## Project outline

Latest version of Project outline: <https://github.com/andics/Big-Bang-Files.git>

The neurocranium is composed of flat intramembranous by origin bones. The calvarial

sutures are bands of fibrous connective tissue that fastens together adjacent bones of the skull.

The sutures allow no active motions, but act as flexible joints and allow adjustive overlap of the

calvarial bones as the head becomes compressed during the childbirth. They fasten together the

apposed calvarial bones and function as intramembranous bone growth sites in response to the growing brain requirements. Usually, the brain reaches its optimal shape and size during early adulthood. Then, the process of fusion of the adjacent calvarial bones slowly begins with a series of morphological changes, which finally lead to complete remodeling and obliteration of the sutures.

The accurate age estimation is a substantial part of the integral biological profile, but quite

complex in cases of unidentified decomposed and skeletonized human remains, particularly in

adults. Commonly, the skull is well-preserved and due to the assumption that the cranial sutures

close in conjunction with age, the patency of contact between adjacent calvarial bones has long

been used for an age-at-death (AAD) prediction in the bioarcheological and forensic expertise.

Until now, the correlation between suture closure and AAD has been examined by

conventional quantifying methods for assessment of the suture closure degree based on a

macroscopic subjective assessment on the endo- and exo-cranial surfaces together or

individually, using scoring scales of various grades. Those methods have existed for hundreds of years. They don’t take advantage of modern technology, and so are not very accurate in the age estimates they produce.

Nowadays, the availability of technology like the CT scanner allows an inside view of a skull’s structure, which can further be used to not only explore the endo and exo-cranial surface, but the cross-sectional depth of the suture as well. This type of in-depth analysis of a suture is a new approach, and only three studies have been made on the topic.

In two of the studies a human is responsible for evaluating the level of bone fusion along the suture, which is incredibly time consuming, subjective and therefore, sometimes inaccurate. There has been only one attempt to automatize this process with the use of a simple algorithm, but the results were not promising, as the algorithm lacked the ability to consider enough factors in the suture image. If we take image sagittal0014.png from the “old\_person\_sagittal”, and run the previously used algorithm on it, the only information we’ll receive about the suture is that it is “closed” on this image. While the suture is very vague, it can still be seen that the bones aren’t completely fused as the color of the suture isn’t completely white. How far they are from complete fusion directly depends on how close to white the color of the suture is. Computationally, this is relatively easy to calculate on a grayscale image but can hardly be done along the whole length of the suture by a human. Those bits of extra information on a certain image, like the color of the suture or the depth of the suture, are neglected by all currently known techniques for age estimation. Considering this extra information can be a key to improving the accuracy of age estimation based on cranial sutures, with real world applications in multiple fields including archeology, criminology and anthropology.

With the use of different algorithms, the purpose of the project is to achieve a better cross-sectional view of sutures from a skull CT scan, and to create an automatically executed metric system for estimating the age of an individual, based on this cross-sectional view.