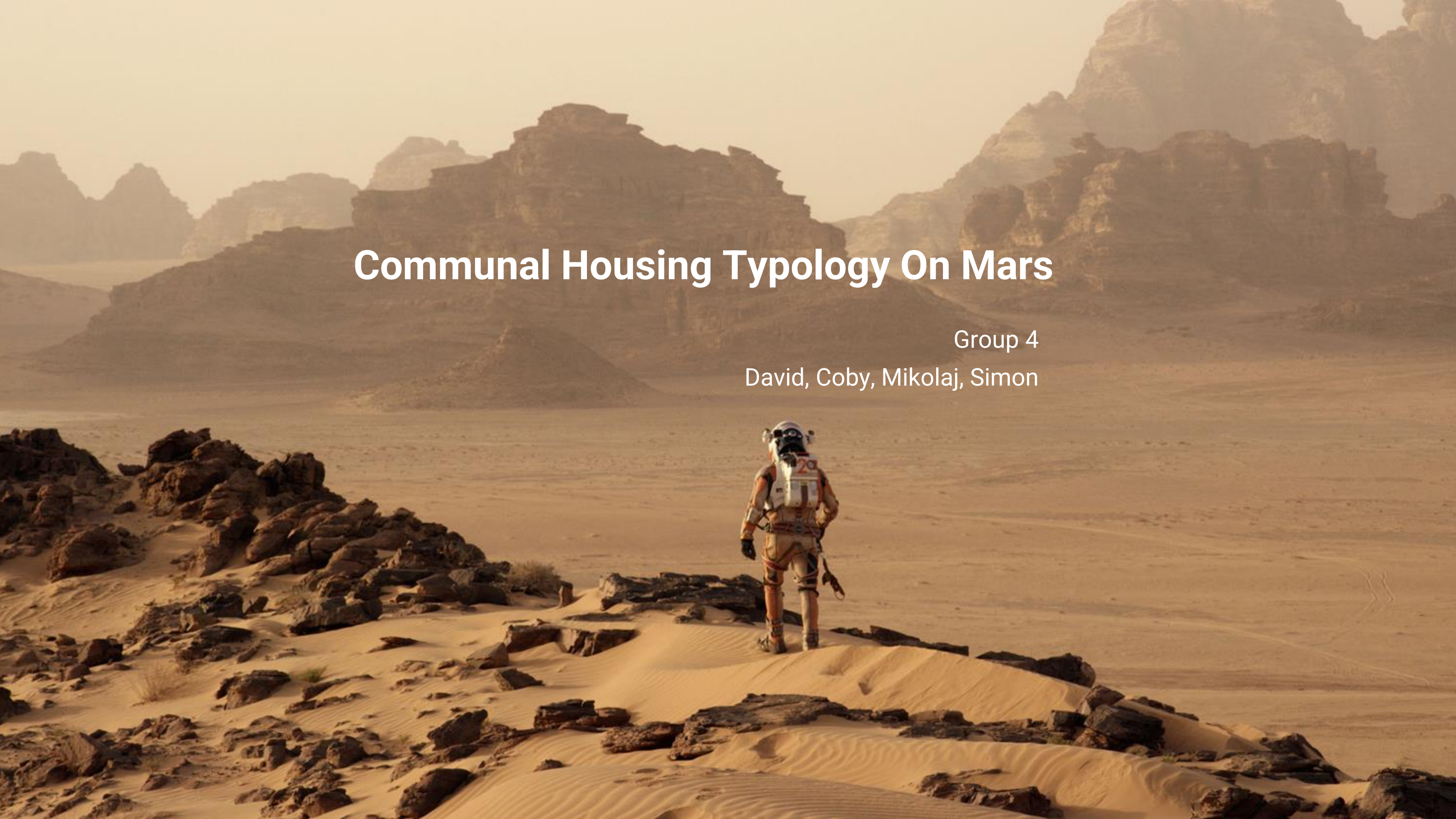


Communal Housing Typology On Mars

Group 4

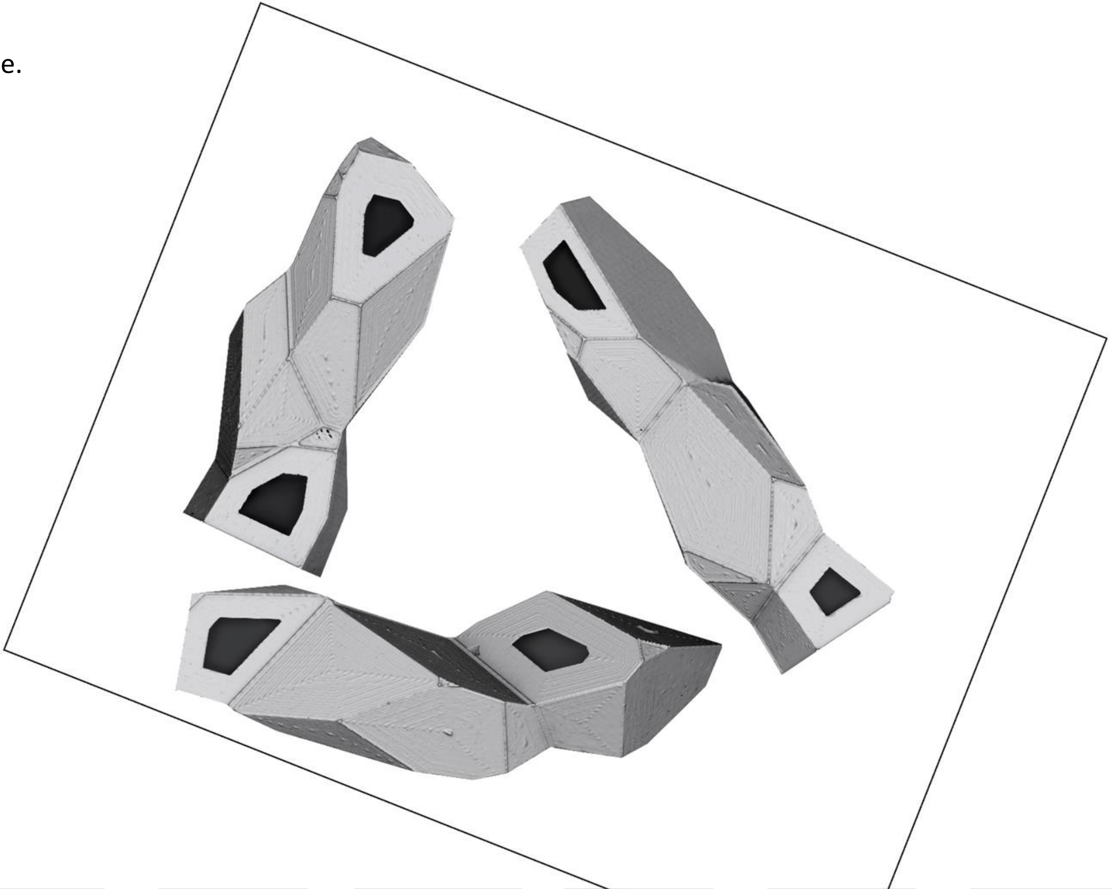
David, Coby, Mikolaj, Simon

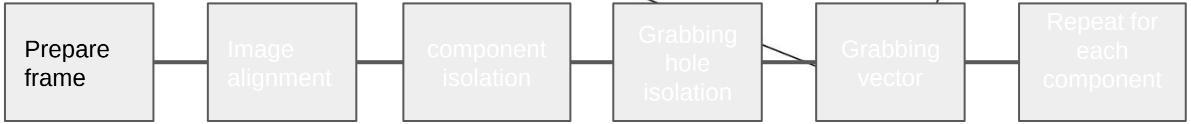
ComputerVision

Preparing components onto platform (frame)

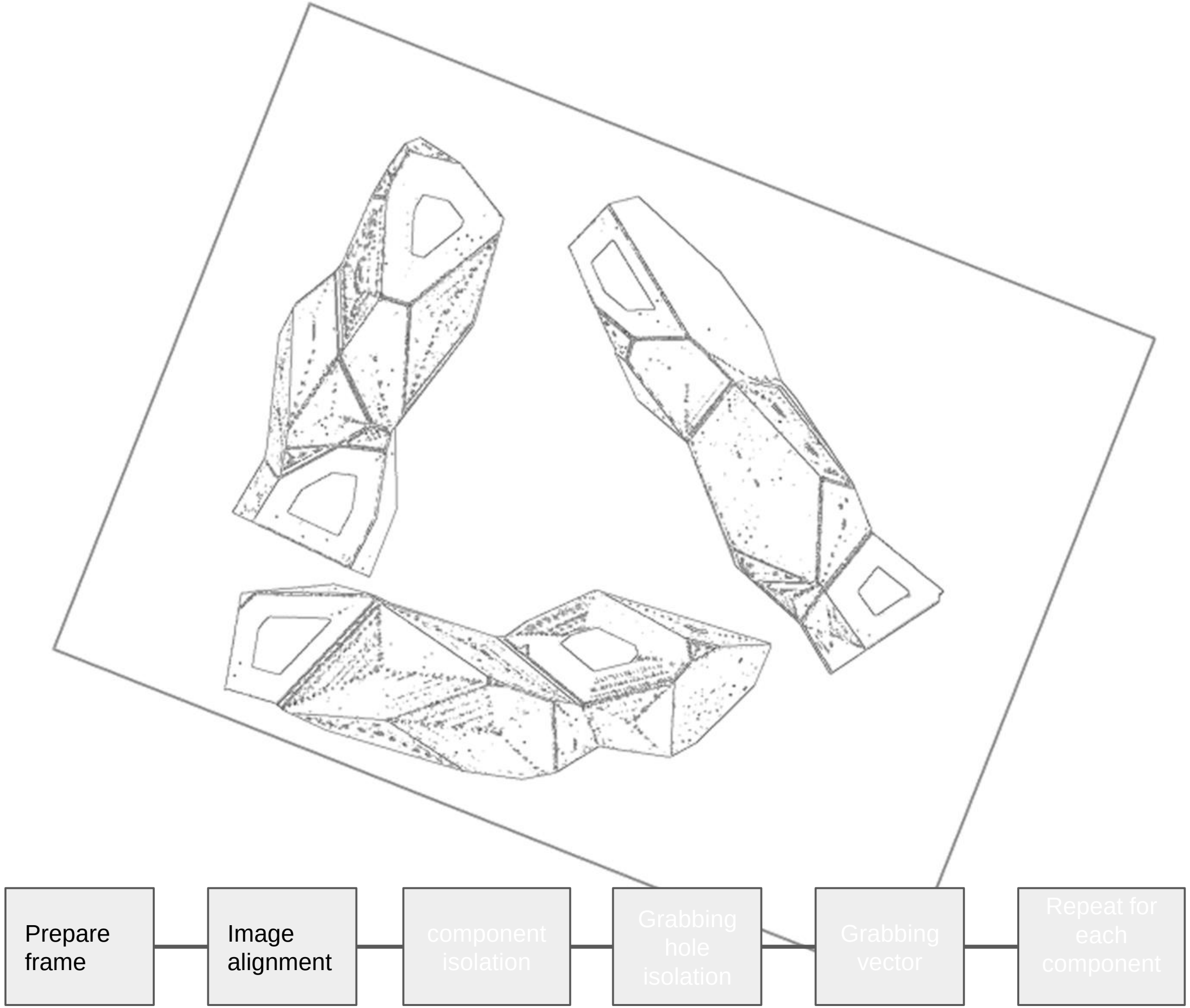
Add image here of the components being placed on the frame, it would be nice to have an animated gif of that happening.

We set up a camera of the components on a frame,
This frame should be identifiable and complete in the image.





An edge contour algorithm is run on the image. In this case it is the Canny edge detector algorithm. Here a gradient of contrast is used to determine an edge. The difference in gradient is a parameter that can be fine tunes to match the image.



