {-0.85, 1.15},
 DisplayFunction -> Identity];
g = FullGraphics[g];
g[[1, 2]] = g[[1, 2]] /.
  Text[labely, {b_, c_}, {1., 0.}] ->
   Text[labely, {b - 5.4, c}, {0, 0}, {0, 1}];
g[[1, 2]] = g[[1, 2]] /.
  Text[labelx, {b_, c_}, {0., -1.}] ->
   Text[labelx, {b, c + 0.625}, {0, -1}, {1, 0}];
g[[1, 2]] = g[[1, 2]] /.
  Text[a_, {b_, c_}, {0., -1.}] ->
   Text[a, {b, c + 0.25}, {0, 0}, {0, 1}];
p3 = Show[g,
  AspectRatio -> 1.05,
  PlotRange -> All];
```




```
(* Display Selected Eigengenes *)

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

```
(* Display Eigengenes, Fractions and Selected Eigengenes *)

Show[GraphicsArray[{g1, g2, g3}],
 GraphicsSpacing -> -0.2];
```




```
(* Reconstruct Data With Rotated Eigengenes and Eigenarrays *)

matrix = Dot[eigenarrays, DiagonalMatrix[eigenexpressions], eigengenes];
arraycorrelations = Dot[DiagonalMatrix[eigenexpressions], eigengenes];
genecorrelations = Dot[eigenarrays, DiagonalMatrix[eigenexpressions]];
genecorrelations = Transpose[genecorrelations];

(* Create Parameter Graphs of Arrays According to Projections on Eigenarrays *)

labelx = ColumnForm[{"Array Correlation with |α₂⟩"}, Center];
labely = ColumnForm[{"Array Correlation with |α₁⟩"}, Center];
matrix = Transpose[matrix];
coordinates = Table[
   {arraycorrelations[[2, a]] / Sqrt[Dot[matrix[[a]], matrix[[a]]]],
    arraycorrelations[[1, a]] / Sqrt[Dot[matrix[[a]], matrix[[a]]]]},
   {a, 1, arrays}];
matrix = Transpose[matrix];
points0 = Point[coordinates[[1]]];
points1 = {Point[coordinates[[2]]], Point[coordinates[[10]]], Point[coordinates[[11]]]};
points2 = {Point[coordinates[[3]]], Point[coordinates[[4]]], Point[coordinates[[12]]],
   Point[coordinates[[13]]], Point[coordinates[[21]]], Point[coordinates[[22]]]};
points3 = {Point[coordinates[[5]]], Point[coordinates[[6]]], Point[coordinates[[14]]],
   Point[coordinates[[15]]]};
points4 = {Point[coordinates[[7]]], Point[coordinates[[16]]], Point[coordinates[[19]]],
   Point[coordinates[[20]]]};
points5 = {Point[coordinates[[8]]], Point[coordinates[[9]]], Point[coordinates[[17]]],
   Point[coordinates[[18]]]};
textcoordinates = coordinates;
Do[textcoordinates[[a, 1]] =
   If[textcoordinates[[a, 1]] > 0, textcoordinates[[a, 1]] + 0.085, textcoordinates[[a, 1]] - 0.085],
  {a, 1, 9}];
Do[textcoordinates[[a, 1]] =
   If[textcoordinates[[a, 1]] > 0, textcoordinates[[a, 1]] + 0.11, textcoordinates[[a, 1]] - 0.11],
  {a, 10, arrays}];
```

```
textcoordinates[[3]] = textcoordinates[[3]] + {0, 0.02};
textcoordinates[[10]] = textcoordinates[[10]] + {-0.22, -0.04};
textcoordinates[[12]] = textcoordinates[[12]] + {-0.22, -0.04};
textcoordinates[[15]] = textcoordinates[[15]] + {0, -0.08};
textcoordinates[[17]] = textcoordinates[[17]] + {0.1, -0.1};
texts = Table[Text[a, textcoordinates[[a]]], {a, 1, arrays}];
zerophase = N[ArcTan[arraycorrelations[[1, 2]] / (arraycorrelations[[2, 2]])]];
radius = Sqrt[coordinates[[2, 1]]^2 + coordinates[[2, 2]]^2];
p = Show[{
  Graphics[{RGBColor[0, 0, 0], PointSize[0.035], points0}],
  Graphics[{RGBColor[1, 1, 0], PointSize[0.035], points1}],
  Graphics[{RGBColor[0, 0.5, 0], PointSize[0.035], points2}],
  Graphics[{RGBColor[0, 0, 1], PointSize[0.035], points3}],
  Graphics[{RGBColor[1, 0, 0], PointSize[0.035], points4}],
  Graphics[{RGBColor[1, 0.5, 0], PointSize[0.035], points5}],
  Graphics[{RGBColor[1, 0.5, 0], Text["G2/M", {-0.6, -0.95}]}],
  Graphics[{RGBColor[0, 0, 0], Text["M/G1", {0.875, -0.775}]}],
  Graphics[{RGBColor[1, 0, 0], Text["S/G2", {-0.875, -0.75}]}],
  Graphics[{RGBColor[0, 0, 1], Text["S", {-0.8, 0.8}]}],
  Graphics[{RGBColor[0, 0.5, 0], Text["G1", {0.55, 0.95}]}],
  Graphics[{RGBColor[0, 0, 0], Text["(a)", {-0.9, 0.95}]}],
  Graphics[texts],
  Graphics[{RGBColor[0, 0, 0], Arrow[{0.675, -0.875}, {0.04, -0.395},
      HeadCenter -> 0.5, HeadLength -> 0.035, HeadWidth -> 0.75]}],
  Graphics[{RGBColor[0, 0, 0], Text["CLB2", {0.75, -0.95}]}],
  Graphics[{RGBColor[0, 0, 0], Arrow[{0.665, 0.8}, {0.03, 0.325},
      HeadCenter -> 0.5, HeadLength -> 0.035, HeadWidth -> 0.75]}],
  Graphics[{RGBColor[0, 0, 0], Text["CLN3", {0.85, 0.8}]}],
  Graphics[{RGBColor[0, 0, 0], Dashing[{0.03, 0.02}], Circle[{0, 0}, 0.5, {0.5*Pi, 1.5*Pi}]}],
  Graphics[{RGBColor[0, 0, 0], Dashing[{0.03, 0.02}], Circle[{0, 0}, 1]}],
  Graphics[{RGBColor[0, 0, 0], Circle[{0, 0}, radius, {zerophase, 0}]}],
  Graphics[{RGBColor[0, 0, 0], Arrow[
     {radius*Cos[-0.05], radius*Sin[-0.05]}, {radius*Cos[0], radius*Sin[0]},
     HeadCenter -> 0.5, HeadLength -> 0.035, HeadWidth -> 0.75]}],
  Graphics[{RGBColor[0, 0, 0], Circle[{0, 0}, 0.925, {zerophase, -0.5*zerophase}]}],
  Graphics[{RGBColor[0, 0, 0], Arrow[
      {0.925*Cos[-0.5*zerophase - 0.05], 0.925*Sin[-0.5*zerophase - 0.05]},
      {0.925*Cos[-0.5*zerophase], 0.925*Sin[-0.5*zerophase]},
      HeadCenter -> 0.5, HeadLength -> 0.035, HeadWidth -> 0.75]}],
  Graphics[{RGBColor[0, 0, 0], Arrow[{0, 0}, coordinates[[2]],
      HeadCenter -> 0.5, HeadLength -> 0.035, HeadWidth -> 0.75]}],
  Graphics[{RGBColor[0, 0, 0], Text["r", {0.2, -0.3}]}],
  Graphics[{RGBColor[0, 0, 0], Text["π/4", {0.4, -0.15}]}]},
 AspectRatio -> 1,
 PlotRange -> {{-1.05, 1.05}, {-1.05, 1.05}},
 Frame -> True,
 FrameTicks -> False,
 FrameLabel -> {labelx, labely, None, None},
 GridLines -> {{{0, RGBColor[0, 0, 0]}}, {{0, RGBColor[0, 0, 0]}}},
 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];
```

```
(* Create Parameter Graphs of Genes According to Projections on Eigengenes *)

labelx = ColumnForm[{"Gene Correlation with |γ2⟩"}, Center];
labely = ColumnForm[{"Gene Correlation with |γ1⟩"}, Center];
coordinates = Table[
  {genecorrelations[[2, a]] / Sqrt[Dot[matrix[[a]], matrix[[a]]]],
   genecorrelations[[1, a]] / Sqrt[Dot[matrix[[a]], matrix[[a]]]]},
  {a, 1, genes}];
points = Table[Point[coordinates[[a]]],  {a, 1, genes}];
stream = StringJoin[name, ":Desktop Folder:PNAS Data:Classify_Alpha&Cls.txt"];
list = ReadList[stream, Word, RecordLists -> True, NullWords -> True];
list = Drop[list, 2];

position = Position[list, "M/G1"];
points1 = Table[Point[coordinates[[position[[a, 1]]]]], {a, 1, Dimensions[position][[1]]}];
radii1 = Table[Sqrt[coordinates[[position[[a, 1]], 1]]^2 + coordinates[[position[[a, 1]], 2]]^2],
   {a, 1, Dimensions[position][[1]]}];
Dimensions[points1][[1]]
position = Position[list, "G1"];
points2 = Table[Point[coordinates[[position[[a, 1]]]]], {a, 1, Dimensions[position][[1]]}];
radii2 = Table[Sqrt[coordinates[[position[[a, 1]], 1]]^2 + coordinates[[position[[a, 1]], 2]]^2],
   {a, 1, Dimensions[position][[1]]}];
Dimensions[points2][[1]]
position = Position[list, "S"];
points3 = Table[Point[coordinates[[position[[a, 1]]]]], {a, 1, Dimensions[position][[1]]}];
radii3 = Table[Sqrt[coordinates[[position[[a, 1]], 1]]^2 + coordinates[[position[[a, 1]], 2]]^2],
   {a, 1, Dimensions[position][[1]]}];
Dimensions[points3][[1]]
position = Position[list, "S/G2"];
points4 = Table[Point[coordinates[[position[[a, 1]]]]], {a, 1, Dimensions[position][[1]]}];
radii4 = Table[Sqrt[coordinates[[position[[a, 1]], 1]]^2 + coordinates[[position[[a, 1]], 2]]^2],
   {a, 1, Dimensions[position][[1]]}];
Dimensions[points4][[1]]
position = Position[list, "G2/M"];
points5 = Table[Point[coordinates[[position[[a, 1]]]]], {a, 1, Dimensions[position][[1]]}];
radii5 = Table[Sqrt[coordinates[[position[[a, 1]], 1]]^2 + coordinates[[position[[a, 1]], 2]]^2],
   {a, 1, Dimensions[position][[1]]}];
Dimensions[points5][[1]]
```

```
87
```

```
238
```

```
54
```

```
95
```

```
164
```

```
radii = AppendRows[{radii1}, {radii2}, {radii3}, {radii4}, {radii5}][[1]];
radii = Sort[radii, OrderedQ[{#1}, {#2}]&];
N[Round[radii[[94]] * 100] / 100]
N[Round[radii[[95]] * 100] / 100]
```

