CT and MRI basics

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With the discovery of x-ray in the 1890's by W.C. Röntgen, it was made possible the first time to look into a human's body non-invasively. This facilitated the diagnosis of various health conditions, and thus, x-ray was adopted in clinical routine shortly after its invention. However, x-ray imaging just provides information of the total attenuation of x-rays across a body and thus, falls short of representing the 3 dimensional nature of human morphology. To gain 3D information of a human's anatomy tomographic imaging devices had to be developed.

The first tomographic device to image the human anatomy was Computed tomography (CT). It was invented by G. Hounsfield and A. Cormack and is based on the reconstruction of the 3 dimensional attenuation of x-rays from x-ray recordings from multiple angles (an x-ray tube rotated around the investigated subject). A different concept to visualize anatomical structures is based on the measurement of radio-waves originating from excited nuclear spins. This technique is called Magnetic Resonance Imaging (MRI) and is able to provide excellent soft tissue contrasts. The basic principle is the phenomenon of nuclear magnetic resonance, based on the Zeeman effect and is nowadays, like CT, a standard imaging modality in modern healthcare.