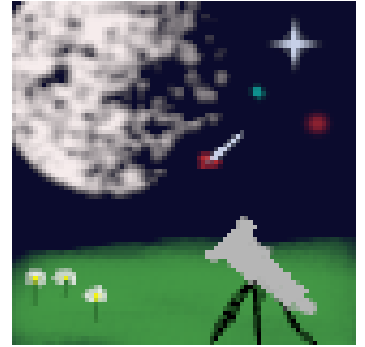# Team First Light

User Manual

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User Manual - A GUI interface for all-sky astronomical survey data exploration

1.0 Introduction

One of the most important parts of any software development process is communication and clarity among developers, managers, and investors. Without a clear understanding among all parties involved in the creation of software, there are bound to be issues and/or confusion for somebody at some point in the development or release process. Throughout the entirety of the Computer Science capstone experience at Northern Arizona University (NAU), Team First Light created a web-based application capable of providing visualizations, organization, and interactivity among large astronomical datasets, specifically those of asteroids from all-sky observations. Team First Light consists of Team Lead Matt List, Recorder Carson Pociask, Release Manager Jakob Nelson, and Architect William Fuertes. The team created said software product for NAU professors Dr. David Trilling, Professor of Astronomy and Planetary Science and Dr. Mike Gowanlock, Assistant Professor at the School of Informatics, Computing, and Cyber Systems (SICCS). A thorough description of the project's history and current standing can be found in the final report. Minimal detail about project background is provided here as this document intends to serve as a user manual for anyone that has interest in, or is going to use Team First Light's software. Starting below, one can get a solid understanding of how to use the web application via walkthroughs and explanations of the different modules implemented by the team.

2.0 URLs and Home Page

To even begin a description of the functionalities available through this web application, one should first have access to the live site. The web application can be accessed at: https://rc.nau.edu/snaps/ or, in the sense of a development process rather than for public use, https://rc.nau.edu/snaps-dev/ which only serves as a development server can be used. Given that the site is up and running properly, one will be able to enter the above address into the URL of a browser and visit the site. Once the website is loaded, a user will be brought to the home page where there are four histograms that provide high level views of the asteroid data from the Zwicky Transient Facility (ZTF) database, the primary database utilized in the project. These histograms are intended to give a user an idea of the general asteroid data available to interact with and explore. The four histograms are as follows: count of asteroids over g-r color, number of objects over light curve rotation periods, number of objects over light curve amplitudes, and finally number of objects over number of observations. These histograms have the ability to give

a user an idea of what to explore when diving deeper into the asteroid data. There are a few links that can be accessed off of the home page where a user will first land. First, the team will describe the pages that contain the different kinds of plots, described in the next section.

3.0 Plot Pages - Heat Maps and Scatter Plots

If a user interacts with the sidebar on the left side of the page, they will find direct links to different pages. One of these links gives access to the heat map page. Once arrived at the heat map page, a user will specify ranges for the X and Y axes that they want to view asteroids in for a selected combination of asteroid attributes. Once satisfied with the inputs, a user can hit the 'build graph' button to trigger the building of the plot. After a short wait, a user will be presented with a heat map fitting the requested inputs where each point within the plot represents an individual asteroid. There are two dropdown menus above the heat map that a user can interact with. In these dropdown menus are the attributes used to measure asteroids from the ZTF database. A user can build a graph using different combinations of attributes from these dropdowns.

The biggest implementation of this project is the creation of scatter plots. Similar to the path to the heat maps, a user can navigate through the left sidebar to get to the scatter plot page. A user will specify ranges for the X and Y axes that they want to view asteroids in for a selected combination of asteroid attributes. Once satisfied with the inputs, a user can hit the 'build graph' button to trigger the building of the plot. After a short wait, a user will be presented with a scatter plot fitting the requested inputs where each point within the plot represents an individual asteroid. Interaction among both the scatter plots and heat maps include the ability to zoom in/out and pan across the plot. However, far more interaction exists in the scatter plots.