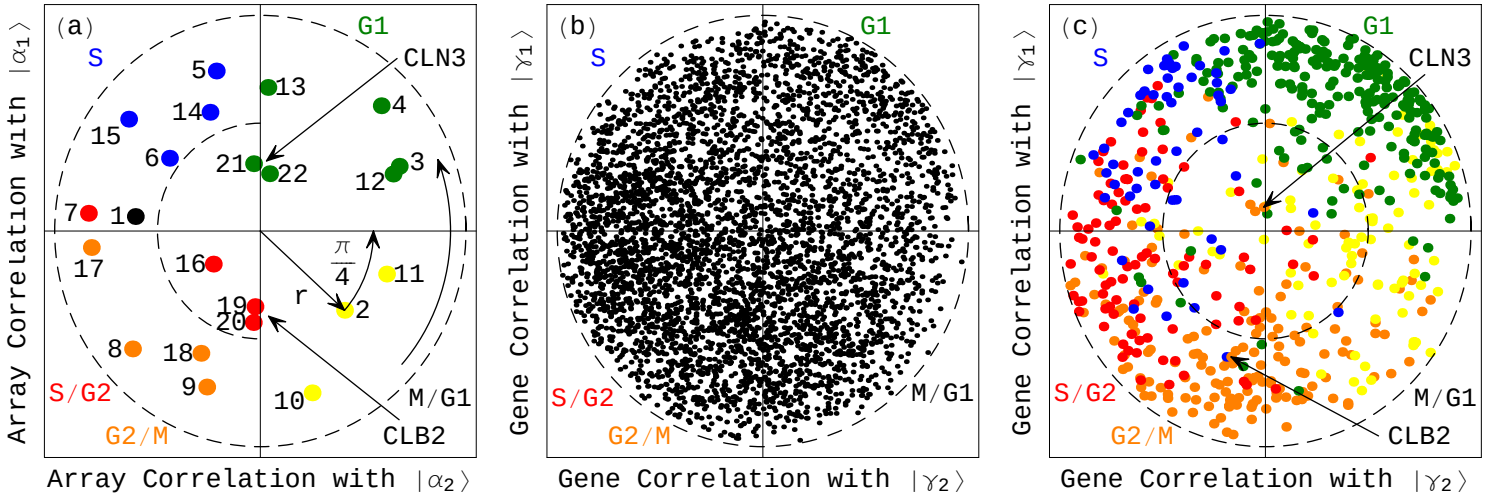
```
0.49
```

```
0.5
```

```
(* 638 cell cycle genes, 87 in M/G1, 238 in G1, 54 in S, 95 in S/G2, 164 in G2/M. *)

(* 544 with more than 25% of normalized expression in the cell cycle subspace. *)
```

```
p = Show[{
  Graphics[{RGBColor[0, 0, 0], PointSize[0.01], points}],
  Graphics[{RGBColor[1, 0.5, 0], Text["G2/M", {-0.6, -0.95}]}],
  Graphics[{RGBColor[0, 0, 0], Text["M/G1", {0.875, -0.75}]}],
  Graphics[{RGBColor[1, 0, 0], Text["S/G2", {-0.875, -0.775}]}],
  Graphics[{RGBColor[0, 0, 1], Text["S", {-0.8, 0.8}]}],
  Graphics[{RGBColor[0, 0.5, 0], Text["G1", {0.55, 0.95}]}],
  Graphics[{RGBColor[0, 0, 0], Text["(b)", {-0.9, 0.95}]}],
  Graphics[{RGBColor[0, 0, 0], Dashing[{0.03, 0.025}], Circle[{0, 0}, 1]}]},
 AspectRatio -> 1,
 PlotRange -> {{-1.05, 1.05}, {-1.05, 1.05}},
 Frame -> True,
 FrameTicks -> False,
 FrameLabel -> {labelx, labely, None, None},
 GridLines -> {{{0, RGBColor[0, 0, 0]}}, {{0, RGBColor[0, 0, 0]}}},
 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];

clb2 = coordinates[[Position[list, "YPR119W"][[1, 1]]]];
cln3 = coordinates[[Position[list, "YAL040C"][[1, 1]]]];
p = Show[{
  Graphics[{RGBColor[1, 0.5, 0], PointSize[0.02], points5}],
  Graphics[{RGBColor[1, 1, 0], PointSize[0.02], points1}],
  Graphics[{RGBColor[1, 0, 0], PointSize[0.02], points4}],
  Graphics[{RGBColor[0, 0.5, 0], PointSize[0.02], points2}],
  Graphics[{RGBColor[0, 0, 1], PointSize[0.02], points3}],
  Graphics[{RGBColor[1, 0.5, 0], Text["G2/M", {-0.6, -0.95}]}],
  Graphics[{RGBColor[0, 0, 0], Text["M/G1", {0.875, -0.775}]}],
  Graphics[{RGBColor[1, 0, 0], Text["S/G2", {-0.875, -0.75}]}],
  Graphics[{RGBColor[0, 0, 1], Text["S", {-0.8, 0.8}]}],
  Graphics[{RGBColor[0, 0.5, 0], Text["G1", {0.55, 0.95}]}],
  Graphics[{RGBColor[0, 0, 0], Text["(c)", {-0.9, 0.95}]}],
  Graphics[{RGBColor[1, 0.5, 0], PointSize[0.02], Point[clb2]}],
  Graphics[{RGBColor[0, 0, 0], Arrow[{0.55, -0.95}, clb2,
      HeadCenter -> 0.5, HeadLength -> 0.035, HeadWidth -> 0.75]}],
  Graphics[{RGBColor[0, 0, 0], Text["CLB2", {0.75, -0.95}]}],
  Graphics[{RGBColor[1, 0.5, 0], PointSize[0.02], Point[cln3]}],
  Graphics[{RGBColor[0, 0, 0], Arrow[{0.775, 0.725}, cln3,
      HeadCenter -> 0.5, HeadLength -> 0.035, HeadWidth -> 0.75]}],
  Graphics[{RGBColor[0, 0, 0], Text["CLN3", {0.85, 0.8}]}],
  Graphics[{RGBColor[0, 0, 0], Dashing[{0.03, 0.02}], Circle[{0, 0}, 0.5]}],
  Graphics[{RGBColor[0, 0, 0], Dashing[{0.03, 0.02}], Circle[{0, 0}, 1]}]},
 AspectRatio -> 1,
 PlotRange -> {{-1.05, 1.05}, {-1.05, 1.05}},
 Frame -> True,
 FrameTicks -> False,
 FrameLabel -> {labelx, labely, None, None},
 GridLines -> {{{0, RGBColor[0, 0, 0]}}, {{0, RGBColor[0, 0, 0]}}},
 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 Both Arrays & Genes Parameter Graphs *)

Show[GraphicsArray[{p1, p2, p3}],
 GraphicsSpacing -> 0];
```




```
(* Sort Normalized Data *)
```

```
(* Define the Initial Phase According to the Initial Array *)

zerophase = N[ArcTan[arraycorrelations[[1, 2]] / (arraycorrelations[[2, 2]])] / Pi]
```

```
-0.232818
```

```
(* Sort Data by Phase *)

radii = Table[Sqrt[coordinates[[a, 1]]^2 + coordinates[[a, 2]]^2], {a, 1, genes}];
coordinates = Table[
  {-genecorrelations[[2, a]] / Sqrt[genecorrelations[[1, a]]^2 + genecorrelations[[2, a]]^2],
   -genecorrelations[[1, a]] / Sqrt[genecorrelations[[1, a]]^2 + genecorrelations[[2, a]]^2],
   N[ArcTan[genecorrelations[[1, a]] / (genecorrelations[[2, a]])] / Pi],
   radii[[a]]},
  {a, 1, genes}];
sortmatrix = AppendRows[coordinates, genenames, matrix];
sortmatrix = Sort[sortmatrix, OrderedQ[{{#1}, {#2}}]&];
negative1 = 1913;
positive1 = 1914;
sortmatrix[[negative1, 1]]
sortmatrix[[positive1, 1]]
```

```
-0.000990132
```

```
0.000695258
```

```
sortmatrix = Transpose[Drop[Transpose[sortmatrix], {1}]];
sortmatrix = AppendColumns[
  Sort[
   TakeRows[sortmatrix, {1, negative1}],
    OrderedQ[{{#2}, {#1}}]&],
  Sort[
   TakeRows[sortmatrix, {positive1, genes}],