Prepare frame

Image alignment

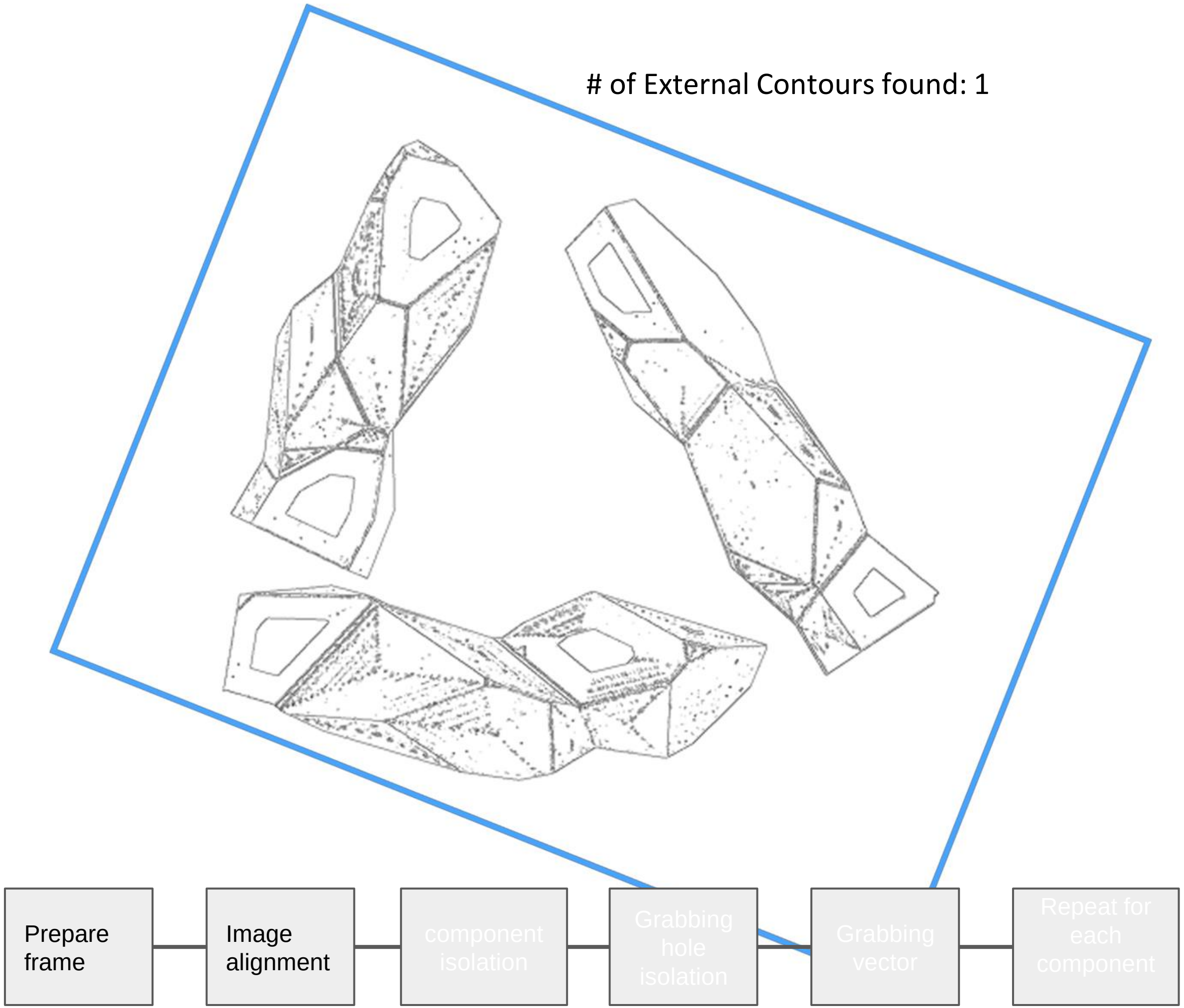
component isolation

Grabbing hole isolation

Grabbing vector

Repeat for each component

On the edges we run a contour finding algorithm called findContours and we set it to find only the most external contours. This is to identify the edge of the frame.



