

M12. PROJECT MODULE

SHINY GRAPHIC TOOLS FOR MICRO- ARRAY AND GENE EXPRESSION ANALYSIS

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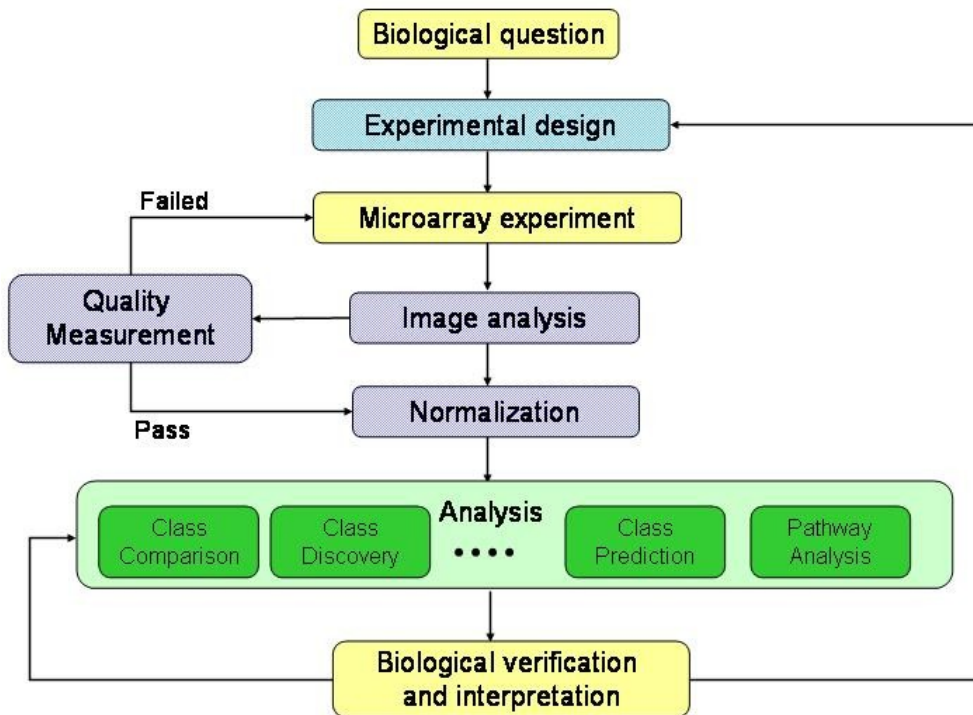
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Purposes

Continuing down the line of a prototypical pipeline in which micro arrays are generally used, we want to focus our project in 4 layers: loading the micro array experiment, Image Analysis, Normalization and a couple of typical Analysis.



Our initial objective is to create a functional application that will help researchers interpret and analyse gene expressions through microarrays stored in .cell files.

We will also give the option of instead uploading the file itself, look up for them in Web Databases using their id

For that, we'll work with R packages such as Bioconductor and Shiny, to work with graphics.

Our application will be a server-based app, with its own database (for users' .cell files, app's users and so on).

