```
(*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]];
```

{{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}}

```
Covariance[Transpose[mt]]
```

{{188.89, 119.039, 220.72, 185.376, 179.73},
 {119.039, 194.331, 148.278, 222.716, 142.404},
 {220.72, 148.278, 283.446, 212.757, 188.519},
 {185.376, 222.716, 212.757, 311.139, 223.907},
 {179.73, 142.404, 188.519, 223.907, 220.485}}

```
Eigenvalues[Covariance[Transpose[mt]]]
```

{991.091, 135.305, 56.5276, 12.5829, 2.78521}

```
Eigenvectors[Covariance[Transpose[mt]]]
```

{{-0.406213, -0.374501, -0.47901, -0.52622, -0.43403},
 {0.413094, -0.540322, 0.559618, -0.472269, 0.0345637},
 {0.0847222, -0.446834, -0.479073, 0.0723387, 0.747274},
 {-0.0518563, -0.599062, 0.0763293, 0.703287, -0.371478},
 {0.808998, 0.0962532, -0.471211, 0.014432, -0.337653}}

```
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}]
```

{{0.0317646, 0., 0., 0., 0.}, {0., 0.0859694, 0., 0., 0.},
 {0., 0., 0.133006, 0., 0.}, {0., 0., 0., 0.281909, 0.}, {0., 0., 0., 0., 0.599199}}

```
emat = Transpose[Eigenvectors[Covariance[Transpose[mt]]]]
```

{{-0.406213, 0.413094, 0.0847222, -0.0518563, 0.808998},
 {-0.374501, -0.540322, -0.446834, -0.599062, 0.0962532},
 {-0.47901, 0.559618, -0.479073, 0.0763293, -0.471211},
 {-0.52622, -0.472269, 0.0723387, 0.703287, 0.014432},
 {-0.43403, 0.0345637, 0.747274, -0.371478, -0.337653}}

```
vmat = emat.dmat.Transpose[emat]
```

{{0.413787, 0.0360247, -0.208879, -0.0124521, -0.142998},
 {0.0360247, 0.162831, -0.0318923, -0.0940416, 0.00240774},
 {-0.208879, -0.0318923, 0.199426, -0.00826509, 0.0479937},
 {-0.0124521, -0.0940416, -0.00826509, 0.168227, -0.0635289},
 {-0.142998, 0.00240774, 0.0479937, -0.0635289, 0.187576}}

```
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]];
```

```
zmat = vmat.mt;

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
```

{{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={0.968534, -0.150088, -0.0710547, -0.184815, 0.014492}

cnt=2

```
w={0.913951, -0.257853, -0.105569, -0.294372, -0.0201328}

cnt=3

w={0.833429, -0.348161, -0.16527, -0.388795, -0.0755268}

cnt=4

w={0.716221, -0.410972, -0.282773, -0.476315, -0.106273}

cnt=5

w={0.529707, -0.420532, -0.456694, -0.577513, 0.0217512}

cnt=6

w={0.292849, -0.364316, -0.572644, -0.629952, 0.238228}

cnt=7

w={0.232177, -0.350175, -0.590803, -0.632275, 0.273224}

cnt=8

w={0.227781, -0.346885, -0.594025, -0.631474, 0.275974}

        :

w={0.227781, -0.346885, -0.594025, -0.631474, 0.275974}

Abs[w.wbefore]=0.999976

cnt=1

w={0.197506, 0.844075, -0.318657, 0.0719093, 0.376585}

cnt=2

w={0.244619, 0.856116, -0.328866, 0.0621633, 0.30856}

cnt=3

w={0.387198, 0.845575, -0.331551, 0.0524711, 0.149672}

cnt=4

w={0.520111, 0.794222, -0.311511, 0.0380727, -0.0143876}

cnt=5

w={0.560107, 0.771104, -0.296203, 0.0340213, -0.0527776}

cnt=6

w={0.56853, 0.766336, -0.291639, 0.0331533, -0.0578855}

        :

w={0.56853, 0.766336, -0.291639, 0.0331533, -0.0578855}

Abs[w.wbefore]=0.999929

cnt=1

w={0.480589, -0.0415767, 0.744281, -0.427421, 0.175109}

cnt=2

w={0.479253, -0.0366027, 0.73814, -0.37523, 0.288666}

cnt=3

w={0.469824, -0.0285697, 0.739526, -0.383455, 0.290709}

cnt=4

w={0.469519, -0.0282988, 0.739401, -0.382927, 0.292241}
```

```
          :
w={0.469519, -0.0282988, 0.739401, -0.382927, 0.292241}

Abs[w.wbefore]=0.999999

cnt=1

w={0.520885, -0.438033, -0.117035, 0.663958, 0.286824}

cnt=2

w={0.520719, -0.437889, -0.117053, 0.66401, 0.287219}

          :

w={0.520719, -0.437889, -0.117053, 0.66401, 0.287219}

Abs[w.wbefore]=1.

cnt=1

w={-0.365093, 0.315995, -0.0408168, 0.112251, 0.867519}

cnt=2

w={-0.365093, 0.315995, -0.0408168, 0.112251, 0.867519}

          :

w={-0.365093, 0.315995, -0.0408168, 0.112251, 0.867519}

Abs[w.wbefore]=1.

-1.19409
```

