```
In[510]:= (*Successive FastICA Negentropy Uniform *)
        x1 = RandomReal[{-Sqrt[3], Sqrt[3]}, 10 000];
        x2 = RandomReal[{-Sqrt[3], Sqrt[3]}, 10 000];
        x3 = RandomReal[{-Sqrt[3], Sqrt[3]}, 10 000];
        x4 = RandomReal[{-Sqrt[3], Sqrt[3]}, 10 000];
        x5 = RandomReal[{-Sqrt[3], Sqrt[3]}, 10 000];
        A = {{5, 10, 3, 2, 7}, {10, 2, 7, 6, 2}, {9, 13, 2, 1, 5}, {12, 3, 5, 7, 9}, {4, 7, 3, 8, 9}}
        mt = A.{x1, x2, x3, x4, x5};
        mt = mt - Mean[Transpose[mt]];

Out[515]= {{5, 10, 3, 2, 7}, {10, 2, 7, 6, 2}, {9, 13, 2, 1, 5}, {12, 3, 5, 7, 9}, {4, 7, 3, 8, 9}}

In[518]:= Covariance[Transpose[mt]]

Out[518]= {{185.192, 115.267, 215.959, 179.291, 175.867},
        {115.267, 190.864, 144.603, 217.974, 139.302},
        {215.959, 144.603, 277.928, 206.38, 183.801},
        {179.291, 217.974, 206.38, 304.021, 218.38},
        {175.867, 139.302, 183.801, 218.38, 216.728}}

In[519]:= Eigenvalues[Covariance[Transpose[mt]]]

Out[519]= {967.19, 135.38, 56.5457, 12.773, 2.844}

In[520]:= Eigenvectors[Covariance[Transpose[mt]]]

Out[520]= {{-0.405841, -0.375033, -0.479104, -0.525306, -0.434922},
        {0.417046, -0.536868, 0.557613, -0.475178, 0.0334492},
        {0.0900613, -0.443563, -0.481651, 0.0675933, 0.747385},
        {0.0517172, 0.603683, -0.077914, -0.702378, 0.365358},
        {0.806585, 0.099707, -0.470604, 0.0188676, -0.343007}}

In[521]:= d12 = Eigenvalues[Covariance[Transpose[mt]]][[1]] ^ (-1 / 2);
        d22 = Eigenvalues[Covariance[Transpose[mt]]][[2]] ^ (-1 / 2);
        d32 = Eigenvalues[Covariance[Transpose[mt]]][[3]] ^ (-1 / 2);
        d42 = Eigenvalues[Covariance[Transpose[mt]]][[4]] ^ (-1 / 2);
        d52 = Eigenvalues[Covariance[Transpose[mt]]][[5]] ^ (-1 / 2);
        dmat = DiagonalMatrix[{d12, d22, d32, d42, d52}]

Out[526]= {{0.0321547, 0., 0., 0., 0.}, {0., 0.0859453, 0., 0., 0.},
        {0., 0., 0.132984, 0., 0.}, {0., 0., 0., 0.279804, 0.}, {0., 0., 0., 0., 0.592974}}

In[527]:= emat = Transpose[Eigenvectors[Covariance[Transpose[mt]]]]

Out[527]= {{-0.405841, 0.417046, 0.0900613, 0.0517172, 0.806585},
        {-0.375033, -0.536868, -0.443563, 0.603683, 0.099707},
        {-0.479104, 0.557613, -0.481651, -0.077914, -0.470604},
        {-0.525306, -0.475178, 0.0675933, -0.702378, 0.0188676},
        {-0.434922, 0.0334492, 0.747385, 0.365358, -0.343007}}

In[528]:= vmat = emat.dmat.Transpose[emat]

Out[528]= {{0.407848, 0.0367625, -0.20574, -0.0105071, -0.142942},
        {0.0367625, 0.163324, -0.0325248, -0.0932523, 0.00104921},
        {-0.20574, -0.0325248, 0.197978, -0.00896229, 0.0481849},
        {-0.0105071, -0.0932523, -0.00896229, 0.167135, -0.0629422},
        {-0.142942, 0.00104921, 0.0481849, -0.0629422, 0.187577}}

In[529]:= x1 = RandomReal[{-Sqrt[3], Sqrt[3]}, 10 000];
        x2 = RandomReal[{-Sqrt[3], Sqrt[3]}, 10 000];
        x3 = RandomReal[{-Sqrt[3], Sqrt[3]}, 10 000];
        x4 = RandomReal[{-Sqrt[3], Sqrt[3]}, 10 000];
        x5 = RandomReal[{-Sqrt[3], Sqrt[3]}, 10 000];
        mt = A.{x1, x2, x3, x4, x5};
        mt = mt - Mean[Transpose[mt]];
```

```
In[536]:= zmat = vmat.mt;

In[537]:= m = 5;
        wmatinit = {RandomReal[{-Sqrt[3], Sqrt[3]}, m],
            RandomReal[{-Sqrt[3], Sqrt[3]}, m], RandomReal[{-Sqrt[3], Sqrt[3]}, m],
            RandomReal[{-Sqrt[3], Sqrt[3]}, m], RandomReal[{-Sqrt[3], Sqrt[3]}, m]};
        wmatinit = {{1, 0, 0, 0, 0}, {0, 1, 0, 0, 0}, {0, 0, 1, 0, 0},
            {0, 0, 0, 1, 0}, {0, 0, 0, 0, 1}};
        wmat = {};
        i = 1;
        While[i <= m,
         wmat = Append[wmat, wmatinit[[All, i]] / Norm[wmatinit[[All, i]]]];
         i++;
        ]
        wmat = Transpose[wmat]
        (*
        w={1,0,0,0,0};
        *)
        epsilon = 0.0001;
        n = Length[x1];
        p = 1;
        wmatconv = {};
        For[p = 1, p ≤ m, p++,
         w = wmat[[All, p]] / Norm[wmat[[All, p]]];
         cnt = 1;
         wbefore = w;
         While[cnt < n,
          wbefore = w;
          w = (1 / n) * Sum[Tanh[w.zmat[[All, i]]] * zmat[[All, i]], {i, 1, n}] -
             (1 / n) * Sum[1 - (Tanh[w.zmat[[All, i]]])^2, {i, 1, n}] * w;
          If[2 ≤ p,
           w = w - Sum[(w.wmatconv[[j]]) * wmatconv[[j]], {j, 1, p - 1}], a = 0
          ];
          w = w / Norm[w];

          Print["cnt=", cnt];
          Print["w=", w];

          ++cnt;
          If[1 - epsilon <= Abs[w.wbefore] && Abs[w.wbefore] <= 1 + epsilon,
           Print["        :"];
           Print["w=", w];
           Print["Abs[w.wbefore]=", Abs[w.wbefore]];
           wmatconv = Append[wmatconv, w];
           cnt = n;
          ]
         ]
        ]
        Kurtosis[w.zmat] - 3
```

