

3D-Image-Marker – Documentation

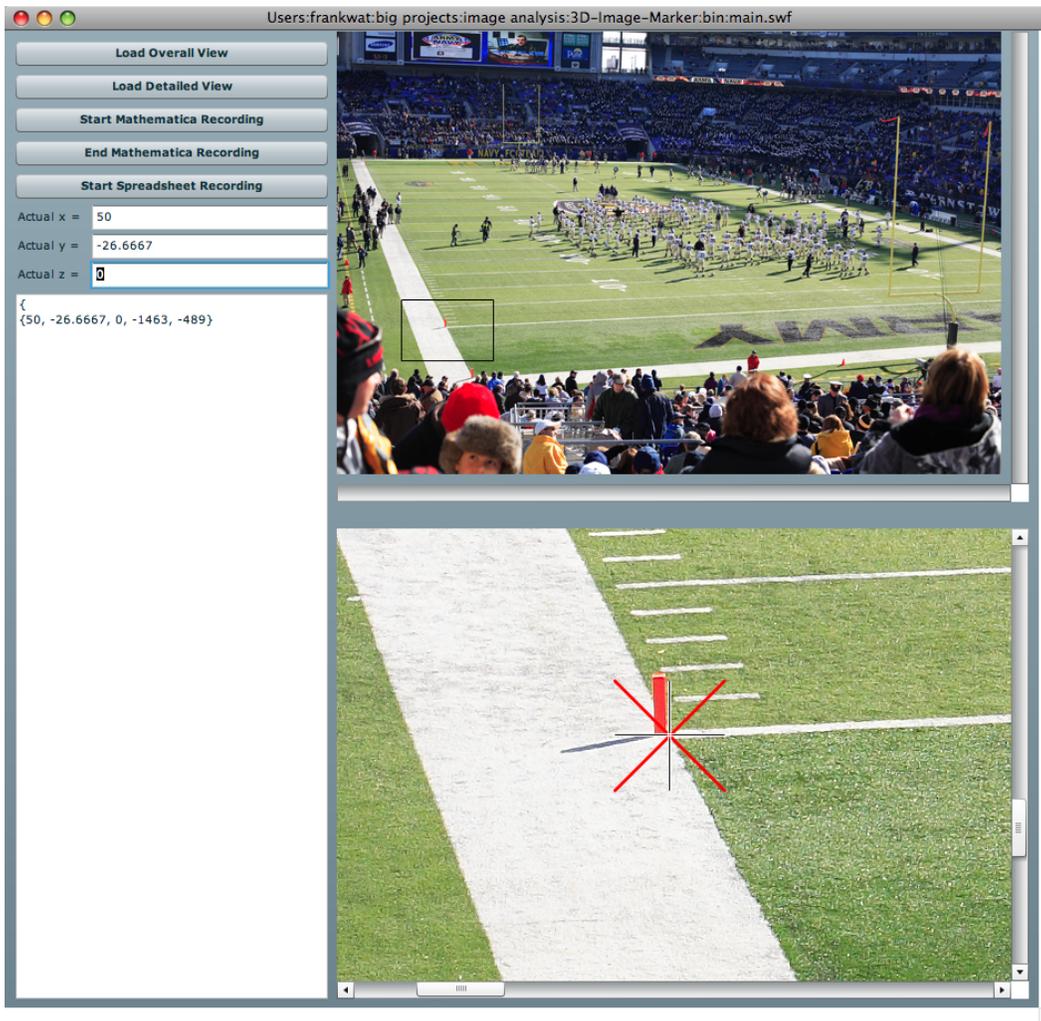


Figure 1: Marking Features on a Digital Photograph

This program (see Figure 1) enables you to mark and record the coordinates of features on a digital photograph for analysis in a spreadsheet or in *Mathematica*. We are interested in both the three dimensional real world coordinates (x, y, z) of each feature and its two dimensional coordinates (s, t) on the photograph. The output from this program is usually used to determine the seven parameters that describe how the picture was taken. Knowing these parameters enables us to convert back-and-forth between real world coordinates and coordinates on the digital photograph.