Prepare frame

Image alignment

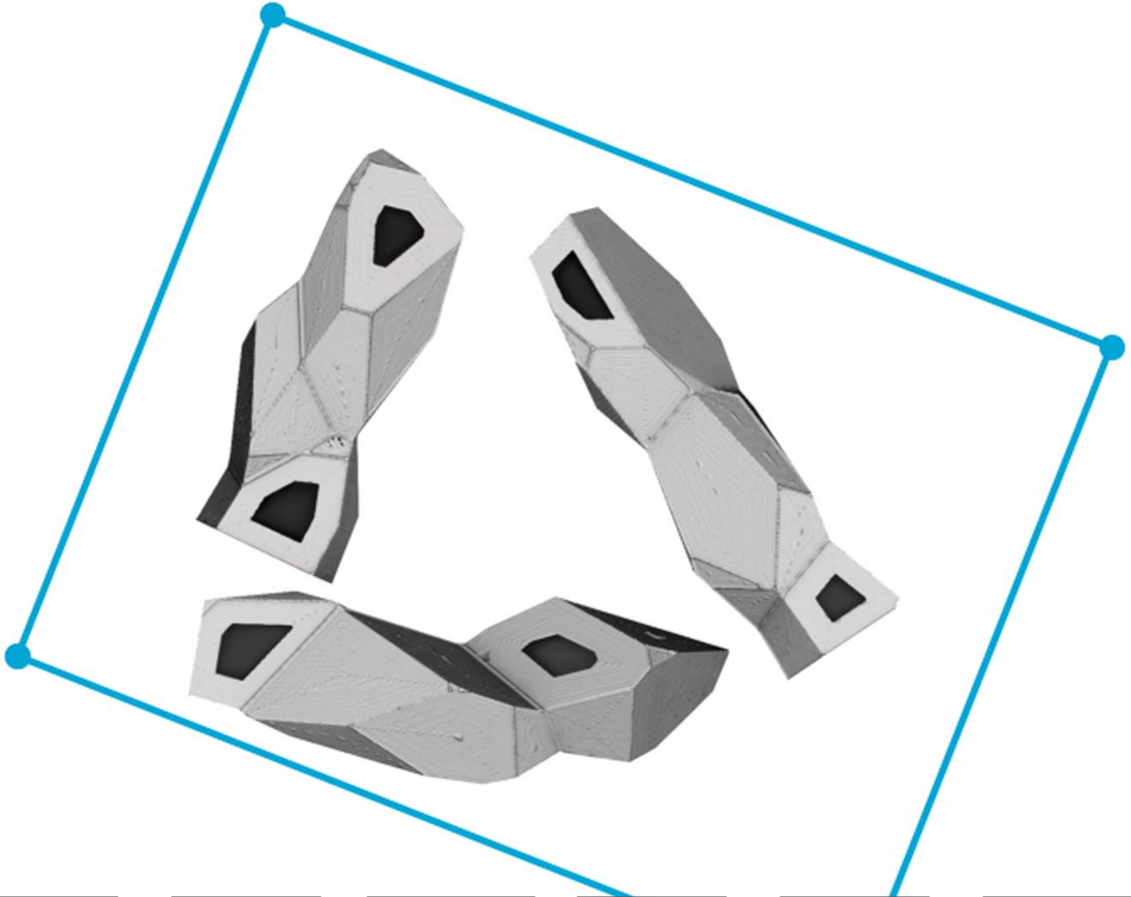
component isolation

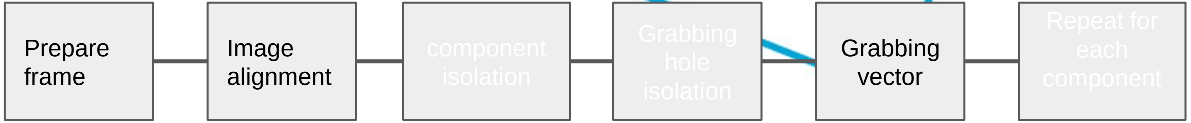
Grabbing hole isolation

Grabbing vector

Repeat for each component

The contour is matched to a box polygon





Prepare frame

Image alignment

component isolation

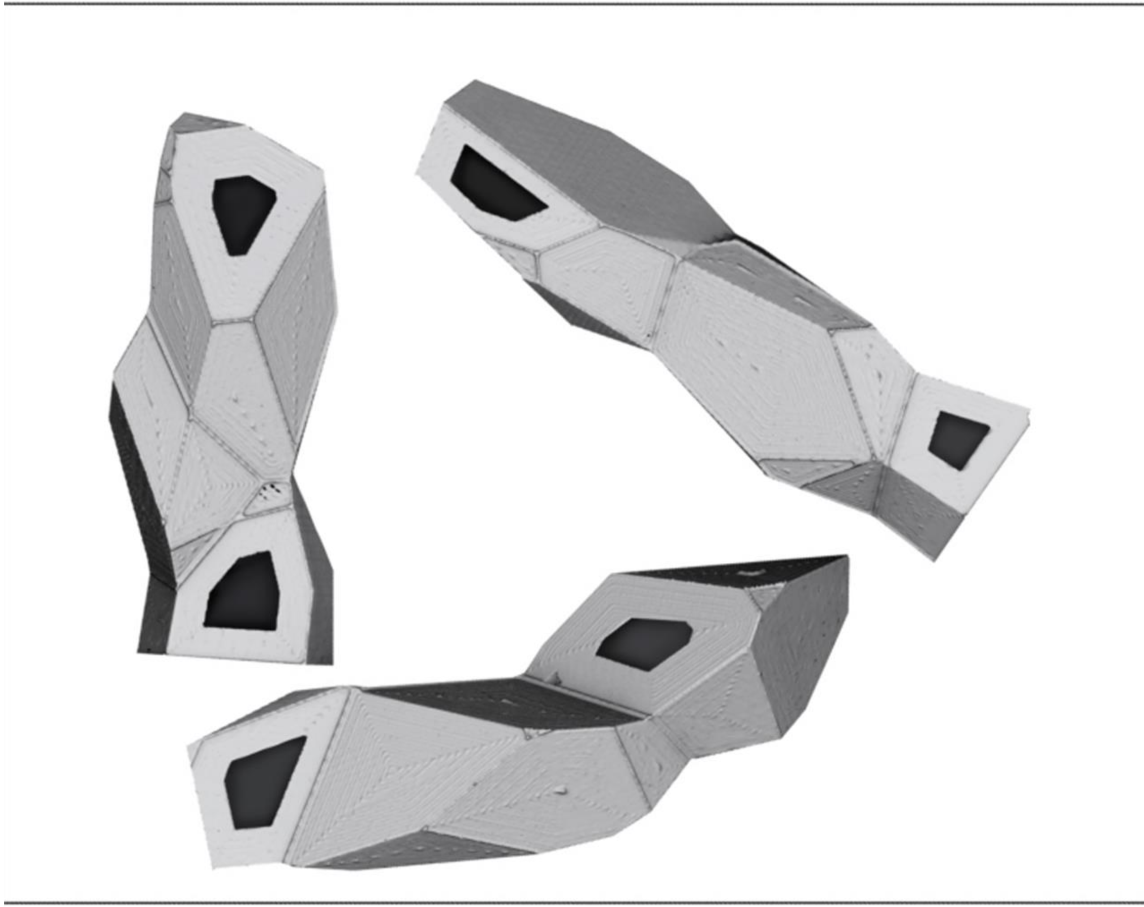
Grabbing hole isolation

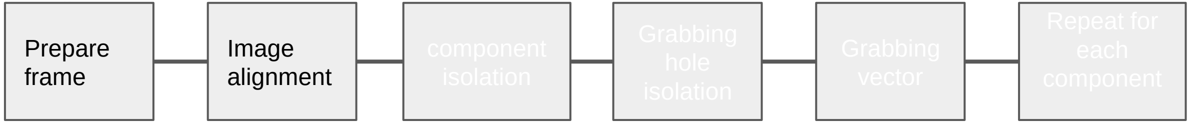
Grabbing vector

Repeat for each component

And the whole image is warped to fix any misalignments between the frame and the camera. The pixels of the image can then be converted into physical units using the frame as a reference object.