Out[543]= {{1, 0, 0, 0, 0}, {0, 1, 0, 0, 0}, {0, 0, 1, 0, 0}, {0, 0, 0, 1, 0}, {0, 0, 0, 0, 1}}

cnt=1

w={0.367278, 0.795663, 0.0654413, 0.470173, -0.0817386}

cnt=2

```
w={0.577441, 0.751173, 0.000103366, 0.30683, -0.0903138}

cnt=3

w={0.596482, 0.771683, -0.190947, 0.094153, -0.058216}

cnt=4

w={0.591871, 0.766658, -0.242747, 0.0157983, -0.0524398}

cnt=5

w={0.588069, 0.768036, -0.248215, 0.00787346, -0.0512208}

        :

w={0.588069, 0.768036, -0.248215, 0.00787346, -0.0512208}

Abs[w.wbefore]=0.999945

cnt=1

w={0.455013, -0.151305, 0.456759, 0.0412506, 0.748158}

cnt=2

w={0.273645, 0.0871195, 0.816408, -0.193944, 0.461945}

cnt=3

w={0.378392, -0.0195045, 0.737662, -0.367934, 0.420617}

cnt=4

w={0.352326, 0.00607015, 0.757832, -0.368613, 0.406995}

cnt=5

w={0.357554, 0.000597456, 0.752498, -0.370684, 0.41048}

         :

w={0.357554, 0.000597456, 0.752498, -0.370684, 0.41048}

Abs[w.wbefore]=0.999949

cnt=1

w={0.568484, -0.507823, -0.296775, 0.401352, 0.412047}

cnt=2

w={0.477875, -0.361558, -0.0249181, 0.741862, 0.299886}

cnt=3

w={0.501453, -0.386488, -0.0456533, 0.714965, 0.293108}

cnt=4

w={0.499681, -0.385252, -0.0468208, 0.715193, 0.296995}

        :

w={0.499681, -0.385252, -0.0468208, 0.715193, 0.296995}

Abs[w.wbefore]=0.999989

cnt=1

w={-0.0826773, 0.211963, 0.600551, 0.464479, -0.609782}

cnt=2

w={-0.224102, 0.33327, 0.603617, 0.548554, -0.416466}

cnt=3
```

```
        w={-0.251146, 0.355079, 0.598307, 0.560542, -0.372379}

        cnt=4

        w={-0.251383, 0.355267, 0.598251, 0.56064, -0.371982}

                :

        w={-0.251383, 0.355267, 0.598251, 0.56064, -0.371982}

        Abs[w.wbefore]=1.

        cnt=1

        w={-0.462013, 0.368086, -0.109725, 0.191605, 0.776083}

        cnt=2

        w={-0.462013, 0.368086, -0.109725, 0.191605, 0.776083}

                :

        w={-0.462013, 0.368086, -0.109725, 0.191605, 0.776083}

        Abs[w.wbefore]=1.
```

