

Singular Value Decomposition

This program computes the *Singular Value Decomposition* of a $m \times n$ matrix A , that is it finds an orthogonal $m \times m$ matrix U , a $m \times n$ matrix D , whose non-zero elements are located on its main diagonal, and a orthogonal $n \times n$ matrix V such that $UDV^t = A$. The program also computes the generalized inverse or pseudo-inverse matrix of A .

The use of the program will be explained in the following example. We store in a the matrix

$$a = \begin{bmatrix} 3 & 1 & 2 & 1 & 2 \\ 1 & 2 & 3 & 0 & 5 \\ 2 & 1 & 5 & 0 & 2 \\ 1 & 2 & 1 & 1 & 1 \end{bmatrix}$$

Then we run the program using the instruction

$$svd(a, "u", "d", "v", "g")$$

The following screens show the result of the computation.

matrix u					
F1	F2	F3	F4	F5	F6
Algebra	Calc	Other	PrgmIO	Clean Up	
prog\svd(a, "u", "d", "v", "g") Done					
u					
$\begin{bmatrix} .427976 & .28051 & -.646554 & .565791 \\ .637218 & -.734848 & .202517 & .113746 \\ .591241 & .614482 & .48218 & -.20087 \\ .247435 & -.061026 & -.55539 & -.791577 \end{bmatrix}$					
u					
MAIN	RAD AUTO	FUNC 2/30			

matrix d					
F1	F2	F3	F4	F5	F6
Algebra	Calc	Other	PrgmIO	Clean Up	
$\begin{bmatrix} .591241 & .614482 & .48218 & -.20087 \\ .247435 & -.061026 & -.55539 & -.791577 \end{bmatrix}$					
d					
$\begin{bmatrix} 9.22278 & 0 & 0 & 0 & 0 \\ 0 & 2.79526 & 0 & 0 & 0 \\ 0 & 0 & 2.31325 & 0 & 0 \\ 0 & 0 & 0 & 1.33254 & 0 \end{bmatrix}$					
d					
MAIN	RAD AUTO	FUNC 3/30			

matrix v					
F1	F2	F3	F4	F5	F6
Algebra	Calc	Other	PrgmIO	Clean Up	
$\begin{bmatrix} 0 & 0 & 0 & 1.33254 & 0 \end{bmatrix}$					
v					
$\begin{bmatrix} .363346 & .455994 & -.57416 & .463627 \\ .302351 & -.249263 & -.376146 & -.743497 \\ .647445 & .489351 & .505762 & -.242473 \\ .073233 & .07852 & -.519592 & -.16944 \\ .593309 & -.695922 & .055528 & .380472 \end{bmatrix}$					
v					
MAIN	RAD AUTO	FUNC 4/30			

matrix u * d * v ^t					
F1	F2	F3	F4	F5	F6
Algebra	Calc	Other	PrgmIO	Clean Up	
$\begin{bmatrix} .647445 & .489351 & .505762 & -.242473 \\ .073233 & .07852 & -.519592 & -.16944 \\ .593309 & -.695922 & .055528 & .380472 \end{bmatrix}$					
u * d * v ^t					
$\begin{bmatrix} 3. & 1. & 2. & 1. & 2. \\ 1. & 2. & 3. & 9.E-12 & 5. \\ 2. & 1. & 5. & 2.496E-11 & 2. \\ 1. & 2. & 1. & 1. & 1. \end{bmatrix}$					
u*d*v ^t					
MAIN	RAD AUTO	FUNC 5/30			

matrix g					
F1	F2	F3	F4	F5	F6
Algebra	Calc	Other	PrgmIO	Clean Up	
$\begin{bmatrix} 1. & 2. & 1. & 1. & 1. \end{bmatrix}$					
g					
$\begin{bmatrix} .419952 & -.105463 & -.066033 & -.137767 \\ -.221536 & -.009976 & -.001742 & .545527 \\ -.165162 & -.060333 & .291053 & .029295 \\ .084561 & -.075534 & -.060808 & .225653 \\ .103721 & .261283 & -.160728 & -.208234 \end{bmatrix}$					
g					
MAIN	RAD AUTO	FUNC 6/30			

matrix a * g * a					
F1	F2	F3	F4	F5	F6
Algebra	Calc	Other	PrgmIO	Clean Up	
$\begin{bmatrix} -.165162 & -.060333 & .291053 & .029295 \\ .084561 & -.075534 & -.060808 & .225653 \\ .103721 & .261283 & -.160728 & -.208234 \end{bmatrix}$					
a * g * a					
$\begin{bmatrix} 3. & 1. & 2. & 1. & 2. \\ 1. & 2. & 3. & 1.05E-12 & 5. \\ 2. & 1. & 5. & 3.7E-12 & 2. \\ 1. & 2. & 1. & 1. & 1. \end{bmatrix}$					
a*g*a					
MAIN	RAD AUTO	FUNC 7/30			