At this point the image can be used to guide any robot that is also connected to the coordinate system of the frame. We will continue to process the image so that a robot can interact with the components more autonomously.





Prepare frame

Image alignment

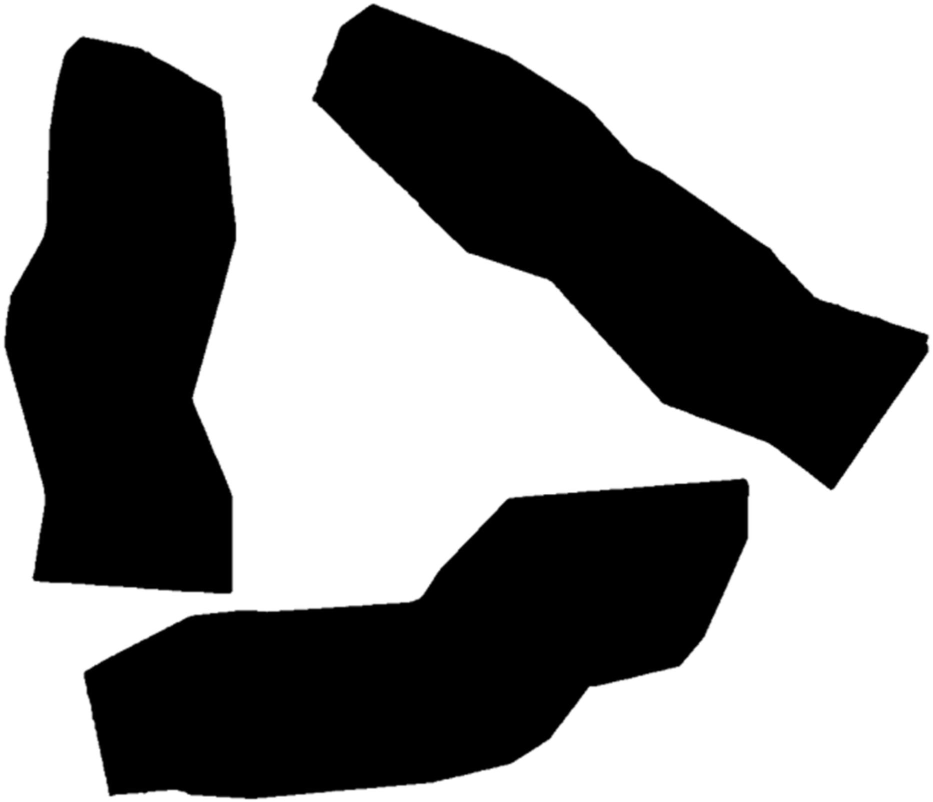
component isolation

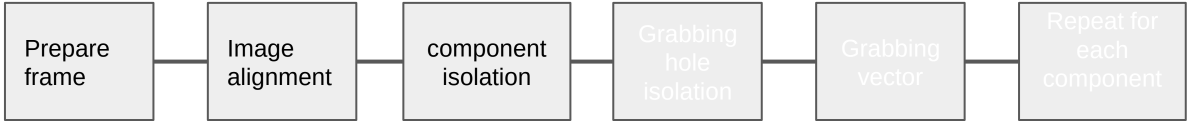
Grabbing hole isolation

Grabbing vector

Repeat for each component

We first isolate the components by using a grayscale contrast threshold. Any value that is whiter than 240 is made white, and any value darker than 240 is made black.





Prepare frame

Image alignment

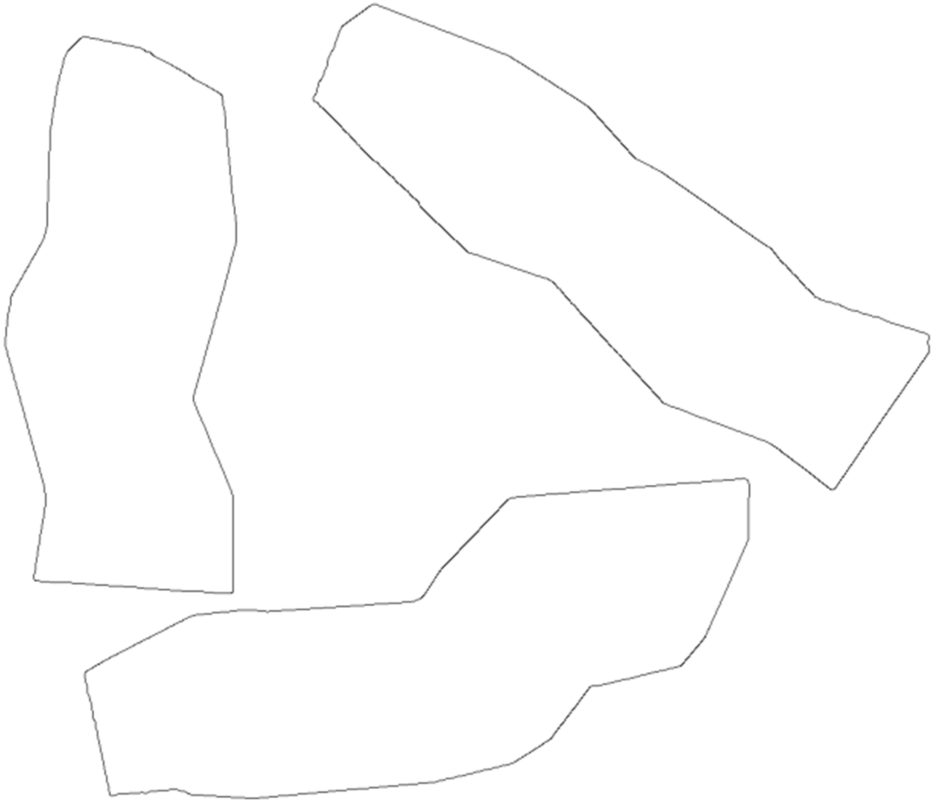
component isolation

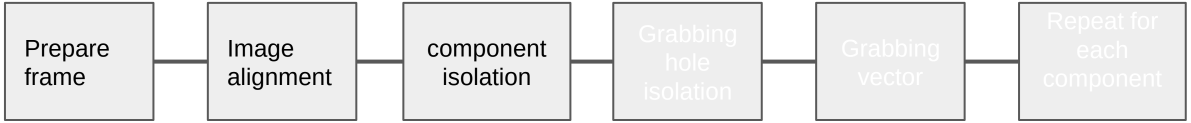
Grabbing hole isolation

Grabbing vector

Repeat for each component

Running an edge detection and a findcontours becomes trivial.