Out[549]= −1.15789

In[550]:= **MatrixForm[Transpose[wmatconv]]**

Out[550]//MatrixForm=

$$\begin{pmatrix} 0.588069 & 0.357554 & 0.499681 & -0.251383 & -0.462013 \\ 0.768036 & 0.000597456 & -0.385252 & 0.355267 & 0.368086 \\ -0.248215 & 0.752498 & -0.0468208 & 0.598251 & -0.109725 \\ 0.00787346 & -0.370684 & 0.715193 & 0.56064 & 0.191605 \\ -0.0512208 & 0.41048 & 0.296995 & -0.371982 & 0.776083 \end{pmatrix}$$

In[551]:= **(* True Value*)**
tmat = vmat.A;
truemat = {};
i = 1;
While[i ≤ m,
  truemat = Append[truemat, tmat[[All, i]] / Norm[tmat[[All, i]]]];
  i++;
 ];
truemat = Transpose[truemat];
MatrixForm[truemat]

Out[556]//MatrixForm=

$$\begin{pmatrix} -0.142596 & 0.444486 & 0.587182 & -0.388281 & 0.519921 \\ 0.409351 & -0.000961232 & 0.72433 & 0.378251 & -0.409413 \\ 0.51287 & 0.760333 & -0.348684 & -0.0862906 & -0.162709 \\ 0.687886 & -0.346664 & -0.0552848 & 0.0772576 & 0.634331 \\ -0.275457 & 0.322722 & -0.07698 & 0.832316 & 0.364983 \end{pmatrix}$$

```
In[557]:= m = 5;
        wmatinit = {RandomReal[{-Sqrt[3], Sqrt[3]}, m],
           RandomReal[{-Sqrt[3], Sqrt[3]}, m], RandomReal[{-Sqrt[3], Sqrt[3]}, m],
           RandomReal[{-Sqrt[3], Sqrt[3]}, m], RandomReal[{-Sqrt[3], Sqrt[3]}, m]};
        (*
        wmatinit={{1,0,0,0,0},{0,1,0,0,0},{0,0,1,0,0},{0,0,0,1,0},{0,0,0,0,1}};
        *)
        wmat = {};
        i = 1;
        While[i <= m,
         wmat = Append[wmat, wmatinit[[All, i]] / Norm[wmatinit[[All, i]]]];
         i++;
        ]
        wmat = Transpose[wmat]
        (*
        w={1,0,0,0,0};
        *)
        epsilon = 0.0001;
        n = Length[x1];
        p = 1;
        wmatconv = {};
        For[p = 1, p ≤ m, p++,
         w = wmat[[All, p]] / Norm[wmat[[All, p]]];
         cnt = 1;
         wbefore = w;
         While[cnt < n,
          wbefore = w;
          w = (1 / n) * Sum[Tanh[w.zmat[[All, i]]] * zmat[[All, i]], {i, 1, n}] -
            (1 / n) * Sum[1 - (Tanh[w.zmat[[All, i]]])^2, {i, 1, n}] * w;
          If[2 ≤ p,
           w = w - Sum[(w.wmatconv[[j]]) * wmatconv[[j]], {j, 1, p - 1}], a = 0
          ];
          w = w / Norm[w];

          Print["cnt=", cnt];
          Print["w=", w];

          ++cnt;
          If[1 - epsilon <= Abs[w.wbefore] && Abs[w.wbefore] <= 1 + epsilon,
           Print["        :"];
           Print["w=", w];
           Print["Abs[w.wbefore]=", Abs[w.wbefore]];
           wmatconv = Append[wmatconv, w];
           cnt = n;
          ]
         ]
        ]
```

