Diffusion Tensor Imaging Introduction And Atlas

Diffusion-weighted magnetic resonance imaging

of DWI, diffusion tensor imaging (DTI), has been used extensively to map white matter tractography in the brain. In diffusion weighted imaging (DWI), the

Diffusion-weighted magnetic resonance imaging (DWI or DW-MRI) is the use of specific MRI sequences as well as software that generates images from the resulting data that uses the diffusion of water molecules to generate contrast in MR images. It allows the mapping of the diffusion process of molecules, mainly water, in biological tissues, in vivo and non-invasively. Molecular diffusion in tissues is not random, but reflects interactions with many obstacles, such as macromolecules, fibers, and membranes. Water molecule diffusion patterns can therefore reveal microscopic details about tissue architecture, either normal or in a diseased state. A special kind of DWI, diffusion tensor imaging (DTI), has been used extensively to map white matter tractography in the brain.

Medical image computing

information in the diffusion tensor, these methods have been adapted to account for tensor valued volumes when performing registration and segmentation. Given

Medical image computing (MIC) is the use of computational and mathematical methods for solving problems pertaining to medical images and their use for biomedical research and clinical care. It is an interdisciplinary field at the intersection of computer science, information engineering, electrical engineering, physics, mathematics and medicine.

The main goal of MIC is to extract clinically relevant information or knowledge from medical images. While closely related to the field of medical imaging, MIC focuses on the computational analysis of the images, not their acquisition. The methods can be grouped into several broad categories: image segmentation, image registration, image-based physiological modeling, and others.

Traumatic brain injury

techniques post-mortem, and in the early 2000s, researchers discovered that diffusion tensor imaging (DTI), a way of processing MRI images that shows white matter

A traumatic brain injury (TBI), also known as an intracranial injury, is an injury to the brain caused by an external force. TBI can be classified based on severity ranging from mild traumatic brain injury (mTBI/concussion) to severe traumatic brain injury. TBI can also be characterized based on mechanism (closed or penetrating head injury) or other features (e.g., occurring in a specific location or over a widespread area). Head injury is a broader category that may involve damage to other structures such as the scalp and skull. TBI can result in physical, cognitive, social, emotional and behavioral symptoms, and outcomes can range from complete recovery to permanent disability or death.

Computational anatomy

1098/rstb.2001.0915. PMC 1088516. PMID 11545704. "White Matter Atlas

Diffusion Tensor Imaging Atlas of the Brain's White Matter Tracts". www.dtiatlas.org. Retrieved - Computational anatomy is an interdisciplinary field of biology focused on quantitative investigation and modelling of anatomical shapes variability. It involves the development and application of mathematical, statistical and data-analytical methods for modelling and simulation of biological structures.

General American English

Philadelphia, and the North". Freuhwald, Josef T. (November 11, 2007). "The Spread of Raising: Opacity, lexicalization, and diffusion". University of

General American English, known in linguistics simply as General American (abbreviated GA or GenAm), is the umbrella accent of American English used by a majority of Americans, encompassing a continuum rather than a single unified accent. It is often perceived by Americans themselves as lacking any distinctly regional, ethnic, or socioeconomic characteristics, though Americans with high education, or from the (North) Midland, Western New England, and Western regions of the country are the most likely to be perceived as using General American speech. The precise definition and usefulness of the term continue to be debated, and the scholars who use it today admittedly do so as a convenient basis for comparison rather than for exactness. Some scholars prefer other names, such as Standard American...

Functional magnetic resonance imaging

Functional magnetic resonance imaging or functional MRI (fMRI) measures brain activity by detecting changes associated with blood flow. This technique

Functional magnetic resonance imaging or functional MRI (fMRI) measures brain activity by detecting changes associated with blood flow. This technique relies on the fact that cerebral blood flow and neuronal activation are coupled. When an area of the brain is in use, blood flow to that region also increases.