Each point within the scatter plots is clickable in that a link will be generated to a new page. Once a user clicks an asteroid point, said link will appear below the plot that, when clicked, will bring a user to a new page dedicated to that selected asteroid. Once on this newly created page, a user will be presented with another scatter plot but this time each point represents one observation of the selected asteroid. The same dropdowns are present on this page as well if a user wanted to measure observations of an asteroid over different attributes. Even further interaction exists on this page in that each observation point within the plot is clickable. The same functionality of a link populating below the graph is in place for this page as well. Once clicked, this link will take a user to a new page dedicated to that selected observation. It is here that a datatable is built that contains every single attribute-value pairing for the selected observation.

4.0 Account Functionality

Another important feature of the created web application is the ability to have an account within the application. This account feature consists of the ability to sign up for an account, login to a created account, and log out of a created account. To create a new account, a user can navigate to the top bar of the application and click the 'sign up' button located at the top right. Once on the sign up page, a user will be prompted to input information into the following fields: username, password, confirm password, and email address. A user cannot create multiple accounts under the same email and must have a unique username not already taken by another user. A user must also confirm that the password they chose is really what they think it is by typing it out twice. This way, a user won't mistype a password by accident and not be able to login in the future. Once a new account has been created, the user will automatically be logged in and be able to access their account page. Located in the same area as the 'sign up' button is a 'logout' button that a user can click to logout of a signed in account. Once a user has a credential pairing associated with the application, they are able to login to the web application at any time by inputting their username and password on the login page. The login page can be accessed by clicking the 'sign in' button located in the top right corner. Once the user logs in, they will be rerouted to their account page. This account functionality opens up a key feature discussed in the next section.

5.0 Save Asteroid Functionality

A key component of the application is the save asteroid functionality. A user of the application is able to sign up for an account and login/logout of their account, as mentioned previously. The main idea behind this save functionality is to provide a user the ability to save asteroids that they come across. This way, a user does not have to write down or remember IDs of asteroids that they will want to revisit. A simple save button is in place on each individual asteroid page. If a user is logged in, they will be able to save whatever asteroid they come across and have it stored on their account. This can be accomplished on any individual asteroid page by clicking the 'Save Asteroid' button located below the scatter plot. Once clicked, feedback will be shown to the user for success/failure of the save. If a user is logged in and does not already have the asteroid saved, the save will be a success. If a user is not logged in or if they already saved the asteroid, the save will be a failure. To reference back to these saved asteroids, a user can click the direct links that reside in a datatable on the account page. To display this datatable, a user can navigate to their account page, given they are logged in, and click the 'My Asteroids' button.

6.0 Search Bar

At the top of the web application exists a search bar consisting of an input box and 'search' button. The purpose of this search bar is to provide quick and convenient access to individual asteroid pages. If a user already knows of an asteroid ID (represented by the attribute ssnamenr), they have the ability to input it to the search bar for a direct linking to that asteroids page. Like most search bars, simply type in the desired asteroid ID and hit the button titled 'search'. This will take a user to the scatter plot page dedicated to the requested asteroid.

7.0 Downloading Data

The last feature to be mentioned in this document is the ability to download different data from the web application. A user may want to use a certain asteroid's data for further exploration outside of the application, or maybe share an interesting plot with a colleague or friend. On each scatter plot and heat map page, a user has the ability to download the plot as a PNG. This can be accomplished by clicking the image logo located at the top right corner of the plot. Once clicked, a PNG of the plot will be downloaded to the user's computer. Another piece of data that can be downloaded are the datatables on the observation page, as mentioned previously in this document. Once a user is on an observation page, they can download the datatable as a CSV file by clicking the 'export' button located at the top left corner of the datatable. Once clicked, a CSV of the current datatable will be downloaded to the user's computer.