Prepare frame

Image alignment

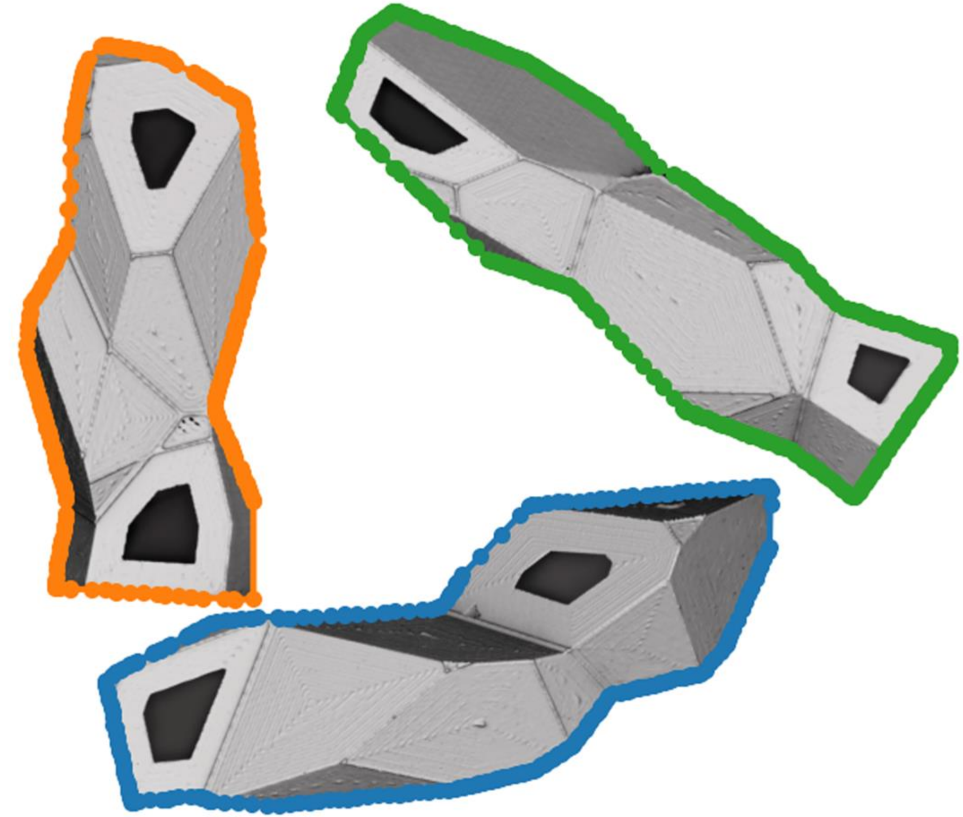
component isolation

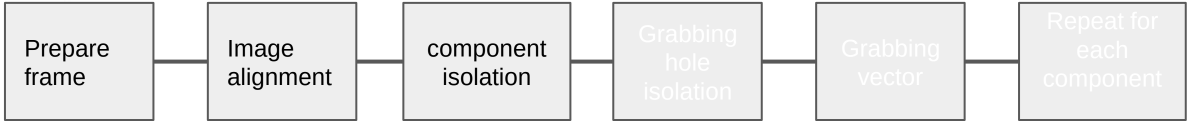
Grabbing hole isolation

Grabbing vector

Repeat for each component

Running an edge detection and a findcontours becomes trivial.