    OrderedQ[{{#1}, {#2}}]&]
  ];
sortmatrix = Transpose[Drop[Transpose[sortmatrix], {1}]];
```

```
(* Correct for the Phase & Calibrate According to the Initial Phase *)

Do[sortmatrix[[a, 1]] = sortmatrix[[a, 1]] - zerophase,
 {a, 1, negative1}];
Do[sortmatrix[[a, 1]] = sortmatrix[[a, 1]] + 1 - zerophase,
 {a, positive1, genes}];
negative2 = 620;
positive2 = 621;
sortmatrix[[negative2, 1]]
sortmatrix[[positive2, 1]]
```

```
-0.000297782
```

```
0.00017983
```

```
sortmatrix = AppendColumns[
  TakeRows[sortmatrix, {positive2, genes}],
  TakeRows[sortmatrix, {1, negative2}]
  ];
positive3 = 3959;
negative3 = 3960;
sortmatrix[[positive3, 1]]
sortmatrix[[negative3, 1]]
```

```
1.7326
```

```
-0.266866
```

```
Do[sortmatrix[[a, 1]] = sortmatrix[[a, 1]] + 2,
 {a, negative3, genes}];

(* Reconstruct Data With Sorted Genes *)

matrix = TakeColumns[sortmatrix, {4, arrays + 3}];
eigenarrays = Dot[eigengenes, Transpose[matrix]];
Do[
 eigenarrays[[a]] = eigenarrays[[a]] / eigenexpressions[[a]],
 {a, 1, arrays}];
eigenarrays = Transpose[eigenarrays];
arraycorrelations = Dot[DiagonalMatrix[eigenexpressions], eigengenes];
genecorrelations = Dot[eigenarrays, DiagonalMatrix[eigenexpressions]];
genecorrelations = Transpose[genecorrelations];
```

```
(* Classify Gene Phases into Cell Cycle Phases *)

phases = TakeColumns[sortmatrix, {1, 1}];
ph1 = -zerophase;
ph2 = 0.5 - zerophase;
ph3 = 1 - zerophase;
ph4 = 1.25 - zerophase;
ph5 = 1.5 - zerophase;

endph5 = 400;
beginph1 = 401;
phases[[endph5]] - ph1
phases[[beginph1]] - ph1
```

```
{-0.000187677}
```

```
{0.000212016}
```

```
endph1 = 1293;
beginph2 = 1294;
phases[[endph1]] - ph2
phases[[beginph2]] - ph2
```

```
{-0.00100573}
```

```
{0.000373599}
```

```
endph2 = 2489;
beginph3 = 2490;
phases[[endph2]] - ph3
phases[[beginph3]] - ph3
```

```
{-0.000678895}
```

```
{0.0000777914}
```

```
endph3 = 3296;
beginph4 = 3297;
phases[[endph3]] - ph4
phases[[beginph4]] - ph4
```

```
{-0.000102043}
```

```
{0.0000380196}
```

```
endph4 = 3959;
beginph5 = 3960;
phases[[endph4]] - ph5
phases[[beginph5]] - ph5
```

```
{-0.000221307}
```

```
{0.000315169}
```

```
(* 4579 yeast genes, 1020 in M/G1, 893 in G1, 1196 in S, 807 in S/G2, 663 in G2/M. *)
```

```
(* Create Classified Sorted Data 2 D Red & Green Raster Display *)

contrast = 2;
displaying = Table[
  If[contrast * matrix[[i, j]] > 0,
   If[contrast * matrix[[i, j]] < 1, {contrast * matrix[[i, j]], 0}, {1, 0}],
   If[contrast * matrix[[i, j]] > -1, {0, -contrast * matrix[[i, j]]}, {0, 1}]],
  {i, 1, genes}, {j, 1, arrays}];
framex = Table[{a - 0.5, arraynames[[2, a]]}, {a, 1, arrays}];
framey = {
 {genes - endph5 / 2, "M/G1"},
 {genes - (endph5 + endph1) / 2, "G1"},
 {genes - (endph1 + endph2) / 2, "S"},
 {genes - (endph2 + endph3) / 2, "S/G2"},
 {genes - (endph3 + endph4) / 2, "G2/M"},
 {(genes - endph4) / 2, "M/G1"}};
gridy = {
  {genes - endph1 + 0.5, {RGBColor[0, 0, 0]}},
  {genes - endph2 + 0.5, {RGBColor[0, 0, 0]}},
  {genes - endph3 + 0.5, {RGBColor[0, 0, 0]}},
  {genes - endph4 + 0.5, {RGBColor[0, 0, 0]}},
  {genes - endph5 + 0.5, {RGBColor[0, 0, 0]}}};
labelx = "(a) Arrays";
labely = ColumnForm[{" ", "Genes", " ", " ", " ", " ", " ", " "}, Center];
g = Show[
 Graphics[
  RasterArray[
   Table[
    RGBColor[
     displaying[[i, j, 1]], displaying[[i, j, 2]], 0
     ],
    {i, genes, 1, -1}, {j, 1, arrays}
   ]]],
 AspectRatio -> 1,
 Frame -> True,
 FrameTicks -> {None, framey, framex, None},
 FrameLabel -> {None, labely, labelx, None},
 GridLines -> {None, gridy},
 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[a_, {b_, c_}, {1., 0.}] ->
   Text[a, {b - 1.5, c}, {0, 0}, {0, 1}];
g[[1, 2]] = g[[1, 2]] /.
  Text[labelx, {b_, c_}, {0., -1.}] ->
   Text[labelx, {b, c + 800}, {0, -1}, {1, 0}];
g[[1, 2]] = g[[1, 2]] /.
  Text[a_, {b_, c_}, {0., -1.}] ->
   Text[a, {b, c + 350}, {0, 0}, {0, 1}];
g1 = Show[g,
 AspectRatio -> GoldenRatio * 1.15,
 PlotRange -> All,
 DisplayFunction -> Identity];
```

