

Assignment IV:

Smashtag Mentions

Objective

In this assignment, you will enhance the Smashtag application that we built in class to give ready-access to hashtags, urls, images and users mentioned in a tweet.

Submit your solution via the normal process before the start of lecture next Wednesday.

Be sure to review the Hints section below!

Also, check out the latest in the Evaluation section to make sure you understand what you are going to be evaluated on with this assignment.

Materials

- This is a completely new application, so you will not need anything (but the knowledge you gained) from your first three homework assignments.
 - You will need a Twitter account.
 - The [Twitter utility classes](#) are required (or at least, will be extremely useful!) for this assignment.
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Required Tasks

1. Enhance Smashtag from lecture to highlight (in a different color for each) hashtags, urls and user screen names mentioned in the text of each Tweet (these are known as “mentions”). Note that mentions are already located for you in each Tweet by Twitter and show up as [Mention]s in the `Twitter.Tweet` class in the Twitter framework that comes along with the demo from class.
2. When the user touches a Tweet, segue to a new `UITableViewController` which has four sections listing the “mentions” in the Tweet: images, hashtags, users and urls. The first section displays (one per row) any images attached to the Tweet (found in the `media` variable in the `Twitter.Tweet` class). The last three sections list the items described in Required Task 1 (again, one per row).
3. Images in the table above should be shown in their normal aspect ratio and should use the entire width of the table view (a standard surrounding border is acceptable).
4. Each section in the mentions table view should have an appropriate header, but if a section has no items in it, there should be no header visible for that section.
5. If a user touches an entry for a hashtag or a user in the mentions table view, segue to show the results of searching Twitter for that hashtag or user. It should be searching for hashtags or users, not just searching for a string that is the name of the hashtag or user (e.g. search for “#stanford”, not “stanford”). The view controller to which you segue must work identically to the main Tweet-viewing view controller (`TweetTableViewController`).
6. If the user touches on a mentioned url in your newly created view controller, you should open up that url in Safari (see Hints below for how to do that).
7. If the user touches on an image in your newly created view controller, segue to yet another new MVC which lets the user scroll around and zoom in on the image. When the image **first appears** in this new MVC, it should display zoomed (in its normal aspect ratio) to **show as much of the image as possible but with no “whitespace” around it**. The user can then scroll around and zoom from there.
8. Keep track of the most recent 100 Twitter searches the user has invoked (by any means) in your application. Add a `UITabBarController` to your application with a tab for searching (i.e. the functionality above) and a second tab showing these most recent search terms in a table view (**case-insensitively unique with most recent first**). When a user touches on a search term in this tab, segue (stay in that same tab) to show the most recent Tweets matching that search term. Store these most recent search terms permanently so that your application doesn’t forget them if it is restarted.
9. You must not block the main thread of your application at any time.
10. Your application must work properly in portrait and landscape on any iPhone (this is an iPhone-only application).

Hints

1. You will need to log in to Twitter in Settings on your device (or on the simulator) to make the provided Twitter framework work.
2. Remember that you must create a workspace in Xcode that contains both your Smashtag project and the provided Twitter framework project. The two projects must be **siblings** (not have an ancestral relationship to each other) in the workspace.
3. You will also need to drag the Twitter framework (from the navigation pane of your workspace) into the General tab of your Smashtag Project Settings under Embedded Binaries.
4. The Twitter data structures provided are `CustomStringConvertible`, so you can print them out with `print`. This might be helpful for debugging purposes.
5. Don't be overwhelmed by all the code in the Twitter framework. The only method you'll ever need to call in the entire framework is `fetchTweets`. Otherwise you just need to access whatever `public` properties you need in the `Tweet`, `MediaItem` and `User` data structures. You can completely ignore non-`public` parts of the Twitter framework.
6. Warning: Twitter does not always report every single mention (especially url mentions at the end of a tweet). As long as 90+% of the mentions are showing up in your UI, you are probably doing it right.
7. Most `UIKit` classes (like `UILabel` and `UIButton`) have a method `attributedText` which lets you set and get its text using an `NSAttributedString`.
8. Make sure you do not "break" the feature that currently exists in Smashtag whereby it shows Tweets using the preferred body font style (and thus the text in the Tweets can be made larger or smaller by the user in Settings).
9. To add a `UITableViewController` to your storyboard, just drag one out of the Object Palette and change its class to be a custom subclass of `UITableViewController` you create using `File → New → File...`
10. Your new "mentions" (and images) MVC has different "kinds" of things in each section. While you might be tempted to deal with this with large `if-then` or `switch` statements in your `UITableViewDataSource` and navigation methods, a cleaner approach would be to create an internal data structure for your `UITableViewController` which encapsulates the data (both the similarities and differences) in the sections. For example, it'd be nice if `numberOfSectionsInTableView`, `numberOfRowsInSection`, and `titleForHeaderInSection` were all "one-liners".
11. In fact, in general, any method that has more than a dozen lines of code is probably going to be hard for readers of your code to understand (and might well betray a "less than optimal" architectural approach).

