

# IPHONE APPS WORKSHOP FOR RUNNING BIOINFORMATICS AND GENOMICS APPLICATIONS

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Advances in Bioinformatics  
and Genomics Symposium

# Presentation Overview

- ▣ iPhone and Mobile Computing Revolution
- ▣ System Architecture
- ▣ iPhone Software Delivery
- ▣ Server Side Computing and Communication
- ▣ User Access and Security
- ▣ Running Macros and Selecting Parameters
- ▣ Viewing SAS Data



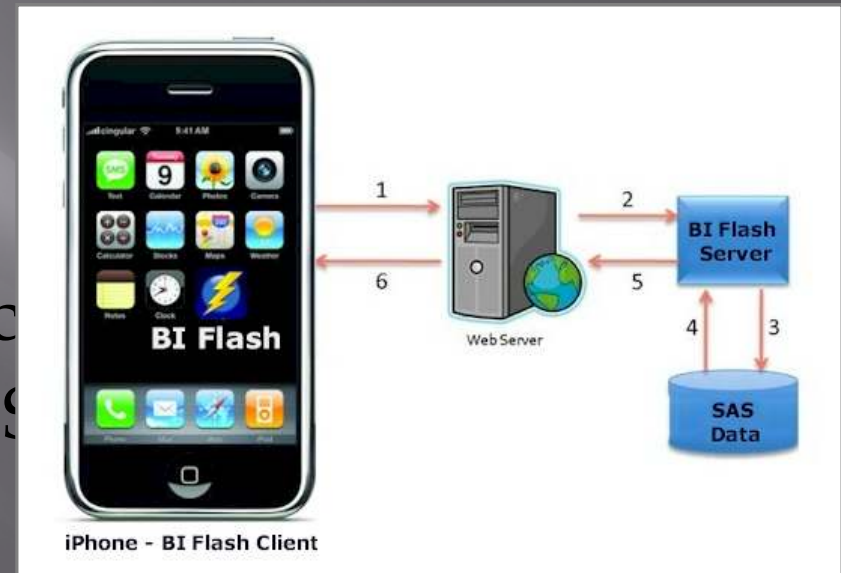
# iPhone and Mobile Computing Revolution

- ❑ Tipping Point: AppStore, 2 billion iPhone downloads with 50K apps
- ❑ Analagous to PC Revolution vs Main Frames



# System Architecture

- TCP/IP Similarities Web Client
- Three Components
  - iPhone Client
  - Web Server
  - SAS Application server
- SAS Data and Macro Logic
- Data View and Parameter S



# iPhone Software Delivery

- ❑ iPhone App Store
- ❑ Search, Download, Run...
- ❑ No more Shrink Wrap Box



# Server Side Computing and Communication

- iPhone Settings Like Control Panel
- SAS Host Server
  - Host Name
  - User Name
  - Password



# Step 1 - Selecting Data

- ❑ Select SAS Dataset from SAS Libraries
- ❑ Standard iPhone Selection List



# Step 2 – View Data

- View Micro Array Data with Gene Expression Optimized for iPhone Screen
  - ODS Optimized Fonts
  - Vertical or Landscape View
  - Dynamic Update to Date View Noted Footnote
  - Thanks to Jordan Hiller from SAS Institute for Sample Genomics Data

Obs	Probe_Set_ID	MPRO_Ohr_A	MPRO_Ohr_B	MPRO_
1	100001_at	2.8271	2.7349	
2	100002_at	4.9980	4.8828	
3	100003_at	4.8174	4.6582	
4	100004_at	7.0762	7.0459	
5	100005_at	7.2354	7.1094	
6	100006_at	3.2104	3.2817	
7	100007_at	8.2793	8.2637	
8	100009_r_at	2.8120	2.7329	
9	100010_at	5.9590	5.9854	
10	100011_at	4.4570	4.3643	
11	100012_at	11.3750	11.4883	1
12	100013_at	7.4072	7.5537	
13	100014_at	5.5645	5.6182	
14	100015_at	4.2051	4.3643	