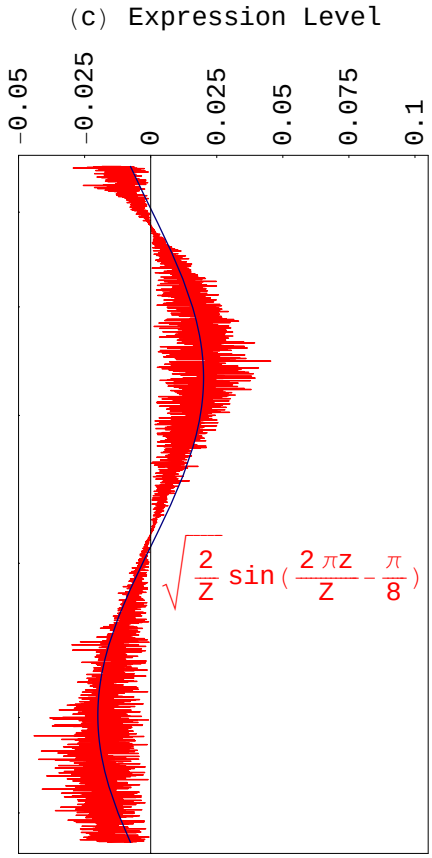
```
(* Create Classified Sorted Eigenarrays 2 D Red & Green Raster Display *)

contrast = 50;
displaying = Table[
  If[contrast * eigenarrays[[i, j]] > 0,
   If[contrast * eigenarrays[[i, j]] < 1, {contrast * eigenarrays[[i, j]], 0}, {1, 0}],
   If[contrast * eigenarrays[[i, j]] > -1, {0, -contrast * eigenarrays[[i, j]]}, {0, 1}]],
  {i, 1, genes}, {j, 1, arrays}];
labelx = "(b) Eigenarrays";
labely = ColumnForm[{" ", " ", " ", " ", " ", " ", " ", " ", " "}, Center];
framex = Table[{a - 0.5, ToString[a]}, {a, 1, arrays}];
sizes = Flatten[
  Table[
   Dimensions[
    Characters[
     framex[[a, 2]]]], {a, 1, arrays}]];
Do[
 Do[framex[[a, 2]] = StringJoin[framex[[a, 2]], " "],
    {b, 1, size - sizes[[a]]}],
   {a, 1, arrays}];
framey = {
 {genes - endph5 / 2, "    ", 0},
 {genes - (endph5 + endph1) / 2, "  ", 0},
 {genes - (endph1 + endph2) / 2, " ", 0},
 {genes - (endph2 + endph3) / 2, "    ", 0},
 {genes - (endph3 + endph4) / 2, "    ", 0},
 {(genes - endph4) / 2, "    ", 0}};
gridy = {
  {genes - endph1 + 0.5, {RGBColor[0, 0, 0]}},
  {genes - endph2 + 0.5, {RGBColor[0, 0, 0]}},
  {genes - endph3 + 0.5, {RGBColor[0, 0, 0]}},
  {genes - endph4 + 0.5, {RGBColor[0, 0, 0]}},
  {genes - endph5 + 0.5, {RGBColor[0, 0, 0]}}};
g = Show[
 Graphics[
  RasterArray[
   Table[
    RGBColor[
     displaying[[i, j, 1]], displaying[[i, j, 2]], 0
     ],
    {i, genes, 1, -1}, {j, 1, arrays}
   ]]],
 AspectRatio -> 1,
 Frame -> True,
 FrameTicks -> {None, framey, framex, None},
 FrameLabel -> {None, labely, labelx, None},
 GridLines -> {None, gridy},
 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[a_, {b_, c_}, {1., 0.}] ->
   Text[a, {b - 1.5, c}, {0, 0}, {0, 1}];
g[[1, 2]] = g[[1, 2]] /.
  Text[labelx, {b_, c_}, {0., -1.}] ->
   Text[labelx, {b, c + 800}, {0, -1}, {1, 0}];
g[[1, 2]] = g[[1, 2]] /.
  Text[a_, {b_, c_}, {0., -1.}] ->
   Text[a, {b, c + 350}, {0, 0}, {0, 1}];
g2 = Show[g,
 AspectRatio -> GoldenRatio * 1.15,
 PlotRange -> All,
 DisplayFunction -> Identity];
```

```
(* Create Classified Selected Eigenarrays Graph Display *)

eigenarrays = Transpose[eigenarrays];

eigenarrays1 = Chop[TrigFit[eigenarrays[[1]], 1, {x, genes - 1}], 0.0025]
eigenarrays2 = Chop[TrigFit[eigenarrays[[2]], 1, {x, genes - 1}], 0.003]
```