12. Don't forget about Swift features like `enum`. Use Swift to its fullest. Harken back to the data structure we created for the `CalculatorBrain`. It might provide some inspiration for this assignment too.
13. As always, give solid thought as to what the “public (i.e. non-private) API” of your new controller is. Make everything else `private`. Your public API is what says to the rest of your application “this is how you use this controller.” No other part of your application should know anything about the internal workings of your controller. And your controller should always “do the right thing (i.e. do what it was created to do)” when some other part of your application uses the controller by calling its public API.
14. Ditto for any `UITableViewCell` subclass you create. Or any class you create for that matter!
15. Be sure to think about the titles of your MVCs (i.e. what appears in the navigation bar of a navigation controller when each MVC is being shown).
16. If you are going to be indexing into an `NSAttributedString`, you will want to use the `nsrange` property of `Tweet.Mention` (since `NSAttributedString` indexes into an underlying `NSString`, not an underlying `String`).
17. If you have an `NSURL` named `url`, you can open it in Safari like this:
`UIApplication.shared.openURL(url)`. In iOS 10, this has changed to `open(URL)`, but if you use the newer one, you'll want to protect it with `if #available(iOS 10.0, *)`. This might be a good chance to read about `#available`!
18. You will almost certainly need two different `UITableViewCell` prototypes in your storyboard. Give them different identifiers and dequeue an appropriate one in `cellForRowAt`.
19. Your new view controller's row heights don't need to be “estimated” like the row heights of the “list of Tweets” controller because you have very few rows and performance is not a consideration. Thus you will likely want to implement the `UITableViewDelegate` method `heightForRowAt`.
20. For your rows that contain an image, you'll have to figure out an appropriate height depending on its aspect ratio. For the other rows in your table, you can just let them automatically figure their own height by returning `UITableViewAutomaticDimension` from `heightForRowAt`.
21. You can figure out the aspect ratio of an image in a `Tweet` without having to actually fetch the actual image from its url. See the `MediaItem` class in the Twitter framework provided.
22. For the required task where the user can click on an image to start panning and zooming on it in a new MVC, you can mostly reuse code from Cassini. However, you'll have to add the autozooming-to-fit capability to the `ImageViewController`.