Estimates of the number of human languages in the world vary between 5,000 and 7,000. Precise estimates depend...

Denis Le Bihan

Nicolas; Chabriat, Hughes (2001). "Diffusion tensor imaging: Concepts and applications". Journal of Magnetic Resonance Imaging. 13 (4): 534–546. doi:10.1002/jmri

Denis Le Bihan (born 30 July 1957) is a medical doctor, physicist, member of the Institut de France (French Academy of sciences), member of the French Academy of Technologies and director since 2007 of NeuroSpin, an institution of the Atomic Energy and Alternative Energy Commission (CEA) in Saclay, dedicated to the study of the brain by magnetic resonance imaging (MRI) with a very high magnetic field. Denis Le Bihan has received international recognition for his outstanding work, introducing new imaging methods, particularly for the study of the human brain, as evidenced by the many international awards he has received, such as the Gold Medal of the International Society of Magnetic Resonance in Medicine (2001), the coveted Lounsbery Prize (US National Academy of Sciences and French Academy...

Language

language structure. One source of language change is contact and the resulting diffusion of linguistic traits between languages. Language contact occurs

Language is a structured system of communication that consists of grammar and vocabulary. It is the primary means by which humans convey meaning, both in spoken and signed forms, and may also be conveyed through writing. Human language is characterized by its cultural and historical diversity, with significant variations observed between cultures and across time. Human languages possess the properties of productivity and displacement, which enable the creation of an infinite number of sentences, and the ability to refer to objects, events, and ideas that are not immediately present in the discourse. The use of human language relies on social convention and is acquired through learning.

Causes include falls, vehicle collisions, and violence. Brain trauma occurs as a consequence of a sudden...

Nicholas Ayache

coupling diffusion with biomech. deformation, IEEE Tr. on Medical Imaging, 24 (10), 1334-1346, 2005. N. Ayache (dir., with J-L. Lions and P. Ciarlet)

Nicholas Ayache, born on 1 November 1958 in Paris, is a French computer scientist and Research Director at INRIA, Sophia Antipolis-Mediterranean Centre. Previously, he was Scientific Director of the Institut hospitalo-universitaire de Strasbourg (2012–2015) and Visiting Professor at the Collège de France (2014). He is also a member of the French Academy of Sciences.

The primary form of fMRI uses the blood-oxygen-level dependent (BOLD) contrast, discovered by Seiji Ogawa in 1990. This is a type of specialized brain and body scan used to map neural activity in the brain or spinal cord of humans or other animals by imaging the change in blood flow (hemodynamic response) related to energy use by brain cells. Since the early 1990s, fMRI has come to dominate brain mapping research because it does not involve the use of injections, surgery, the ingestion...

The field is broadly defined and includes foundations in anatomy, applied mathematics and pure mathematics, machine learning, computational mechanics, computational science, biological imaging, neuroscience, physics, probability, and statistics; it also has strong connections with fluid mechanics and geometric mechanics. Additionally, it complements newer, interdisciplinary fields like bioinformatics and neuroinformatics in the sense that its interpretation uses metadata derived from the original...

Large deformation diffeomorphic metric mapping

T2 magnetic resonance imagery, or as 3x3 diffusion tensor matrices diffusion MRI and diffusion-weighted imaging, to scalar densities associated to computed

Large deformation diffeomorphic metric mapping (LDDMM) is a specific suite of algorithms used for diffeomorphic mapping and manipulating dense imagery based on diffeomorphic metric mapping within the academic discipline of computational anatomy, to be distinguished from its precursor based on diffeomorphic mapping. The distinction between the two is that diffeomorphic metric maps satisfy the property that the length associated to their flow away from the identity induces a metric on the group of diffeomorphisms, which in turn induces a metric on the orbit of shapes and forms within the field of computational anatomy. The study of shapes and forms with the metric of diffeomorphic metric mapping is called diffeomorphometry.

A diffeomorphic mapping system is a system designed to map, manipulate...