Technical Approach

* Goal is to output the bounding box of every substructure in the heart, represented by a 6-D vector (x1, x2, y1, y2, z1, z2) where x1 is the location of one of the faces on the x axis, x2 is the location of the other face on the x axis, etc. Modeled as continuous parameters even though images have discrete pixels
* Regression forest: a collection of regression trees. Input to each regression tree is a pixel with its associated features (tbd), output is the vector (x1-x, x2-x, y1-y, y2-y, z1-z, z2-z) which describes displacement to the bounding box. Therefore the regression forest aims to learn the displacement to the bounding box given an input pixel and its features.
* Regression tree: flowchart-like structure, in which each node is a Boolean function on the input point’s features, which decides whether or not the input point goes down the left or right child of the tree. At each leaf node of the regression tree, there is a Gaussian that gives a probability distribution on the output associated with that input.
* Training the forest: train each tree in the forest individually, with some randomness. To train one tree, you start by generating K random Boolean functions on the features, and the one that has the highest information gain is chosen to be the splitting function associated with the root node. Then, we repeat this process, randomly generating K splitting functions and greedily selecting the best one for the children of the root node, until the information gain reaches some low point or the maximum tree depth has been reached.
* Structure of regression forest: there are T trees, each tree has a maximum depth of D.