23. It would be great to make that autozooming-to-fit behavior continue to happen whenever the MVC's view's geometry changes until the user explicitly zooms with a gesture (there is a delegate method to find out when that occurs). That way it'll autozoom-to-fit as the user rotates their device.
24. A cool feature of your application is (should be!) that if the user wants to zoom in on a Tweet's image a bit without clicking on it to segue to the detailed image viewing MVC, the user can simply rotate the device to landscape. If you implement things properly, you'll get this feature "for free" (i.e. no code required).
25. It's probably a good idea to have a single, global "truth" for the most recent search terms and, since you have to store them in `UserDefaults` anyway, why not make `UserDefaults` be that truth? You might want to wrap a little `class` or `struct` around your storing and recalling from `UserDefaults` that you can use throughout your application.
26. `Data(contentsOf:)` **blocks** the thread it is called from when invoked with a network url. Thus you cannot call it from the main thread.
27. You cannot make any calls into `UIKit` from any thread other than the main thread. Be careful not to "accidentally" do this by calling some method which subsequently calls a method in `UIKit`. If you call a method from `UIKit` (directly or indirectly) off the main thread, your UI will fail in unpredictable ways.
28. The `fetchTweets` method can execute its handler **off** the main thread (so `UIKit` methods **cannot** be called from that results handler).
29. Remember that the cells of a `UITableView` are only created for **visible** cells and they are **reused** as data comes on screen and goes off screen.
30. If you are fetching in a thread other than the main thread and then get the result and then want to ask the main queue to do something with that result, you'd better be sure nothing has "changed" while the network call was going on (especially note this with respect to the Hint immediately above this one).

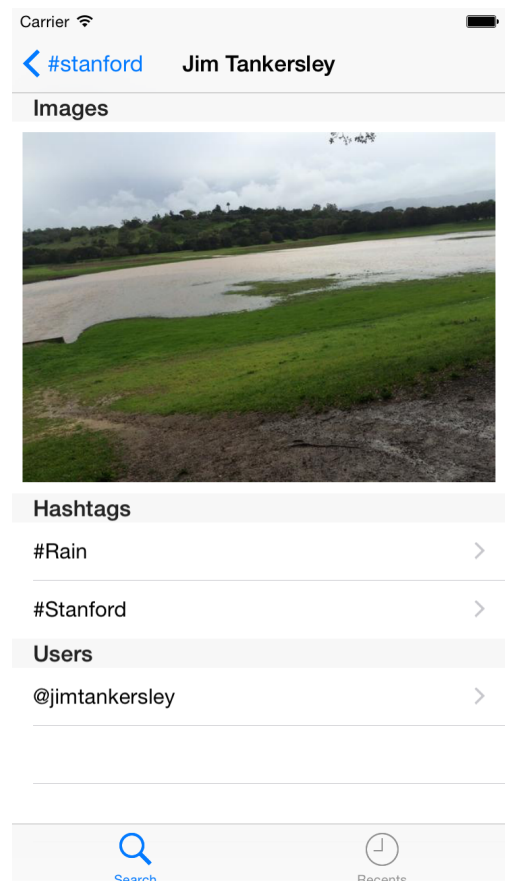
Things to Learn

Here is a partial list of concepts this assignment is intended to let you gain practice with or otherwise demonstrate your knowledge of.

1. NSAttributedString
2. UITableView
3. UITableViewController
4. UITableViewCell
5. UIRefreshControl
6. UIActivityIndicatorView
7. UITabBarController
8. Multithreading
9. Data structure design
- 10.NSUserDefaults
11. UIScrollView
12. UIImageView

Screen Shots

We are always hesitant to include screen shots because we don't want to restrict your creativity. These screen shots are NOT Required Tasks. They are just intended to give you an idea if you are having trouble visualizing the Required Tasks. The colors below were chosen completely at random. You should choose colors you think look good in your UI.



Evaluation

In all of the assignments this quarter, writing quality code that builds without warnings or errors, and then testing the resulting application and iterating until it functions properly is the goal.

Here are the most common reasons assignments are marked down:

- Project does not build.
- Project does not build without warnings.
- One or more items in the Required Tasks section was not satisfied.
- A fundamental concept was not understood.
- Code is visually sloppy and hard to read (e.g. indentation is not consistent, etc.).
- Your solution is difficult (or impossible) for someone reading the code to understand due to lack of comments, poor variable/method names, poor solution structure, long methods, etc.
- UI is a mess. Things should be lined up and appropriately spaced to “look nice.”
- Incorrect or poor use of object-oriented design principles. For example, code should not be duplicated if it can be reused via inheritance or other object-oriented design methodologies.
- Public and private API is not properly delineated.
- Main thread is ever blocked.

Often students ask “how much commenting of my code do I need to do?” The answer is that your code must be easily and completely understandable by anyone reading it. You can assume that the reader knows the SDK, but should not assume that they already know the (or a) solution to the problem.

