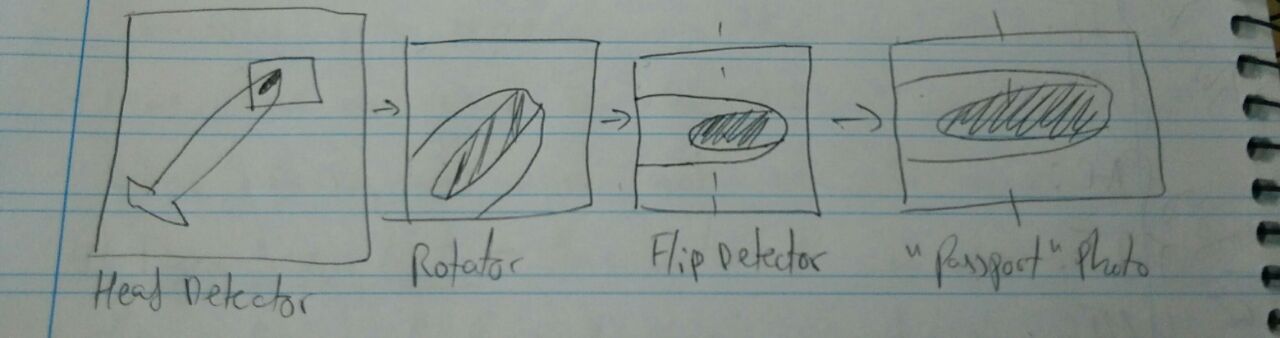
**Possible Improvements**

**Preprocessing**

We were unable to perfect our preprocessing algorithms using conventional computer vision techniques. A solution to utilize computational intelligence to the whale detector. We could take the full set of 11000 images and manually tag the location of the whales head on some of them. Using this supervised data we can train a “whale-head-detector” This algorithm combined with our working rotation algorithm will give us a whale that is roughly aligned to the horizontal axis. At this point the whale will be facing either left or right and we can train another classifier to flip the images to the correct orientation.

Figure X: Proposed whale image preprocessing system

This working preprocessor can then be run on the full set of data – labeled and unlabeled. Ideally this larger dataset should be more trainable without overfitting the data then our α-whales dataset.

**Augmenting the training data**

After obtaining the full training data we would be left with 4500 labeled images of 427 whales – still not enough data to detect some of the whales. We can expand the labeled images set using some augmentation techniques. For every image we would run it through some filters which are meant to signify the variance between the images of the set and then use filter outputs as additional training data. Some of the filters we would use: low pass filter (smoothing), high pass filter (edge detection or sharpening) and various affine transforms such as rotation about the horizontal axis, scaling and pixel-wise shift.

**Improved hardware**

A huge weakness of our project was the lack of cross validation and the constraints imposed on us not being able to train more complex networks in a reasonable amount of time. Training on a video card with a large amount of memory or on the cloud would enable us to iterate through hypothesis much faster.