Prepare frame

Image alignment

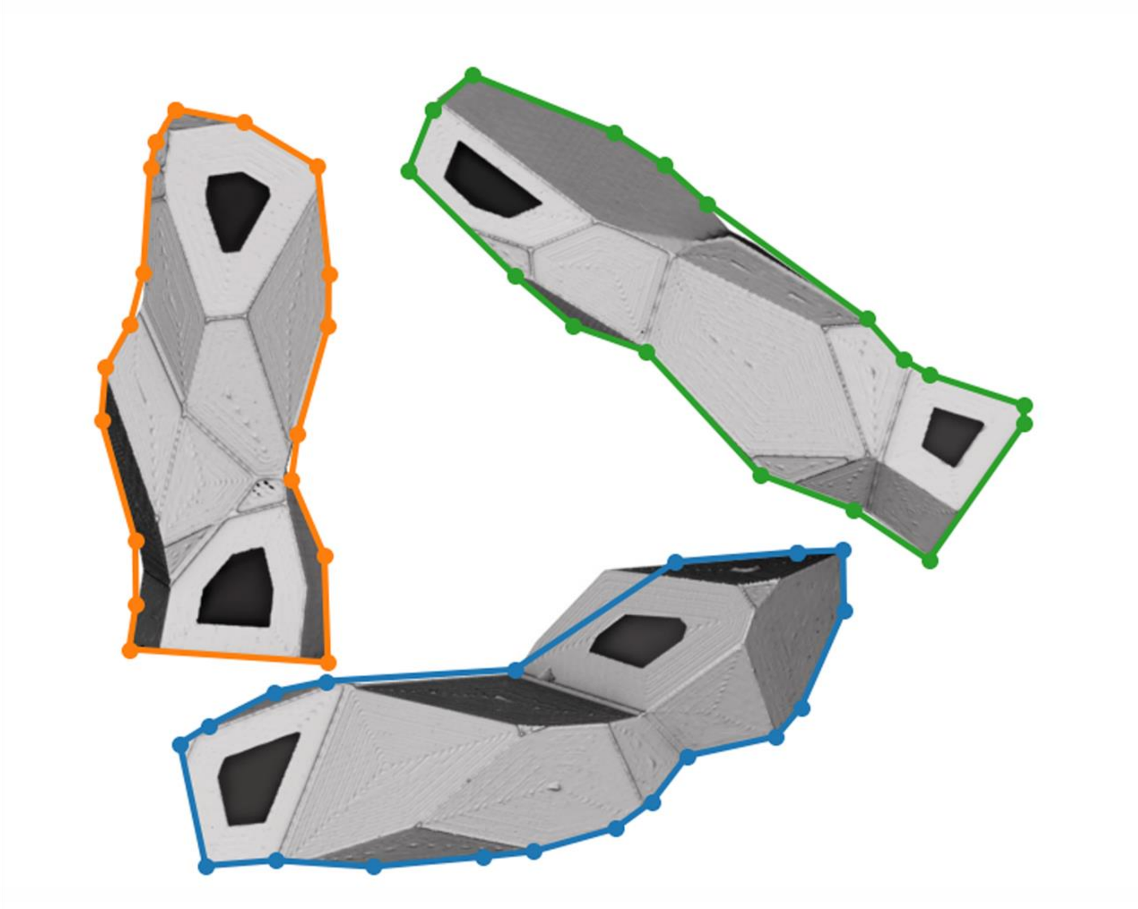
component isolation

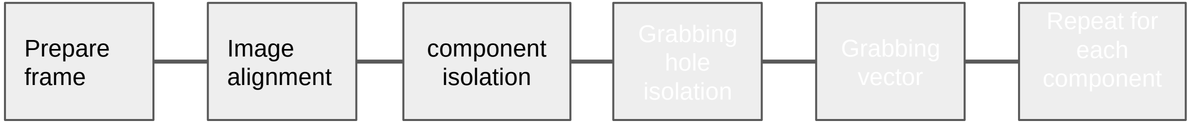
Grabbing hole isolation

Grabbing vector

Repeat for each component

The contours are simplified to make the later steps cleaner.





Prepare frame

Image alignment

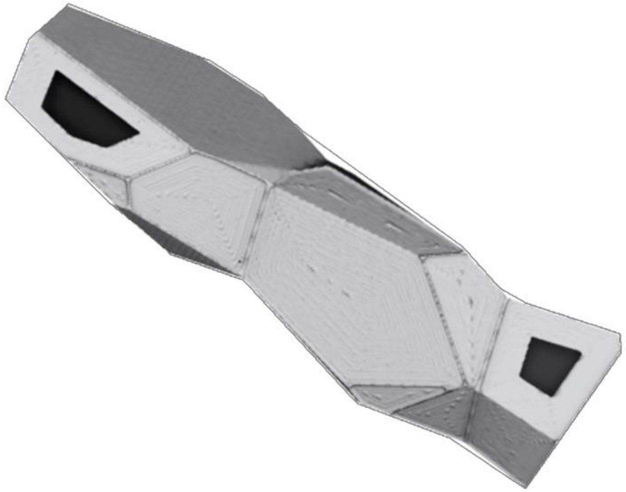
component isolation

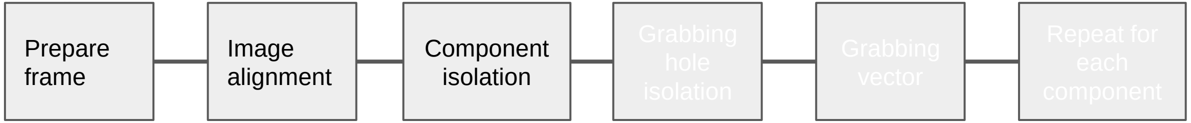
Grabbing hole isolation

Grabbing vector

Repeat for each component

From here we just select a contour
and use it as a mask to isolate the respective
component