MatrixForm[Transpose[wmatconv]]

$$\begin{pmatrix} 0.227781 & 0.56853 & 0.469519 & 0.520719 & -0.365093 \\ -0.346885 & 0.766336 & -0.0282988 & -0.437889 & 0.315995 \\ -0.594025 & -0.291639 & 0.739401 & -0.117053 & -0.0408168 \\ -0.631474 & 0.0331533 & -0.382927 & 0.66401 & 0.112251 \\ 0.275974 & -0.0578855 & 0.292241 & 0.287219 & 0.867519 \end{pmatrix}$$

MatrixForm[Transpose[wmatconv].wmatconv]

$$\begin{pmatrix} 1. & -2.77556 \times 10^{-17} & -1.21431 \times 10^{-17} & 6.245 \times 10^{-17} & -1.66533 \times 10^{-16} \\ -2.77556 \times 10^{-17} & 1. & -4.85723 \times 10^{-17} & -4.85723 \times 10^{-17} & 0. \\ -1.21431 \times 10^{-17} & -4.85723 \times 10^{-17} & 1. & -5.9848 \times 10^{-17} & -6.245 \times 10^{-17} \\ 6.245 \times 10^{-17} & -4.85723 \times 10^{-17} & -5.9848 \times 10^{-17} & 1. & 9.71445 \times 10^{-17} \\ -1.66533 \times 10^{-16} & 0. & -6.245 \times 10^{-17} & 9.71445 \times 10^{-17} & 1. \end{pmatrix}$$

```
(* 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]
```