Out[562]= {{0.225025, -0.0533836, -0.066423, 0.302581, 0.54869},
        {-0.242232, -0.199831, 0.0461976, -0.110991, -0.412239},
        {-0.588535, 0.290893, 0.34513, 0.324316, 0.509558},
        {-0.459613, -0.684926, -0.471435, 0.657284, -0.227657},
        {0.577122, 0.635198, 0.80752, -0.599101, -0.466391}}

cnt=1

w={-0.127172, -0.355322, -0.384731, -0.795922, 0.275798}

```
cnt=2
w={-0.070616, -0.415857, -0.42592, -0.752764, 0.272057}
cnt=3
w={-0.0653543, -0.421713, -0.434252, -0.747284, 0.266231}
        :
w={-0.0653543, -0.421713, -0.434252, -0.747284, 0.266231}
Abs[w.wbefore]=0.999902
cnt=1
w={-0.146626, 0.256094, 0.6935, -0.332772, 0.566778}
cnt=2
w={0.363744, 0.250851, 0.582306, -0.292021, 0.616771}
cnt=3
w={0.405278, 0.141388, 0.706075, -0.376212, 0.419144}
cnt=4
w={0.427966, 0.100141, 0.71637, -0.368779, 0.397031}
cnt=5
w={0.425945, 0.0973175, 0.718449, -0.368409, 0.396492}
        :
w={0.425945, 0.0973175, 0.718449, -0.368409, 0.396492}
Abs[w.wbefore]=0.999992
cnt=1
w={-0.624959, 0.446497, -0.0207356, 0.0422583, 0.638632}
cnt=2
w={-0.40989, 0.427792, -0.158515, 0.161962, 0.773062}
cnt=3
w={-0.434749, 0.433755, -0.144935, 0.148724, 0.761396}
cnt=4
w={-0.432241, 0.432413, -0.146181, 0.150553, 0.762989}
        :
w={-0.432241, 0.432413, -0.146181, 0.150553, 0.762989}
Abs[w.wbefore]=0.999992
cnt=1
w={0.71781, -0.193675, -0.392157, 0.403266, 0.361702}
cnt=2
w={0.541002, -0.465825, -0.234547, 0.503686, 0.426158}
cnt=3
w={0.509211, -0.499424, -0.209133, 0.512165, 0.430385}
cnt=4
w={0.507211, -0.501439, -0.207553, 0.512637, 0.430605}
```

```
              :
      w={0.507211, -0.501439, -0.207553, 0.512637, 0.430605}

      Abs[w.wbefore]=0.999995

      cnt=1

      w={0.608444, 0.611773, -0.480426, -0.142751, -0.065901}

      cnt=2

      w={0.608444, 0.611773, -0.480426, -0.142751, -0.065901}

              :

      w={0.608444, 0.611773, -0.480426, -0.142751, -0.065901}

      Abs[w.wbefore]=1.
```

In[568]:= **MatrixForm[Transpose[wmatconv]]**
MatrixForm[truemat]

Out[568]//MatrixForm=

$$\begin{pmatrix} -0.0653543 & 0.425945 & -0.432241 & 0.507211 & 0.608444 \\ -0.421713 & 0.0973175 & 0.432413 & -0.501439 & 0.611773 \\ -0.434252 & 0.718449 & -0.146181 & -0.207553 & -0.480426 \\ -0.747284 & -0.368409 & 0.150553 & 0.512637 & -0.142751 \\ 0.266231 & 0.396492 & 0.762989 & 0.430605 & -0.065901 \end{pmatrix}$$

Out[569]//MatrixForm=

$$\begin{pmatrix} -0.142596 & 0.444486 & 0.587182 & -0.388281 & 0.519921 \\ 0.409351 & -0.000961232 & 0.72433 & 0.378251 & -0.409413 \\ 0.51287 & 0.760333 & -0.348684 & -0.0862906 & -0.162709 \\ 0.687886 & -0.346664 & -0.0552848 & 0.0772576 & 0.634331 \\ -0.275457 & 0.322722 & -0.07698 & 0.832316 & 0.364983 \end{pmatrix}$$