Prepare frame

Image alignment

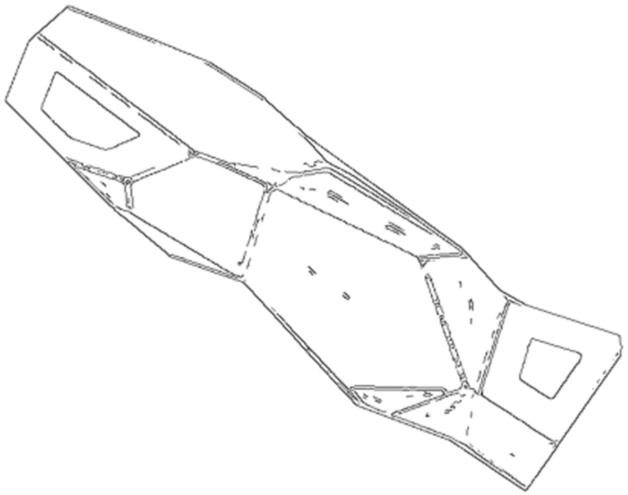
Component isolation

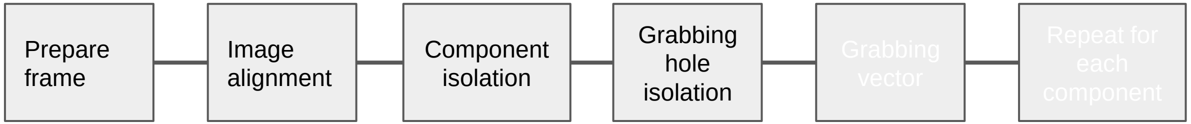
Grabbing hole isolation

Grabbing vector

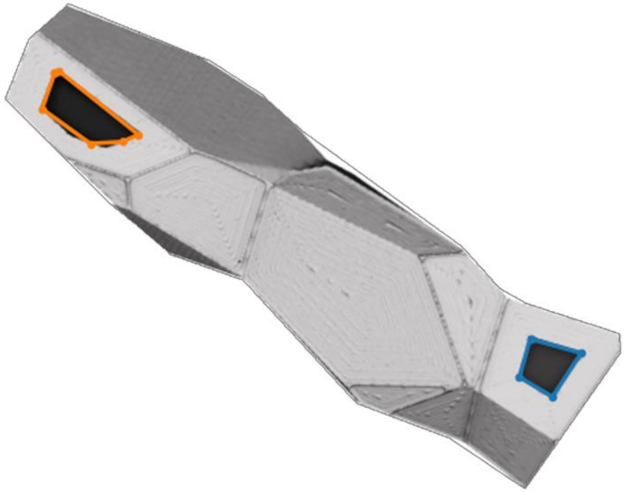
Repeat for each component

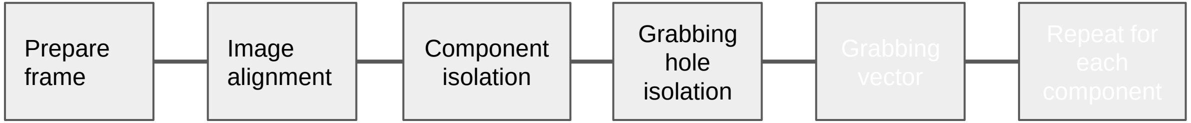
We run an additional edge detection algorithm. and again run the findcontours. In this step a bluring of the image before the edge detection can be useful to reduce the complexity of the edges and eliminate false gaps.





We identify the holes by looking for contours with an area between two values.





Prepare frame

Image alignment

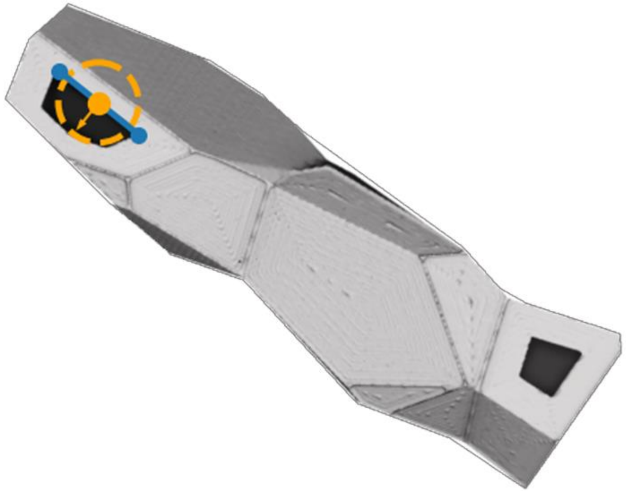
Component isolation

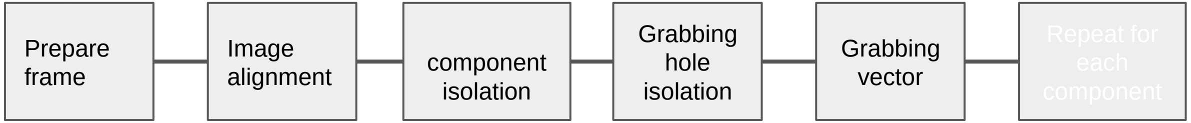
Grabbing hole isolation

Grabbing vector

Repeat for each component

And finally for the robot we create a grabbing vector. We do this by creating a vector between 2 points, the contour centroid and the midpoints of the longest edge of the contour.





Prepare frame

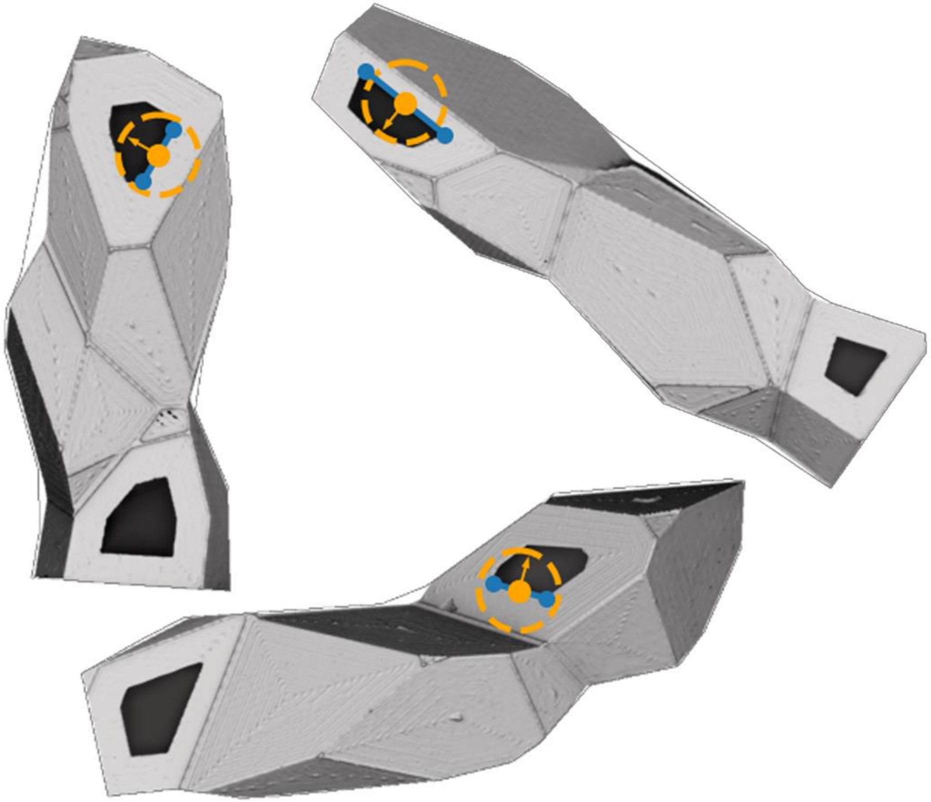
Image alignment

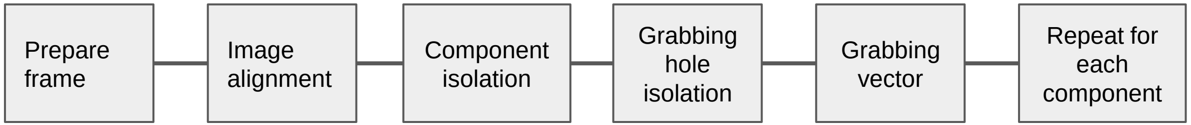
component isolation

Grabbing hole isolation

Grabbing vector

Repeat for each component





Prepare frame

Image alignment

Component isolation

Grabbing hole isolation

Grabbing vector

Repeat for each component