# Step 3 – Navigate Data Chunks

- ❑ Chunk to Smaller Views
- ❑ Slider or List Selection for Check Selection

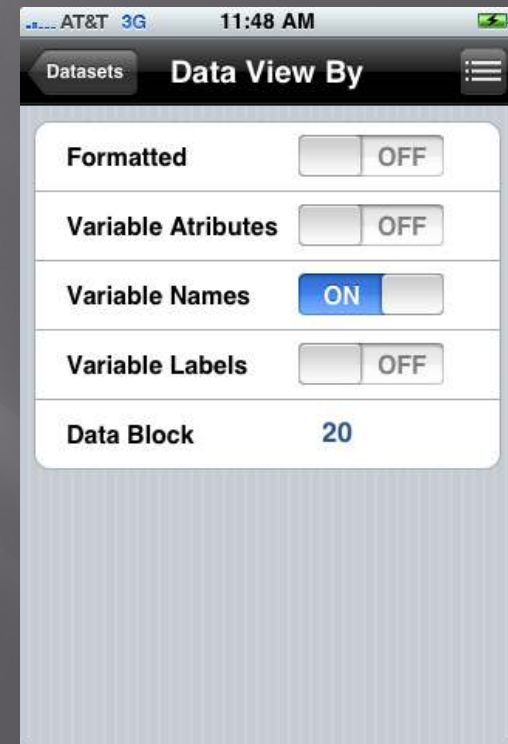


A screenshot of an iPhone app interface showing a data table. The status bar at the top shows 'AT&T 3G' and '8:06 AM'. The app header is 'Datasets MPRO\_DATA'. The table has columns: Obs, Probe\_Set\_ID, MPRO\_Ohr\_A, MPRO\_Ohr\_B, and MPRO\_. The data rows are numbered 381 to 394. Below the table is a navigation bar with a slider and the text '381 - 400'.

Obs	Probe_Set_ID	MPRO_Ohr_A	MPRO_Ohr_B	MPRO_
381	100558_at	4.3818	4.2656	
382	100559_at	6.8975	7.0547	
383	100560_at	7.5156	7.3906	
384	100561_at	7.8545	7.9014	
385	100562_at	8.4102	8.3965	
386	100564_at	7.7246	7.6143	
387	100565_at	7.7275	7.6621	
388	100566_at	4.6289	4.6924	
389	100567_at	4.2529	4.2588	
390	100568_at	8.3203	8.3516	
391	100569_at	10.0547	10.1035	1
392	100570_at	7.4053	7.4365	
393	100571_at	5.3857	5.5996	
394	100572_at	7.3096	7.2979	

# Step 4 – Change View Settings

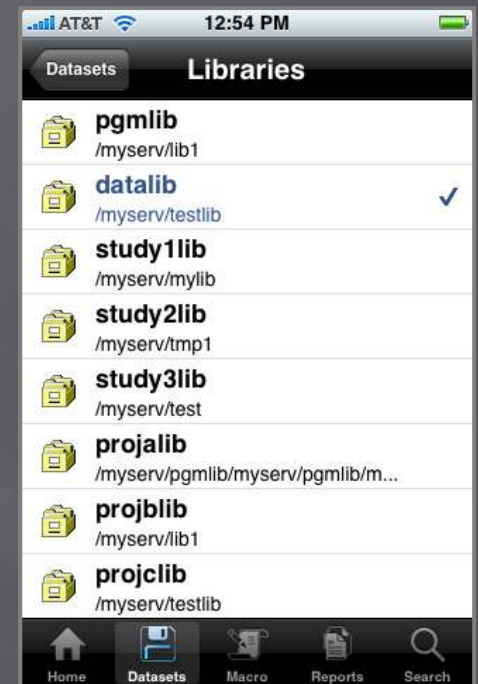
- ▣ Settings Button or Application Settings
  - User Defined Formats
  - Attributes (PROC CONTENTS)
  - Variable Name Column Header
  - Variable Label Column Header
  - Data Block or Chunk Size



