The Harmonizome Mobile Application

Available on the App Store

ANDROID APP ON Google play

BD2K - LINCS
DATA COORDINATION AND INTEGRATION CENTER

Icahn School of Medicine at Mount Sinai

iOS: http://appstore.com/harmonizome
Android: http://goo.gl/JWII8H

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Abstract

Most online databases that enlist properties of human genes and proteins only include information from a hand full of resources. Genomics, transcriptomics and proteomics resources can provide additional information about single genes or proteins, but these are not readily organized and abstracted for such purpose. To create the Harmonizome mobile app, we assembled, extracted, and organized knowledge from over 60 online resources, including novel databases that we created such as: ChEA, KEA, SILAC phosphoproteomics, ESCAPE, PPI Hubs, and collections of signatures extracted from GEO.

The Harmonizome mobile app serves this accumulated knowledge in an easy to access interface where users can enter their gene/protein of interest to discover its properties and functions. The knowledge spans many bioinformatics omics resources from expression in cells, tissues and diseases; regulation by transcription factors, chromatin marks and microRNAs; functional membership in protein complexes, pathways and ontologies; genomic associations with disease, and differential expression upon treatment of human cells with drugs; as well as structural and other genomic features. The Harmonizome app serves the collected knowledge in defined categories for navigation ease, and with links out for further exploration of associated functions of genes and proteins. The Harmonizome mobile application is available at the Google Play Store: http://goo.gl/JWII8H for Android devices, and the App Store http://appstore.com/harmonizome for iOS devices.

Methods

The Harmonizome mobile application consists of an iPhone and Android application in addition to a web server for retrieving information about genes/proteins. Although the application was released on two platforms, there is only one code base built with Facebook's React Native (Facebook, 2015); a framework for building cross-platform native applications using Javascript. The application's server, written in Java, communicates with a MySQL database containing the searchable genes/proteins as well their relationships with terms from over 60 online databases.
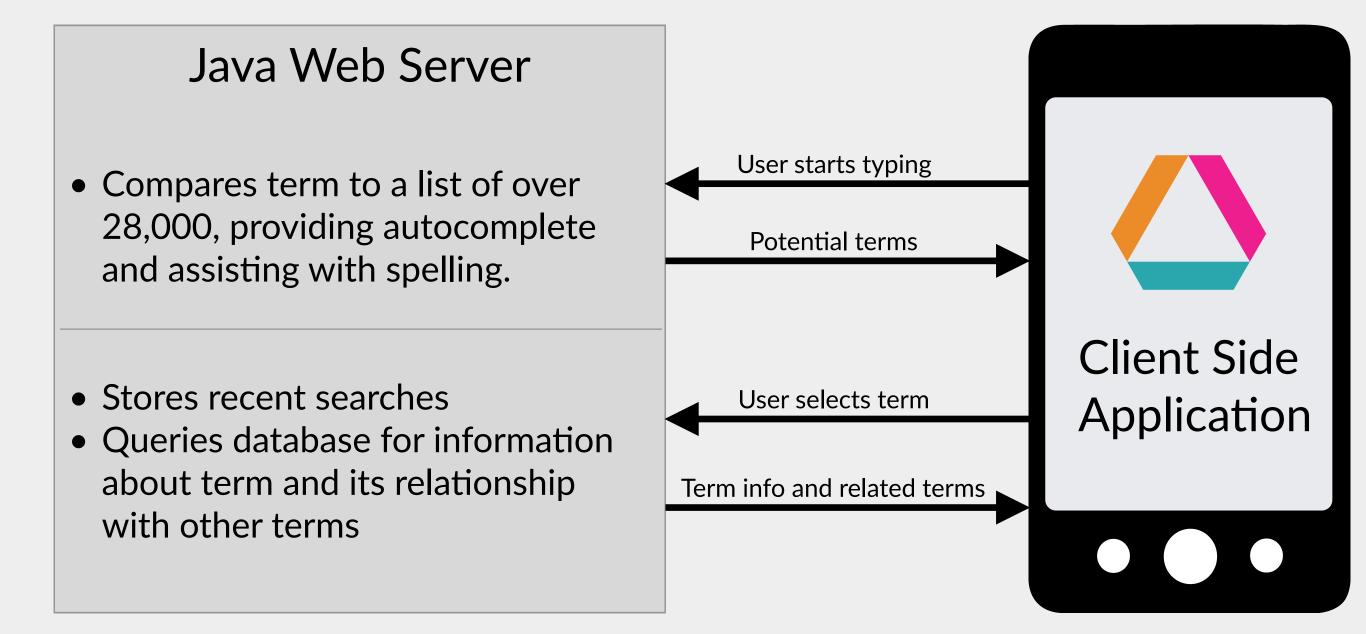
Java Web Server
- Compares term to a list of over 28,000, providing autocomplete and assisting with spelling.
- Stores recent searches
- Queries database for information about term and its relationship with other terms

User starts typing → Potential terms
User selects term → Term info and related terms

Client Side Application

Figure 1. The Harmonizome mobile application's architecture: A client-side mobile application and a Java web server.