$$-0.00813596\,\text{Cos}\left[\frac{\pi x}{2289}\right] + 0.0172082\,\text{Sin}\left[\frac{\pi x}{2289}\right]$$

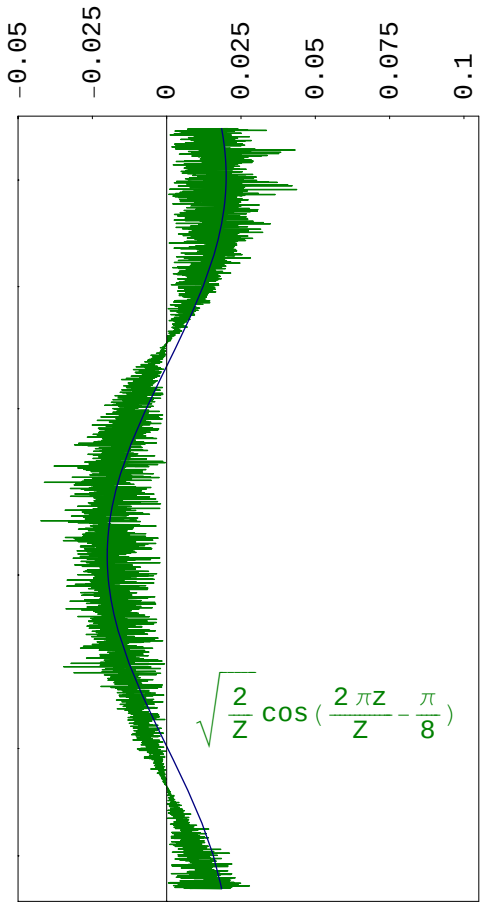
$$0.0172443\,\text{Cos}\left[\frac{\pi x}{2289}\right] + 0.00788086\,\text{Sin}\left[\frac{\pi x}{2289}\right]$$

```
eigenarrays1 = 0.02 * Sin[Pi * x / 2289 - Pi / 8];
eigenarrays2 = 0.02 * Cos[Pi * x / 2289 - Pi / 8];

graph = ParametricPlot[{eigenarrays1, -x},
  {x, genes - 1, 0},
  PlotStyle -> {RGBColor[0, 0, 0.5]},
  DisplayFunction -> Identity];
labelx = "(c) Expression Level";
labely = ColumnForm[{" ", " ", " ", " ", " ", " ", " ", " ", " "}, Center];
framex = {
  {-0.05, "-0.05 "}, {-0.025, "-0.025"}, {0, "0      "},
  {0.025, "0.025 "}, {0.05, "0.05  "}, {0.075, "0.075 "}, {0.1, "0.1   "}};
framey = {
 {-genes + endph5 / 2, "     ", 0},
 {-genes + (endph5 + endph1) / 2, "   ", 0},
 {-genes + (endph1 + endph2) / 2, " ", 0},
 {-genes + (endph2 + endph3) / 2, "     ", 0},
 {-genes + (endph3 + endph4) / 2, "     ", 0},
 {-(genes - endph4) / 2, "     ", 0}};
coordinates = Table[{eigenarrays[[1, a]], -a + 1},  {a, 1, genes}];
line = Line[coordinates];
g = Show[
  {Graphics[{RGBColor[1, 0, 0], line}],
   graph,
   Graphics[{RGBColor[1, 0, 0], Text["√(2/Z) sin(2πz/Z - π/8)", {0.054, -2750}]}]},
 Frame -> True,
 FrameLabel -> {None, labely, labelx, None},
 FrameTicks -> {None, framey, framex, None},
 GridLines -> {{{0, RGBColor[0, 0, 0]}}, None},
 AspectRatio -> GoldenRatio * 1.15,
 PlotRange -> {{-0.05, 0.105}, {75, -genes + 1 - 75}},
 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[a_, {b_, c_}, {1., 0.}] ->
   Text[a, {b - 0.01, c}, {0, 0}, {0, 1}];
g[[1, 2]] = g[[1, 2]] /.
  Text[labelx, {b_, c_}, {0., -1.}] ->
   Text[labelx, {b, c + 800}, {0, -1}, {1, 0}];
g[[1, 2]] = g[[1, 2]] /.
  Text[a_, {b_, c_}, {0., -1.}] ->
   Text[a, {b, c + 350}, {0, 0}, {0, 1}];
p1 = Show[g,
 AspectRatio -> GoldenRatio * 1.15,
 PlotRange -> All];
```


(c) Expression Level
−0.05
−0.025
0
0.025
0.05
0.075
0.1
$\sqrt{\frac{2}{z}}\sin\left(\frac{2\pi z}{z}-\frac{\pi}{8}\right)$