Functional and non-functional Requirements

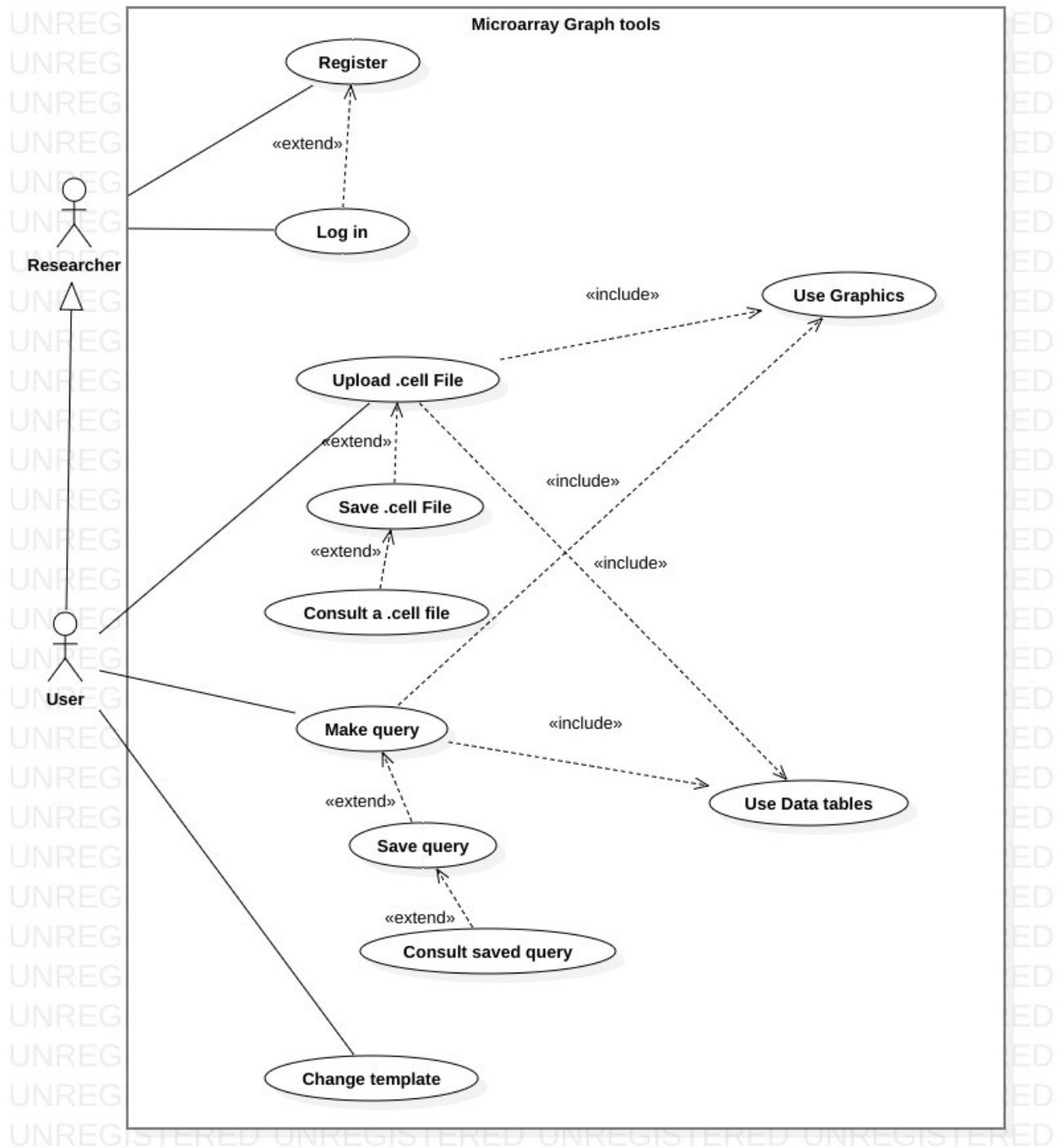
RF1. CELL MANAGEMENT	As a researcher I want to upload my .cell files to the web app, for further consultations Level: high
RF1.1 Saving .cell	procedures to save .cell files into our database Level: high.
RF1.2 Consulting .cell	Procedure to consult saved .cell files in DB Level: medium
RF1.3 Upload .cell	Procedure to upload .cell files for further analysis Level: high
RF2. QUERY MANAGEMENT	As a researcher I want to make a query using microarray's id to GEOQuery or ArrayExpress DB Level: high
RF2.1 Make query	Procedure to make a query into 2 external databases Level: high
RF2.2 Saving queries	Procedure to store previous queries in user data Level: high.
RF2.3 Consulting saved queries	Procedure to access previously saved queries Level: high
RF2.4 Choose external database	Procedure to choose between GEO query or Array Server db Level: medium
RF3. DATA MANAGEMENT	As a researcher I want to use different sets of graphics or data tables to see and interpret gene expressions saved in my .cell files or in my micro array queries Level: high
RF3.1 Graphics	Methods to print reactive graphics and tools Level: high.
RF3.2 Data tables	Methods to print reactive graphics and tools Level: medium
RF4. USER MANAGEMENT	As a researcher I want to be able to register and log unto this web app to consult saved .cell files and saved queries Level: high
RF4.1 Register	Register new user Level: high
RF4.2 Login	Login existing user Level: high

RF5. VIEW CUSTOMIZATION	As a researcher I want choose the graphic tool templates
	Level: low.
RF5.1 Change template	Changing Shiny app template
	Level: low

- Back-end: Shiny for graphic tools, PHP and MySql to handle login and user's info
- Front-end: HTML, Bootstrap
- Data management: R and other R-related packages (like BioConductor)
- Server: Ubuntu Server

Use Case diagram and textual description

Use Case Diagram



Textual Description Templates

ID	1.1
Name	Saving .cell file
Description	Once the user has successfully uploaded a cell file, it has the option to be saved into its personal user account for further access
Normal Flux	
Actors	User
Pre conditions	Being logged in and have already successfully uploaded a .cell file
Activation	Clicks on «Save» button
Description	<ol style="list-style-type: none"> 1. User clicks on «Save» option 2. Confirmation box will ask if wants to save file in its account 3. Confirmation message
PostConditions	Returns to upload file view
Alternate Flux 1	
Description	3. User doesn't accept confirmation box
Post-Condition	File will not be saved in its account
Alternate Flux 2	
Description	3. Error with db occurs and file is not saved
Post-Conditions	Message error informs user about problem

ID	1.2
Name	Consulting .cell
Description	A view where user can access previously uploaded files
Normal Flux	
Actors	User
Pre conditions	Being logged in
Activation	Entering consult .cell file view
Description	<ol style="list-style-type: none"> 1. User goes to this view 2. View is displayed
PostConditions	Use graph or data table tools to analyze this .cell
Alternate Flux 1	
Description	3. No .cell file was saved
Post-Condition	View will be empty