Results

In order to use the Harmonizome mobile application, a device running Android (4.1+) or iOS (8.2+) with an internet connection is required. The application can be downloaded from the Google Play Store for Android devices or from the App Store for iOS devices. Once the application launches, the screen will look similar to figure 2. By typing a query into the search bar, you'll notice that the appearance will change to that of figure 3. The terms available in the autocomplete options below the search bar are pulled from the Harmonizome's web server. While you are required to select one of these provided official human gene symbols, there are over 28,000 available and new ones are being added. Finally, selecting a gene brings you to the category screen, where results are sorted by various categories depending on the gene selected. This view is shown in figure 4.
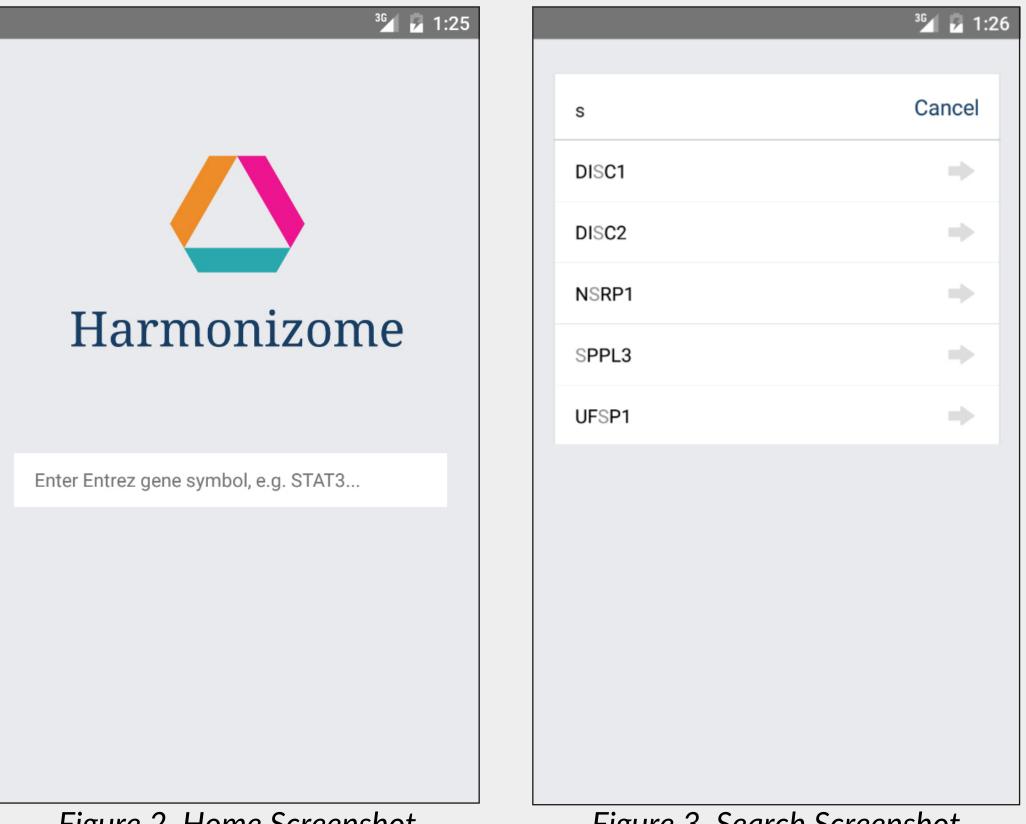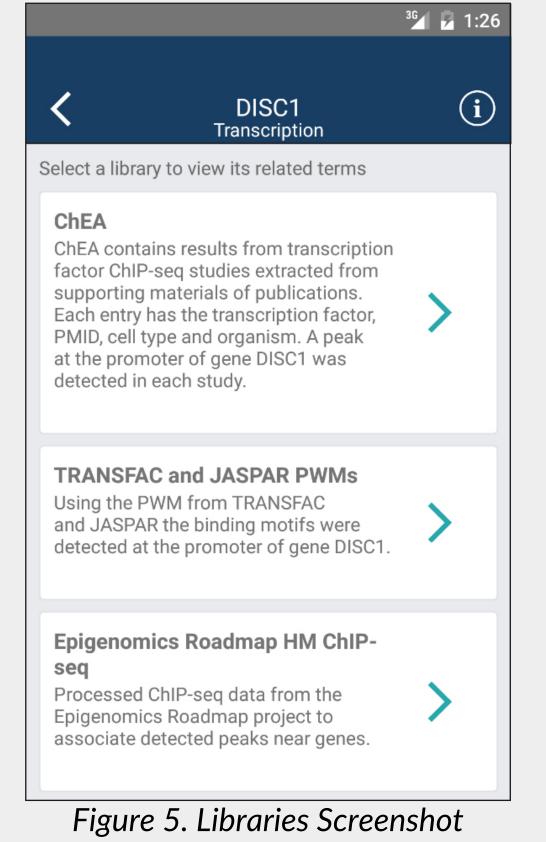
Figure 2. Home Screenshot   Figure 3. Search Screenshot   Figure 4. Categories Screenshot

Upon pressing on a category, a list of available libraries is shown (figure 5). These libraries lead to a results page showing all related terms (figure 6). The class of these terms depend on the category and library selected. If available, links out are provided to further explore additional information about the gene/protein. Finally, at any time, pressing the info (i) button at the top right corner reveals additional information about the gene, such as its full name and its synonyms (figure 7).

Figure 5. Libraries Screenshot   Figure 6. Terms Screenshot   Figure 7. Gene Info Screenshot

Conclusions

Despite the increasing popularity of the iOS and Android mobile platforms, there are a limited number of native applications developed for biomedical researchers. With approximately 70 installs across both platforms, the Harmonizome mobile application is already being used by researchers to quickly access knowledge about genes, proteins, and functional terms from anywhere.

In the near future we plan to add many new additional features to the Harmonizome mobile app, these include: "genes like me" feature which will suggest similar genes based on shared functional terms; visualization of all genes in a pathway, complex or any other term; complex querying that search for genes based on defined criteria, for example, "brain expressed" + "up regulated in disease x" + "regulated by transcription factor y".

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References

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