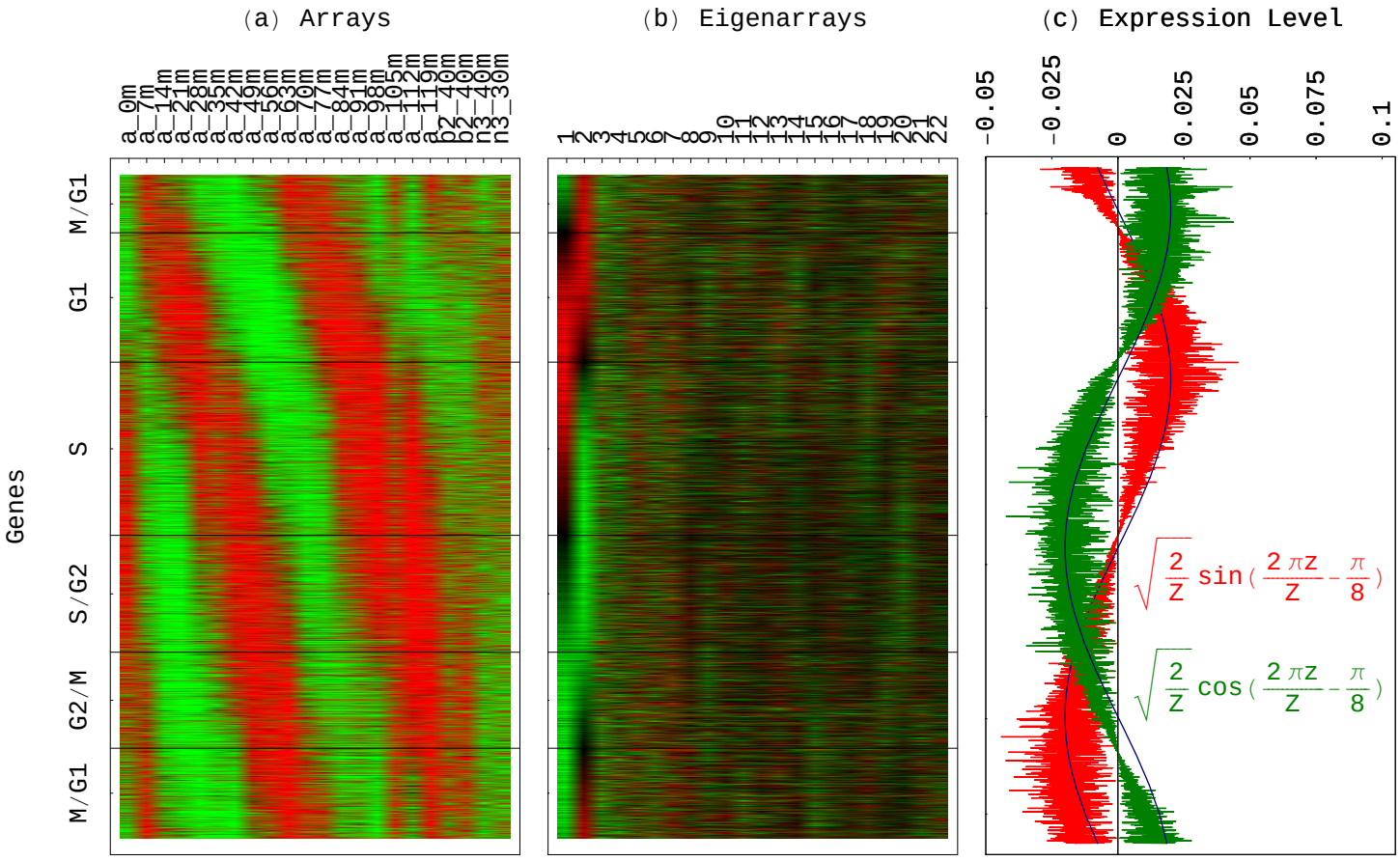
```
graph = ParametricPlot[{eigenarrays2, -x},
  {x, 0, genes - 1},
  PlotStyle -> {RGBColor[0, 0, 0.5]},
  DisplayFunction -> Identity];
labelx = "(c) Expression Level";
labely = ColumnForm[{" ", " ", " ", " ", " "}, Center];
framex = {
  {-0.05, "-0.05 "}, {-0.025, "-0.025"}, {0, "0     "},
  {0.025, "0.025 "}, {0.05, "0.05  "}, {0.075, "0.075 "}, {0.1, "0.1   "}};
framey = {
 {-genes + endph5 / 2, "    ", 0},
 {-genes + (endph5 + endph1) / 2, "  ", 0},
 {-genes + (endph1 + endph2) / 2, " ", 0},
 {-genes + (endph2 + endph3) / 2, "    ", 0},
 {-genes + (endph3 + endph4) / 2, "    ", 0},
 {-(genes - endph4) / 2, "    ", 0}};
coordinates = Table[{eigenarrays[[2, a]], -a + 1},  {a, 1, genes}];
line = Line[coordinates];
g = Show[
  {Graphics[{RGBColor[0, 0.5, 0], line}],
   graph,
   Graphics[{RGBColor[0, 0.5, 0], Text["√(2/Z) cos(2πZ/Z - π/8)", {0.054, -3500}]}]},
 Frame -> True,
 FrameLabel -> {None, labely, labelx, None},
 FrameTicks -> {None, framey, framex, None},
 GridLines -> {{{0, RGBColor[0, 0, 0]}}, None},
 AspectRatio -> GoldenRatio * 1.15,
 PlotRange -> {{-0.05, 0.105}, {75, -genes + 1 - 75}},
 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[a_, {b_, c_}, {1., 0.}] ->
   Text[a, {b - 0.01, c}, {0, 0}, {0, 1}];
g[[1, 2]] = g[[1, 2]] /.
  Text[labelx, {b_, c_}, {0., -1.}] ->
   Text[labelx, {b, c + 800}, {0, -1}, {1, 0}];
g[[1, 2]] = g[[1, 2]] /.
  Text[a_, {b_, c_}, {0., -1.}] ->
   Text[a, {b, c + 350}, {0, 0}, {0, 1}];
p2 = Show[g,
 AspectRatio -> GoldenRatio * 1.15,
 PlotRange -> All];
```

(c) Expression Level




```
(* Display Classified Selected Sorted Eigenarrays *)

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

```
(* Display Classified Sorted Data, Eigenarrays and Selected Eigenarrays *)

Show[GraphicsArray[{g1, g2, g3}],
 GraphicsSpacing -> -0.225];
```




```
(* Save Sorted Rotated Normalized Data in Sort_Data.txt *)

sortmatrix = AppendRows[
  Table[{a}, {a, 1, genes}],
  N[Round[TakeColumns[sortmatrix, {1, 2}] * 1000] / 1000],
  TakeColumns[sortmatrix, {3, 3}],
  N[Round[TakeColumns[sortmatrix, {4, arrays + 3}] * 100000] / 100000]];
sortmatrix = AppendColumns[
  AppendRows[{{" ", " ", " ", " "}, {" ", "Phase", "Radius", "UID"}}, arraynames],
  sortmatrix];
stream = OpenWrite[
  StringJoin[name, ":Desktop Folder:PNAS Data:Sort_Alpha&Cls.nb"],
  PageWidth -> Infinity];
Write[
 stream,
 OutputForm[
  TableForm[sortmatrix, TableSpacing -> {0, 1}]
 ]];
Close[stream];
Clear[sortmatrix];
```

