# Progress Report

## Results so far

So far, we have achieved reading with low latency from an external camera into opencv to accomplish the first few items from our plan. We are capable of recognizing the board and using the vertex points of the discovered contour to do a projective transform into an orthographic view of the board tiles. One of the first problems we encountered was making sure that the board could be recognized despite changes and inconsistencies in lighting conditions. To do this, we created variable thresholds for hue, saturation, and value, and added keyboard functionality to change them, so we can calibrate each time we run the program. Next, we have been able to take a frame which contains a tile, and learn distinct features of the image using SURF. Doing this with each type of tile and saving the features, we have been able to take a frame which contains one of the tiles and recognize which tile it is most likely to be. The biggest problem we encountered was this, as some tiles had far more useful features than others. This led to some tiles, like Ore, getting high numbers of matches on other, less feature-rich tiles, like Wool. To fix this, we compared every feature source image with all the other source images and discover the distribution of matched features for each one. The correct one was always the highest, but the distribution of matches for incorrect guesses was useful to us. Normalizing these distributions allowed us to match more accurately, as we could see if the new image created a similar distribution when attempting to match against all sources.

## Problems

Problems we have yet to solve include matching each of the slightly different resource tiles to the same template sources. Since not all Brick tiles are exactly alike, it is unclear if the SURF algorithm will be able to match all of the brick tiles with enough accuracy. We may have to allow calibration with every single tile in the game, but avoiding this would be ideal. Another problem we are having is that the resulting image that is output by the projective transform is low quality, and potentially lacks the necessary detail to match features for resources and discover settlements. We are also struggling with dividing this image into sections to feature match each hexagonal tile individually. Also, the numbers that label each resource appear very difficult to read, so template matching them will be difficult.

## Plan

Our plan going forward is to successfully feature match every tile on the orthographic projection, with and without the number tokens on them, and to identify which number each token has. Once that has been completed, we will work toward identifying if there is a settlement at each intersection, and which color it is. This, combined with a model of the game and game rules, will allow us to display the desired information.