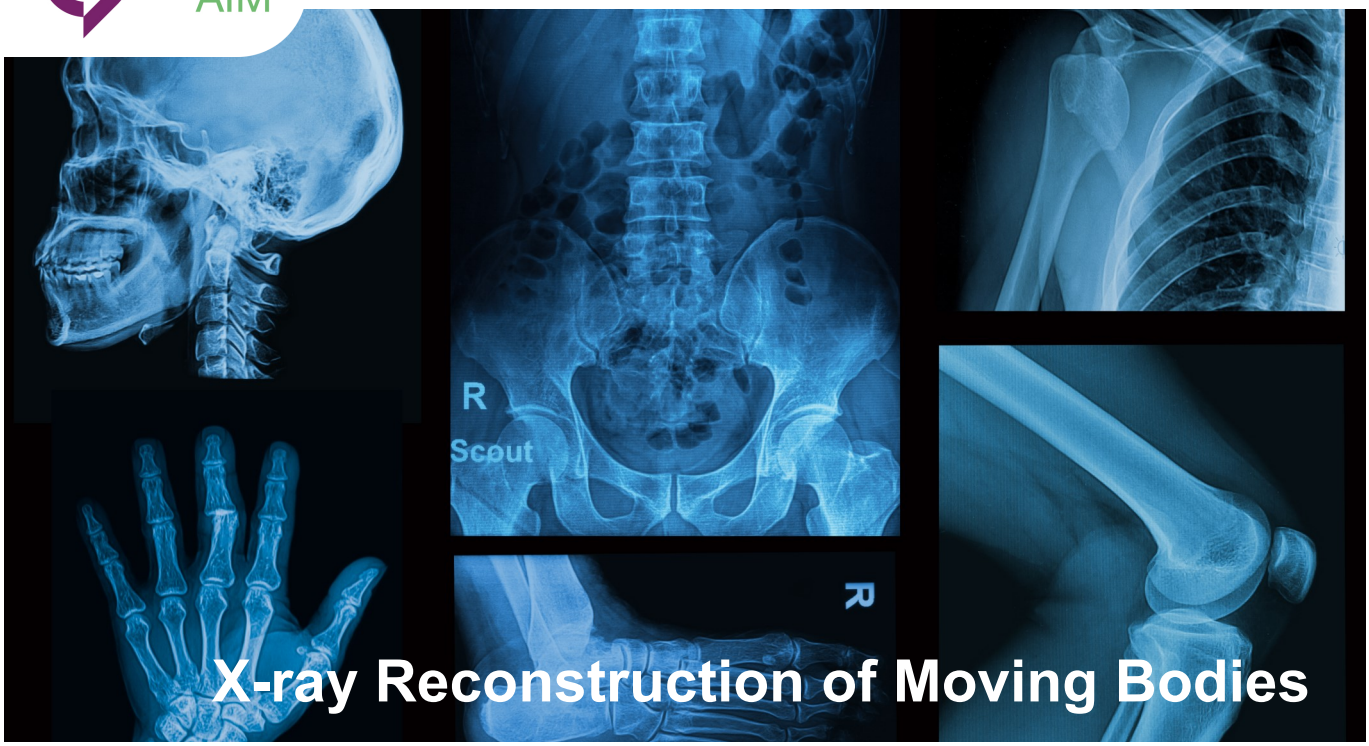
Take AIM

Smith institute



X-ray Reconstruction of Moving Bodies

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Have you ever needed an X-ray? If so, you were probably told to keep still to make sure that the resulting image was clear. In our research, we use a technique known as digital tomosynthesis to construct 3D images from multiple X-rays taken in quick succession. You can probably imagine how still a patient needs to be to keep all of the images clear!

Any movement causes blurring in the final 3D image, due to measurement discrepancies between successive X-rays, making it harder for a doctor to make an accurate diagnosis. Unfortunately, keeping still can be difficult for many patients, even for just a few seconds. Therefore, to obtain a clear image under these conditions we need to correct for movements that occur.

We use numerical optimisation to suppress the effects of patient motion, minimising the total amount of blur in the final 3D image. In particular, we use a sequence of computational models, first finding a coarse approximation of the final image before successively resolving increasing levels of detail.

Current methods for 3D imaging often require a large amount of radiation, but we model the use of low-power X-rays so that the total radiation cost is roughly the same as a standard X-ray. This means that we can create 3D images for the cost of 2D! With over 20 million X-rays taken by the NHS each year, this research could help low-radiation 3D imaging become a viable and accessible technology, greatly improving patient diagnosis and treatment.

The Smith Institute, enabled by the generous sponsorship of our leading corporate partners, ran the TakeAIM competition in 2018 to make visible the crucial role that mathematics will increasingly play in all aspects of our lives. The competition was open to undergraduate and postgraduate students working in the mathematical sciences. First prize was £1,250 of Apple vouchers, with nine runners-up each receiving £100 of Amazon vouchers.