```
(* Summarize Alpha Factor & CLB2 & CLN3 Analysis *)
```

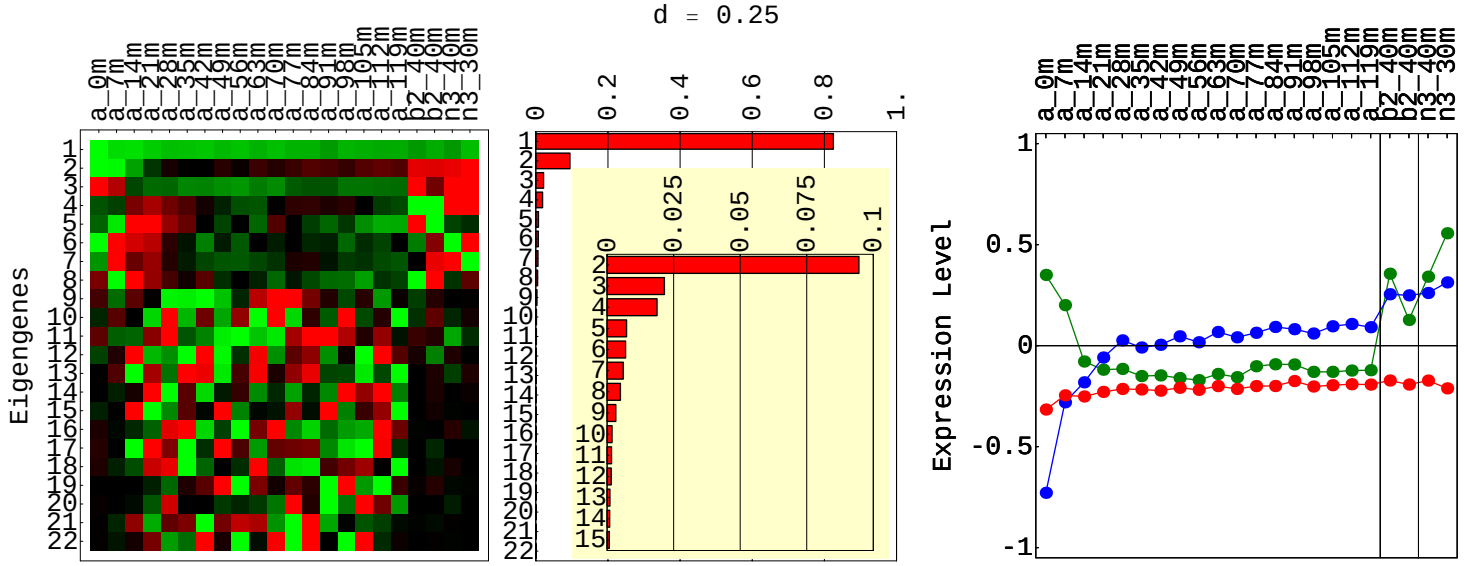
```
(* Centering by Removing the Additive Constant, i.e., the Steady State *)
```

(a) Arrays

(b) Eigenexpression Fraction

d = 0.25

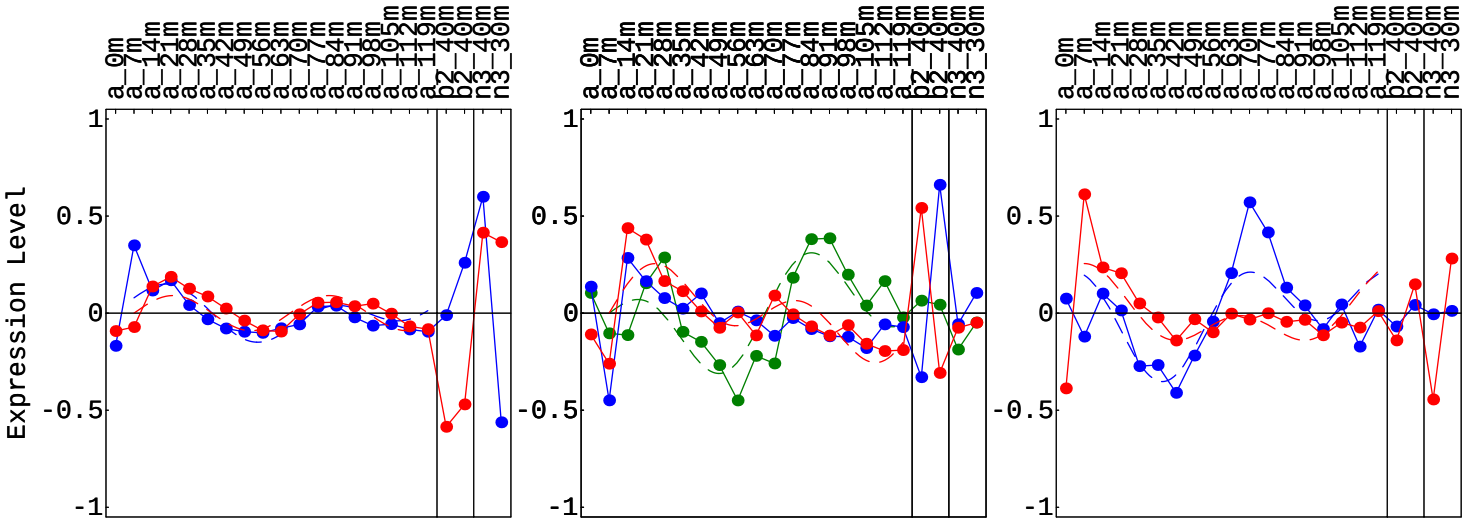
(c) Arrays



(d) Arrays

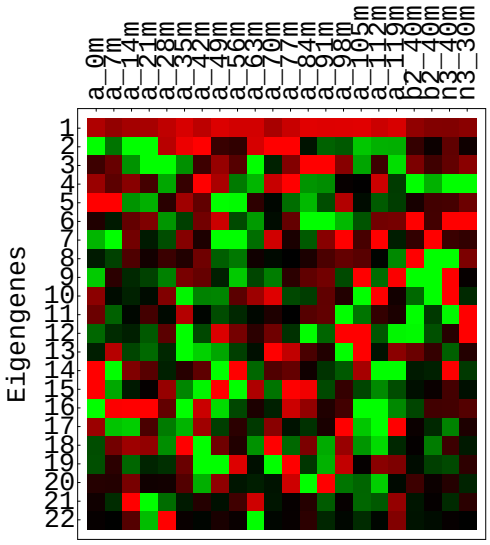
(e) Arrays

(f) Arrays



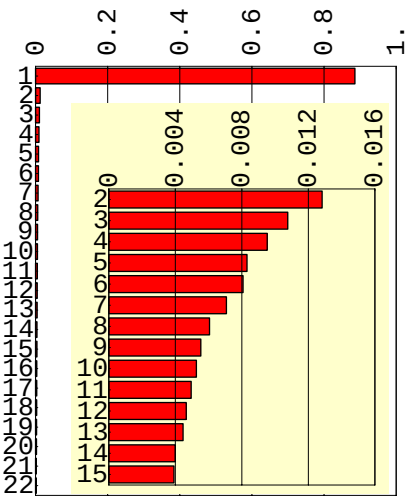
(* Normalizing the Variances by Removing the Multiplicative Constant *)

(a) Arrays



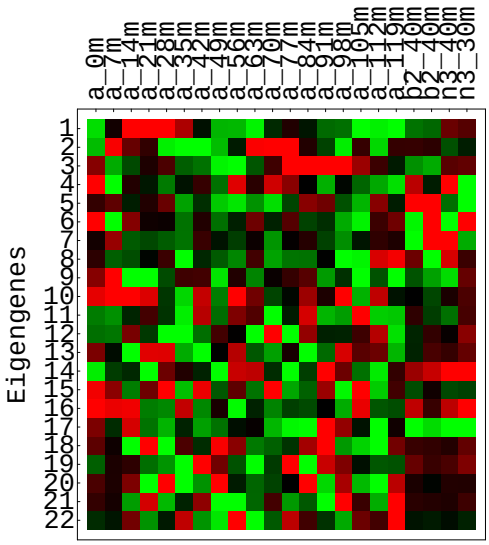
(b) Eigenexpression Fraction

d = 0.22



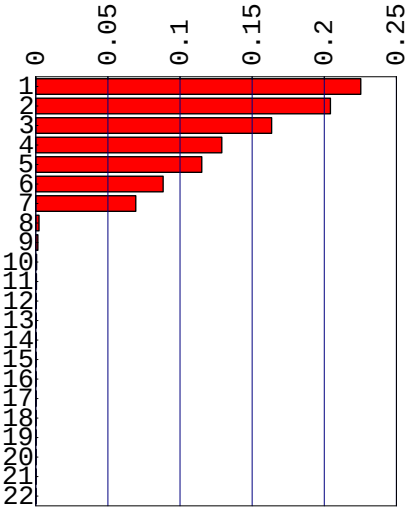
(* Normalized Data *)

(a) Arrays