ID	1.3
Name	Upload .cell
Description	Action that will let user choose a local file and upload it to the web app for further actions
Normal Flux	
Actors	User
Pre conditions	Being logged in
Activation	Clicking the upload button
Description	<ol style="list-style-type: none"> 1. User clicks «upload» option 2. New window will prompt user to choose a local file 3. Select and accept
PostConditions	Uploaded file will be reproduce will default graph and data table tools for further reactive interaction
Alternate Flux 1	
Description	4. File has wrong format (not a .cell file)
Post-Condition	Message error indicating file has wrong format and could not be uploaded

ID	2.1
Name	Make a query
Description	User can choose to make a query to microarray database instead of uploading a local file
Normal Flux	
Actors	User
Pre conditions	Being logged in and being in possession of a microarray's id
Activation	Clicking «Query» view
Description	<ol style="list-style-type: none"> 1. User selects a database 2. In troduced microarray id and accepts 3. If array exists in the database, it will be analyze with graph tools
PostConditions	Using interactive graph tools to study microarray
Alternate Flux 1	
Description	Id doesn't exist
Post-Condition	Error message: id not found

Alternate Flux 2	
Description	No id is introduced
Post-Conditions	Client-side message error informing that id can not be null

ID	2.2
Name	Saving query
Description	Once a db query has being made, user can choose to save it in its account
Normal Flux	
Actors	User
Pre conditions	Being logged in and have made a succesfull query
Activation	Clicking «Save query» option
Description	1. User clicks save option 2. will be prompted to confirm
PostConditions	Id is saved in its account info
Alternate Flux 1	
Description	User doesn't accept query to be saved
Post-Condition	Query id not saved

ID	2.3
Name	Consulting save queries
Description	An option in user view to go and check previously saved queries
Normal Flux	
Actors	User
Pre conditions	Being logged in
Activation	Once user enters «saved queries» view
Description	1. User enters saved queries view 2. A new display with saved ids is shown
PostConditions	User can make a new query using that id
Alternate Flux 1	
Description	3. User doesn't have any saved id
Post-Condition	None special

ID	3.1 and 3.2
Name	Graphic tools and Data table tools
Description	A set of graph and table tools for data analysis
Normal Flux	
Actors	User
Pre conditions	Being logged in and have made a microarray upload (by consulting microarray web database using id or uploading a local .cell file)
Activation	Depends on the view (db query or file upload)
Description	<ol style="list-style-type: none"> 1. User choose how to retrieve a microarray 2. Once retrieved, graph tools are displayed 3. Reactive tools will let user personalize its tools
PostConditions	Printing graphs, exporting them to pdf, saving query id or saving uploaded file in user account

ID	4.1
Name	Register
Description	A researcher can register as a user in this app
Normal Flux	
Actors	Any client or resear who wants to use our app
Pre conditions	None
Activation	Clicking in register option
Description	<ol style="list-style-type: none"> 1. Visitor clicks register option 2. Classic form will ask user to fill data to make an account 3. Everything is sanitize and checkd, then a user account is created
PostConditions	New user can make queries or upload .cell files
Alternate Flux 1	
Description	Error in form inputs
Post-Condition	Message displayed informing about error
Alternate Flux 2	
Description	Visitor introduces an already introduced email
Post-Conditions	Message error informing correu electrònic already informed, no new user created

ID	4.2
Name	Login
Description	A user logs into its account
Normal Flux	
Actors	User
Pre conditions	Have created an account
Activation	Clicking in login option
Description	1. User tries to log in 2. App will ask for credentials 3. User verified
PostConditions	User can access to all user-only views and tools
Alternate Flux 1	
Description	Wrong password introduced in login form
Post-Condition	Message error
Alternate Flux 2	
Description	Wrong user name introduced
Post-Conditions	Message error or prompting researcher to register

ID	5.1
Name	View customization
Description	A simple tool to change graph tools' dashboard view template
Normal Flux	
Actors	User
Pre conditions	Being mlogged in and already using the graph tool
Activation	Changin option in a select form
Description	1. User changes template option 2. View is updated with new template
PostConditions	New color scheme is updated into the dashboard

Database

We are still figuring out what kind of database can be useful for this kind of app. Since we will only need to storage user's credentials and a couple of other details (queries id and .cell files), our database, at the stage of our initial intention, is very simple.

We will further enhance its use with more app development; and then we'll establish a database entity model.

Description of the project methodology used

For our project we'll use an Agile methodology: we'll split all our tasks following each functional requirement needed, giving each one of them a score regarding its value for the app, and organizing them into 4 sprints, each one regarding one week of project time

Project planning

User Story	Difficulty
1.1 Saving .cell	2
1.2 Consulting .cell	2
1.3 Upload .cell	3
2.1 Make query	4
2.2 Save queries	2
2.3 Consult queries	2
2.4 Choose external database	4
3.1 Print graphics	6
3.2 Print data table	6
4.1 Register user	3
4.2 Login user	3
5.1 Changing Shiny template	1

Rearranging with difficulty order:

User Story	Difficulty
3.1 Print graphics	6
3.2 Print data table	6
2.1 Make query	4
2.4 Choose external database	4
1.3 Upload .cell	3
4.1 Register user	3
4.2 Login user	3
1.1 Saving .cell	2
1.2 Consulting .cell	2
2.2 Save queries	2
2.3 Consult queries	2
5.1 Changing Shiny template	1