$$\begin{pmatrix} -0.171066 & 0.45498 & 0.586901 & -0.395322 & 0.527368 \\ 0.399997 & 0.00602417 & 0.724064 & 0.377174 & -0.408081 \\ 0.521001 & 0.749214 & -0.349796 & -0.0833842 & -0.171989 \\ 0.683207 & -0.359156 & -0.0618803 & 0.0717602 & 0.628406 \\ -0.269304 & 0.320378 & -0.0713599 & 0.830276 & 0.361771 \end{pmatrix}$$

```
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;
   ]
  ]
 ]
]
```

```
{{-0.362872, 0.0983107, -0.135418, 0.297097, -0.179765},
 {0.563264, 0.0549519, 0.614059, 0.573663, -0.482064},
 {-0.344154, 0.497449, -0.20418, -0.453051, 0.503398},
 {0.571442, -0.499556, 0.35074, -0.193121, -0.570407},
 {-0.325684, -0.700217, 0.663238, -0.583176, -0.395634}}

cnt=1

w={-0.708316, 0.00900005, -0.436754, 0.51936, -0.194212}
```

```
cnt=2
w={-0.538755, 0.0285217, -0.716594, 0.348182, -0.272382}
cnt=3
w={-0.471959, -0.0181456, -0.77083, 0.335936, -0.264373}
cnt=4
w={-0.462676, -0.0201787, -0.778296, 0.330124, -0.266077}
        :
w={-0.462676, -0.0201787, -0.778296, 0.330124, -0.266077}
Abs[w.wbefore]=0.999909
cnt=1
w={0.116177, -0.230659, 0.237133, -0.0461232, -0.935382}
cnt=2
w={0.355599, -0.412905, 0.0975942, 0.0325198, -0.832152}
cnt=3
w={0.371114, -0.403614, 0.0680403, -0.0158186, -0.833361}
cnt=4
w={0.375115, -0.405797, 0.0636951, -0.0185186, -0.830793}
        :
w={0.375115, -0.405797, 0.0636951, -0.0185186, -0.830793}
Abs[w.wbefore]=0.999973
cnt=1
w={-0.649548, -0.487227, 0.17275, -0.556755, -0.0296418}
cnt=2
w={-0.723873, -0.503444, 0.468959, 0.0236371, -0.0455072}
cnt=3
w={-0.639338, -0.610186, 0.443312, 0.144162, 0.0401466}
cnt=4
w={-0.638146, -0.622065, 0.433282, 0.126271, 0.0461165}
cnt=5
w={-0.63724, -0.624676, 0.431326, 0.124047, 0.0477011}
        :
w={-0.63724, -0.624676, 0.431326, 0.124047, 0.0477011}
Abs[w.wbefore]=0.999991
cnt=1
w={0.458235, -0.633972, -0.34632, 0.178727, 0.486024}
cnt=2
w={0.486109, -0.563986, -0.264674, 0.39825, 0.465792}
cnt=3
w={0.486581, -0.477753, -0.182819, 0.56544, 0.426434}
```

```
cnt=4

w={0.483916, -0.456508, -0.164192, 0.59815, 0.415553}

cnt=5

w={0.483542, -0.453968, -0.161996, 0.601891, 0.414228}

        :

w={0.483542, -0.453968, -0.161996, 0.601891, 0.414228}

Abs[w.wbefore]=0.999986

cnt=1

w={-0.0730259, 0.488482, 0.421798, 0.71625, -0.255196}

cnt=2

w={-0.0730259, 0.488482, 0.421798, 0.71625, -0.255196}

        :

w={-0.0730259, 0.488482, 0.421798, 0.71625, -0.255196}

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

wmatconv = Transpose[wmatconv];

MatrixForm[wmatconv]
MatrixForm[truemat]

$$\begin{pmatrix} -0.462676 & 0.375115 & -0.63724 & 0.483542 & -0.0730259 \\ -0.0201787 & -0.405797 & -0.624676 & -0.453968 & 0.488482 \\ -0.778296 & 0.0636951 & 0.431326 & -0.161996 & 0.421798 \\ 0.330124 & -0.0185186 & 0.124047 & 0.601891 & 0.71625 \\ -0.266077 & -0.830793 & 0.0477011 & 0.414228 & -0.255196 \end{pmatrix}$$

$$\begin{pmatrix} -0.171066 & 0.45498 & 0.586901 & -0.395322 & 0.527368 \\ 0.399997 & 0.00602417 & 0.724064 & 0.377174 & -0.408081 \\ 0.521001 & 0.749214 & -0.349796 & -0.0833842 & -0.171989 \\ 0.683207 & -0.359156 & -0.0618803 & 0.0717602 & 0.628406 \\ -0.269304 & 0.320378 & -0.0713599 & 0.830276 & 0.361771 \end{pmatrix}$$

MatrixForm[Transpose[wmatconv].wmatconv]

$$\begin{pmatrix} 1. & 5.55112 \times 10^{-17} & -3.46945 \times 10^{-18} & -2.77556 \times 10^{-17} & 6.93889 \times 10^{-17} \\ 5.55112 \times 10^{-17} & 1. & -1.38778 \times 10^{-17} & -5.55112 \times 10^{-17} & -5.55112 \times 10^{-17} \\ -3.46945 \times 10^{-18} & -1.38778 \times 10^{-17} & 1. & -4.85723 \times 10^{-17} & -1.73472 \times 10^{-18} \\ -2.77556 \times 10^{-17} & -5.55112 \times 10^{-17} & -4.85723 \times 10^{-17} & 1. & -1.38778 \times 10^{-17} \\ 6.93889 \times 10^{-17} & -5.55112 \times 10^{-17} & -1.73472 \times 10^{-18} & -1.38778 \times 10^{-17} & 1. \end{pmatrix}$$

Transpose[wmatconv].vmat.A // MatrixForm

$$\begin{pmatrix} -0.0374544 & -1.00009 & -0.0152893 & 0.0430723 & 0.00924613 \\ 0.0178948 & -0.0436815 & -0.0353723 & -1.00027 & 0.0400999 \\ 0.156756 & 0.000191838 & -0.984247 & 0.0289163 & -0.0598574 \\ -0.0493518 & 0.012466 & -0.0548261 & 0.0383389 & 0.991936 \\ 0.991975 & -0.0534061 & 0.136622 & 0.0174993 & 0.0471741 \end{pmatrix}$$