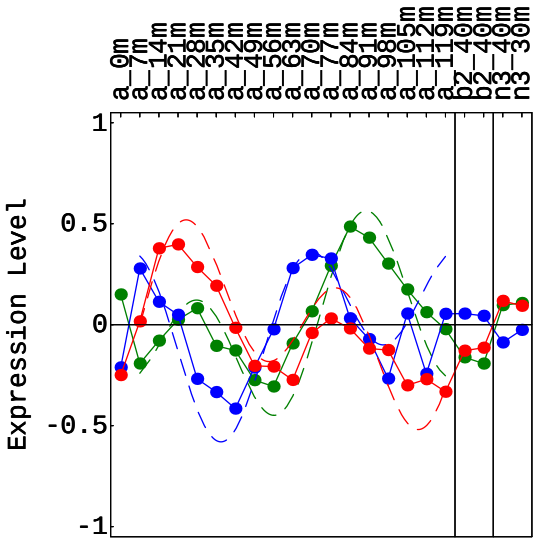


(b) Eigenexpression Fraction

d = 0.62



(c) Arrays

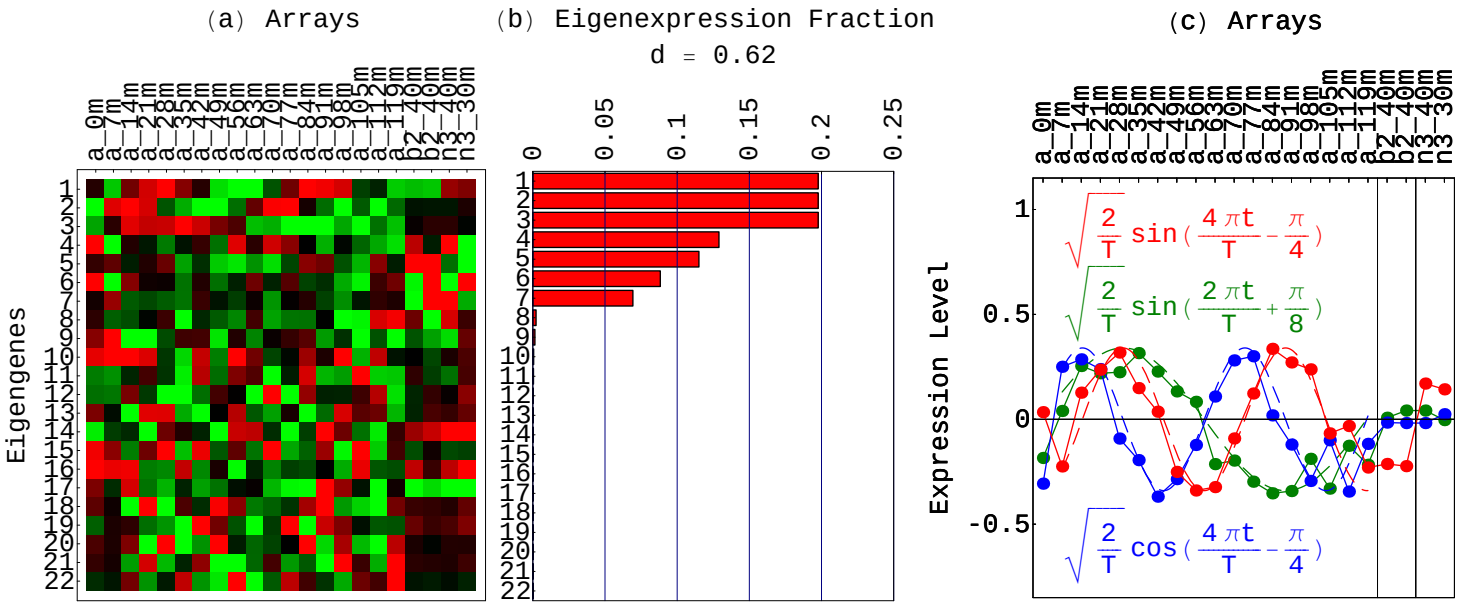


$$\sqrt{\frac{2}{T}}\sin\left(\frac{4\pi t}{T}\right)+\sqrt{\frac{1}{T}}\sin\left(\frac{2\pi t}{T}\right)$$

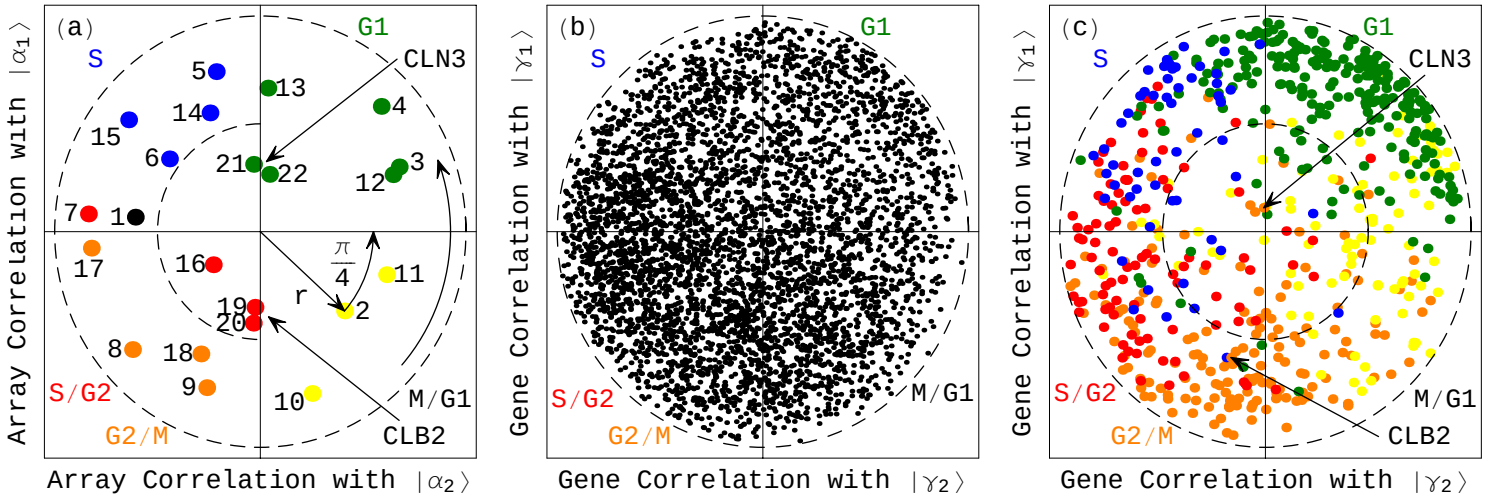
$$\sqrt{\frac{2}{T}}\cos\left(\frac{4\pi t}{T}\right)-\sqrt{\frac{1}{T}}\sin\left(\frac{2\pi t}{T}\right)$$

$$\sqrt{\frac{2}{T}}\sin\left(\frac{4\pi t}{T}-\frac{\pi}{4}\right)-\sqrt{\frac{1}{T}}\sin\left(\frac{2\pi t}{T}\right)$$

(* Rotated Normalized Data *)



(* Sorting the Rotated Normalized Data *)



```
(* Classified Sorted Rotated Normalized Data *)
```