Extra Credit

There are lots of ideas below. We certainly don't expect that you'll do all of them (and some are more difficult than others). Read through them and pick whichever ones intrigue you the most.

1. In the Users section of your new `UITableViewController`, list not only users *mentioned* in the Tweet, but also the user who *posted* the Tweet in the first place.
2. When you click on a user in the Users section, search not only for Tweets that mention that user, but also for Tweets which were posted by that user.
3. The UI of this application can get very, very deep into a `UINavigationController` stack (as you chase mentions down). Add some UI which will allow the user to pop all the way back to the `rootViewController` of the `UINavigationController` at any time.
4. Instead of opening urls in Safari, display them inside your application by segueing to a controller instead. You'll have to provide at least a little bit of "browser control" UI to go along with it (e.g. a "back button"). Remember that `UINavigationController` can display buttons at the bottom as well via the `toolbarItems` method in an embedded MVC.
5. Make the "most recent searches" table be editable (i.e. let the user swipe left to delete the ones they don't like).
6. Add some UI which displays a new view controller showing a `UICollectionView` of all the images in all the Tweets that match the search. When a user clicks on an image in this `UICollectionView`, segue to showing them the Tweet (even though you'd only be showing one Tweet, you could still use your `TweetTableViewController` and then you'd have all the "pursue mentions" functionality available from there).

Extra Credit Hints

1. If you have built a good internal data structure for your section data, hopefully this is just a matter of enhancing an `init()` method for that internal data structure or something.
2. You will want to familiarize yourself with the “operators” in [Twitter search queries](#).
3. The “pop back” UI should obviously not appear when you are at the root view controller.
4. Check out the documentation for `UIWebView` or `SFSafariViewController`.
5. When you create a `UITableViewController` subclass, the template will actually include some methods to help with this.
6. Here are some things to consider ...
 - 6.a. Because you will obviously be downloading all those images off the main thread, scrolling around should be snappy, but, frankly, if you re-download them over and over as the user scrolls around, you’ll get a lot of blank spaces that fill in over time and won’t really look that great. So cache the images. Check out the class `NSCache`. It is like an `NSDictionary` (`object(forKey:)` and `setObject(_, forKey:)`), but adds the concept of a “cost” of something being in the cache via `setObject(_, forKey:, cost:)`. The “cost” of an image could be its size in kb, for example. The `NSCache` will throw things out of the cache any time it wants, so you will always just lookup the URL you want (to find the associated `UIImage`), use it if you find it, or just download it again if you don’t. You’ll want your cache associated with your `UICollectionViewController` subclass (so that it will be shared by all the cells and so that it will go away when the controller goes away). You’ll have to figure out the right way to make the cache available to the cells.
 - 6.b. The big difference between a `UITableView` and a `UICollectionView` is that a table view is always laid out in exactly the same way (i.e. rows in a single column). A collection view has a `UICollectionViewLayout` property which determines how its cells are layout (and is thus massively flexible). `UICollectionViews` by default use a `UICollectionViewFlowLayout` to lay out its cells kind of like the characters in “justified text” are laid out. That should suit your purposes here just fine! Things like the size of a cell is determined by the `delegate` in both table views and collection views, but in collection views, the `delegate` responds to a protocol that is specific to its layout engine. For a `FlowLayout`, the protocol is called `UICollectionViewDelegateFlowLayout`. So if you want to control the size of cells, for example, you’d implement `collectionView:layout:sizeForItemAt:` in your `UICollectionViewController` subclass.

- 6.c. You can take the easy way out and pick a predetermined size for the cells in the `UICollectionView` or, perhaps better, pick a predetermined “area” (i.e. width x height) for each one (but maintain each image’s aspect ratio).
- 6.d. It would be cool to have “pinching” on the `UICollectionView` make the cell’s size get larger and smaller (i.e. showing more or fewer images). Pinching should be trivial to implement if you take the approach above to size your cells (pinching would just scale the “area” up and down).