The work is focussed on developing methods to measure asymmetry of different objects. To measure how asymmetric an object is, a symmetry plane for the object is needed. An optimal symmetry plane is found from an asymmetry measure. To detect a symmetry plane for an object and measure the asymmetry plane are both two different problems and very closely connected.

The dissertation is written in two parts. The first part mainly discuss how to find a symmetry plane for an object by using rigid registration between the object and an arbitrary reflection of the object. Different rigid registration method are applied to human mandibles and reflections of these mandibles. The best results are found by using a rigid registration method based on minimizing the intensity differences between a binary segmented image of the mandible and a reflection of this image.

Not all rigid alignments between an object and its reflect correspond to a reflection plane for the object. A reflection plane is necessary to get an exact asymmetry measure and not just an approximation. Still an alignment is used as a basis, but it needs to be adjusted. A method to project an alignment into a subspace of alignments which correspond to reflection planes, is presented. This method is applied to the mandibles as well.

To find the best alignment between the results from several registration methods, the alignments are evaluated by measuring the volume overlap between an object and its reflection. The mandibles are described as binary segmented images, but the volume calculated from the voxel images do not provide as good results, as volume overlaps calculated from the surfaces extracted from these images. Both methods to calculate the volume overlap is described, and the difference between using the two methods is illustrated.

In the second part spherical harmonic functions are used to measure the asymmetry of objects. An object is projected onto spherical harmonic functions. With this new representation, the object and a reflection of the object is aligned. The alignment is made by optimizing the similarity for some or all spherical harmonics coefficients. After the alignment, the projection coefficients for the object and its reflection are compared. The method is applied to segmented hippocampi and human mandibles. For the hippocampi the left hippocampi is reflected and compared to the right hippocampi.

The coefficients from the hippocampi are used to classify patients with schizophrenia from healthy controls. A difference in one of the coefficients between the left to right hippocampi, is found to provide enough information to separate schizophrenic patients from healthy controls with an accuracy of 0.79. The probability of finding the same result if schizophrenic and healthy controls have the same distribution is less than 0.0008.

When the method is applied to mandibles, the asymmetry measure is used to classified healthy mandibles from mandibles from children with plagiocephaly syndrome. With an asymmetry measure for the healthy mandibles and a low standard deviation for this measure, it is possible to find those mandibles from children with plagiocephaly syndrome with abnormal asymmetry measures. The classification by using spherical harmonics functions is almost the same as the volume overlap after a rigid registration between a mandible and its reflection.