# SAS to XML for iPhone

## SAS Libraries Converted to XML

```
<Libraries>
  <Library id="1">
    <shortTitle>pgmlib</shortTitle>
    <longTitle></longTitle>
    <descriptionTitle>/myserv/lib1</descriptionTitle>
  </Library>
  <Library id="2">
    <shortTitle>datlib</shortTitle>
    <longTitle></longTitle>
    <descriptionTitle>/myserv/testlib</descriptionTitle>
  </Library>
  <Library id="3">
    <shortTitle>study</shortTitle>
    <longTitle></longTitle>
    <descriptionTitle>/myserv/testlib</descriptionTitle>
  </Library>
  ...
</Libraries>
```



# Genomics Summary Macro

- ▣ %GENOSUM Macro Summarize Genomics Data

```
%macro genosum (indata=, invar=);  
    ods listing close;  
    ods html body = "genosum.html";  
  
    title "Summary of Microarray data with Gene Expression";  
    proc univariate data=&indata;  
        var &invar;  
    run;  
  
    ods html close;  
ods listing;  
  
%mend;
```

- ▣ HTML Output
  - Can be Emailed
  - Alternatively, PDF, RTF, Etc...

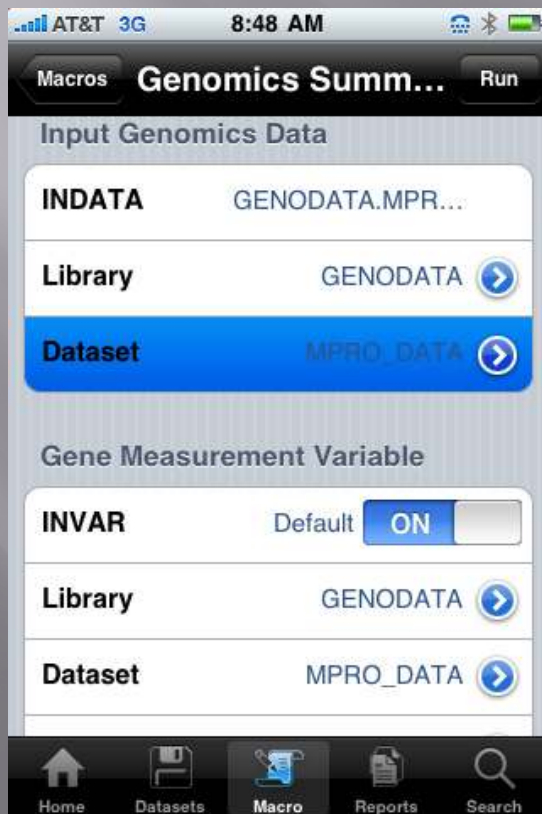
# Step 1 Select Macro

- ❑ %GENOSUM Macro is Loaded to Macro Library
- ❑ Select from Standard List of Programs



# Step 2 Macro Parameters

- Select Parameters based on Named Parameters
- All Selections are Pull Down Menus



# Step 3 Review Output

- Review HTML Output with Multi-Touch Pinch Zoom and Swipe

AT&T 3G 8:49 AM

Genomics Su... Output Result

Summary of Microarray data with Gene Expression

The UNIVARIATE Procedure  
Variable: MPRO\_0hr\_A

Moments			
N	12488	Sum Weights	12488
Mean	<a href="#">6.14723212</a>	Sum Observations	76766.6348
Std Deviation	<a href="#">2.11185503</a>	Variance	<a href="#">4.45993185</a>
Skewness	<a href="#">0.22809748</a>	Kurtosis	<a href="#">-0.478709</a>
Uncorrected SS	<a href="#">527593.49</a>	Corrected SS	55691.1666
Coeff Variation	<a href="#">34.3545678</a>	Std Error Mean	<a href="#">0.01869808</a>