Figure 2: Axes for Real World Coordinates

Figure 2 shows the real world x - and y -axes superimposed on a digital photograph made at the Army-Navy game in December 2007. The x -axis runs midway between the sidelines from end zone to end zone with the positive direction toward the viewer. The y -axis runs from sideline to sideline along the 50 yard line with the positive direction to the viewer's right. The playing field is 100 yards long and 160 feet, or 53.3333 yards wide. Thus the real world coordinates of the feature marked in Figure 1 are $(50, -26.6667, 0)$, measured in yards. The coordinates of this same feature on the digital photograph are $(-1463, -489)$, measured in pixels.

Figure 3 on page 3 shows the upper left corner of Figure 1. The user must enter the real-world coordinates for each point in the boxes that are provided. Then the user clicks on the feature of interest and the program records the real-world and photograph coordinates. In this figure this data is recorded in a format that can be copy-and-pasted into *Mathematica*. The user can choose a format that can be copy-and-pasted into a spreadsheet instead.

Notice the two images on the right side of Figure 1. The top image shows the entire digital photograph reduced to fit the space provided. The bottom image shows part of the

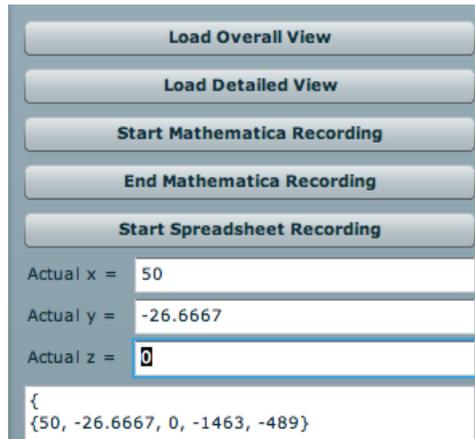


Figure 3: 3D-Image-Marker Controls

original full size image. The user clicks close to the feature of interest in the top image and the area around this feature is then displayed in the bottom image. The user clicks on the feature of interest in the bottom image to record its real world and photograph coordinates. The user repeats these two steps for each feature of interest.

- To start recording a new series of features in spreadsheet format, the user clicks the **Start Spreadsheet Recording** button. When the data for all the features of interest has been recorded it may be copied from this program and then pasted into a spreadsheet.
- To start recording a new series of features in *Mathematica* format, the user clicks the **Start Mathematica Recording** button. When the data for all the features of interest has been recorded the user clicks the **End Mathematica Recording** button. The data may then be copied from this program and pasted into a *Mathematica* notebook.

You are now ready to use **3D-Image-Marker**. Download and unzip the file **3D-Image-Marker.zip**. You should see a directory with several files including the following.

- **3D-Image-Marker.html**– This is the program. Note that it requires FlashPlayer. On some WindowsOS computers this program Internet Explorer will not work. We recommend FireFox.
- **AN76-detailed.jpg** – This is the original full-sized digital image. You can use any digital image in JPG format.

- **AN76-overview.jpg** – This is the smaller digital image. You can use a standard digital image processing program to reduce your original full-sized image to an image whose height is no more than 400 pixels and whose width is no more than 600 pixels.

When you work with your own images all of these files must be located in this same directory. You may use your own names for the two image files. You can try this program or, after you have prepared your two image files and placed them in the same directory as the file **3D-Image-Marker.swf**, you can analyze your own images by following the steps below.

- Double-click the file **3D-Image-Marker.html**. It should open in your browser. Note that this program requires FlashPlayer. On some WindowsOS computers this Internet Explorer browser will not work. We recommend FireFox.
- Click the button **Load Overall View**. In the browse window that opens navigate to and select the file **AN76-overview.jpg** or your own overall view file.
- Click the button **Load Detailed View**. In the browse window that opens navigate to and select the file **AN76-detailed.jpg** or your own detailed view file.
- Record the data for the points in which you are interested in either spreadsheet or *Mathematica* format as described above.
- Eventually you will want to copy-and-paste the data you've recorded into either a spreadsheet or a *Mathematica* notebook.