

Introduction to SAS IML



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Features of SAS/IML

- Rich Set of Mathematical, Statistical, Graphical and data processing
- Data Elements are matrices
- Similarity to Matrix algebra Notation

$$\text{Cov}_b = \sigma^2(X'X)^{-1} \longrightarrow \text{covb} = \text{mse} \# \text{inv}(t(X)*X);$$

- Interactivity
- Data Processing
- Programming Capabilities
- Efficiency



SAS/IML Matrices

- Character or Numeric
- Can Contain Missing values
- Exist without having assigned any values
- Have Dimensions described by the number of rows(r) and columns(c)
- Example $X=\{1 \ -2, \ 3 \ 4\};$

$$X = \begin{pmatrix} 1 & -2 \\ 3 & 4 \end{pmatrix}$$



SAS/IML Language Overview

```
PROC IML <OPTIONS>;  
    IML Statements  
QUIT;
```

- Control Statements (IF-THEN/ELSE, DO-END)
- Commands (FREE, PRINT, READ, USE)
- CALL Statements and subroutines
(CHANGE, RENAME, DELETE)
- Assignment Statements
(RESULT=EXPRESSION;)
- IML Functions (INV, GINV, TRACE)



SAS/IML Examples : Correlation

```
OPTIONS NODATE NONUMBER NOCENTER;
```

```
Proc IML;
```

```
x = { 21 132 159, 32 144 171,
      44 187 168, 50 194 189,
      24 141 144, 51 187 158};
```

```
name={age weight height};
```

```
n = nrow(x); /* number of observations */
sum = x[+,] ; /* compute column sums */
xpx = t(x)*x-t(sum)*sum/n; /*compute sscp
                             matrix*/
```

```
s = diag(1/sqrt(vecdiag(xpx))); /*scaling
                             matrix */
```

```
corr = s*xpx*s; /* correlation matrix */
print corr[rowname=name colname=Name] ;
QUIT;
```

	corr		
	AGE	WEIGHT	HEIGHT
AGE	1	0.9705174	0.5766401
WEIGHT	0.9705174	1	0.5586774
HEIGHT	0.5766401	0.5586774	1



SAS/IML Examples : Regression

```

proc iml;
x= { 1 1 1,
      1 2 4,
      1 3 9,
      1 4 16,
      1 5 25,
      1 6 36,
      1 7 49,
      1 8 64 };
y= {3.929,5.308,7.239,9.638,12.866,17.069,23.191,31.443};
Name={"Intercept", "X1", "X_SQR"};

      n = nrow(x);          /* number of observations */
      k = ncol(x);         /* number of variables */
      xpx = x`*x;          /* cross-products */
      xpy = x`*y;
      xpxi = inv(xpx);     /* inverse crossproducts */
      b = xpxi*xpy;        /* parameter estimates */

print name b ;

QUIT;

```



General Statistics Examples

- Newton's Method for Solving Nonlinear Systems of Equations
- Alpha Factor Analysis
- Categorical Linear Models
- Regression of Subset of Variables
- Response Surface Methodology
- Logistic and Probit Regression for Binary Response Models
- Linear Programming
- Quadratic Programming
- Regression Quantiles
- Simulations of a Univariate ARMA Process
- Parameter Estimation for a Regression Model with ARMA Errors
- Iterative Proportional Fitting
- Full-Screen Nonlinear Regression



For More Examples/Modules visit :

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<http://support.sas.com/rnd/app/examples/IMLexamples.html>



Thank you