Basic Statistical Measures			
Location		Variability	
Mean	<a href="#">6.147232</a>	Std Deviation	2.11186
Median	<a href="#">6.128906</a>	Variance	4.45993
Mode	<a href="#">8.085938</a>	Range	<a href="#">11.68213</a>
		Interquartile Range	3.15283

Home Datasets Macro Reports Search

AT&T 3G 8:49 AM

Genomics Su... Output Result

90%	8.90625
75% Q3	7.64990
50% Median	6.12891
25% Q1	4.49707
10%	3.26416
5%	2.83545
1%	2.42578
0% Min	2.04443

Extreme Observations			
Lowest		Highest	
Value	Obs	Value	Obs
2.04443	4882	13.2207	1087
2.04834	7130	13.2344	12456
2.07910	5816	13.3086	9789
2.09668	3987	13.3826	7102
2.10303	5881	13.7266	120

Home Datasets Macro Reports Search

# Step 4 Share Results w/Email

- Compose Email with Output as Attachments

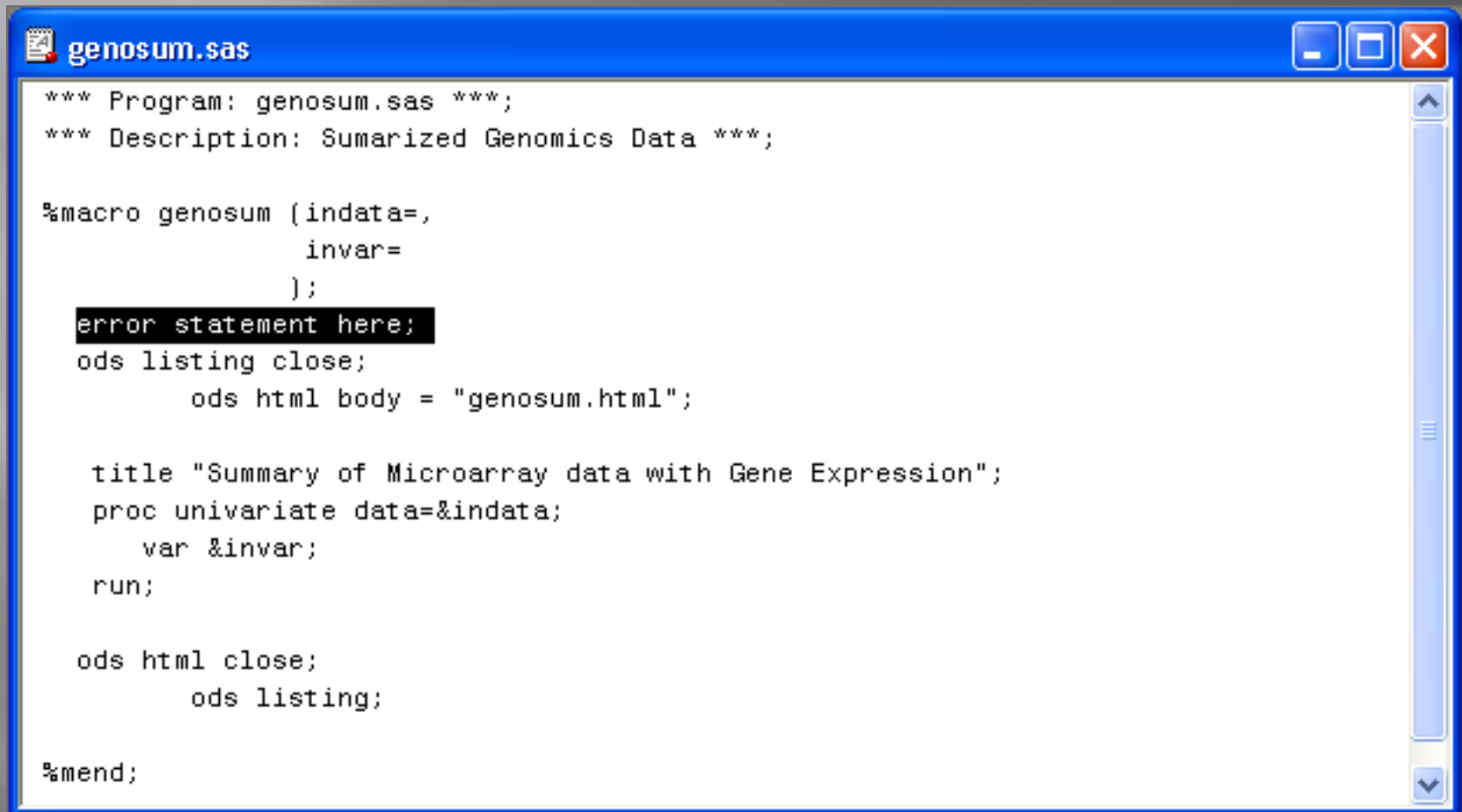


# Sample Macro With Error

- ▣ Displaying SAS Error
  1. Display ERROR
  2. Review Log



# Sample ERROR in Code



```
*** Program: genosum.sas ***;
*** Description: Sumarized Genomics Data ***;

%macro genosum (indata=,
               invar=
               );
  error statement here;
  ods listing close;
    ods html body = "genosum.html";

  title "Summary of Microarray data with Gene Expression";
  proc univariate data=&indata;
    var &invar;
  run;

  ods html close;
    ods listing;

%mend;
```

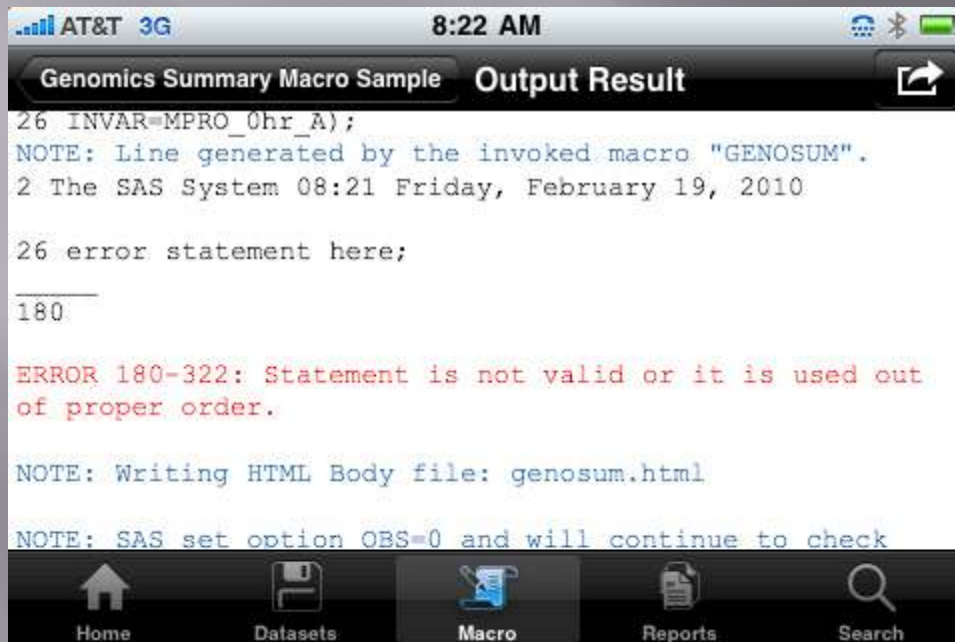
# Sample Macro With Error

- Prompt with iPhone Pop Up



# Sample Macro With Error

- Rotate, Pinch Zoom, View...

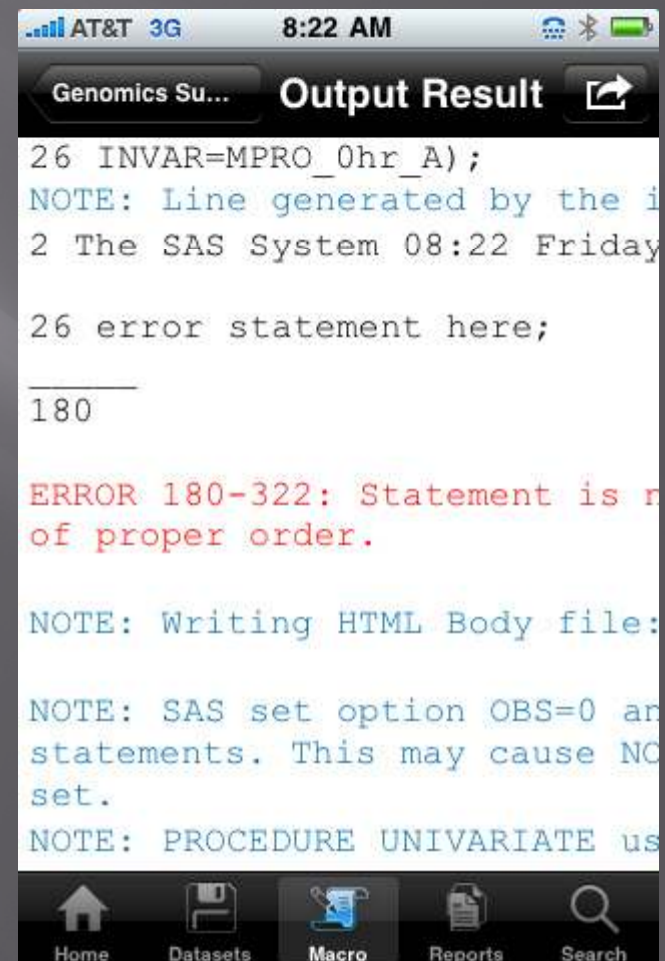


AT&T 3G 8:22 AM

Genomics Summary Macro Sample Output Result

```
26 INVAR=MPRO_Chr_A);  
NOTE: Line generated by the invoked macro "GENOSUM".  
2 The SAS System 08:21 Friday, February 19, 2010  
  
26 error statement here;  
  
180  
  
ERROR 180-322: Statement is not valid or it is used out  
of proper order.  
  
NOTE: Writing HTML Body file: genosum.html  
  
NOTE: SAS set option OBS=0 and will continue to check
```

Home Datasets Macro Reports Search



AT&T 3G 8:22 AM

Genomics Su... Output Result

```
26 INVAR=MPRO_0hr_A);  
NOTE: Line generated by the i  
2 The SAS System 08:22 Friday  
  
26 error statement here;  
  
180  
  
ERROR 180-322: Statement is r  
of proper order.  
  
NOTE: Writing HTML Body file:  
  
NOTE: SAS set option OBS=0 an  
statements. This may cause NO  
set.  
  
NOTE: PROCEDURE UNIVARIATE us
```

Home Datasets Macro Reports Search

# Large Genomics Data on iPhone?



# Mobility and Ubiquity



# User Friendly Interface



# Genomics Data iPhone?... check



Stone (40,000 B.C.)



iPhone 3G (2008)

MMS	X	X
Video recording	X	X
Videocall	X	X
Changeable memory cards	X	X
Running SAS Macros	X	✓

# Conclusion

- ▣ Software Delivery and Distribution Significantly Changed with App Store
- ▣ SAS Macro is Powerful Customizable Business Intelligence Analytical Tool
- ▣ Barriers of SAS Tools Behind IT and Servers is now Broken and Delivered to Users via iPhone
- ▣ Ubiquity of Portable Computing such as iPhone and soon iPad Delivers Information to Masses

# Questions

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