

Diffusion Tensor Imaging A Practical Handbook

White matter

A 2009 paper by Jan Scholz and colleagues used diffusion tensor imaging (DTI) to demonstrate changes in white matter volume as a result of learning a

White matter refers to areas of the central nervous system that are mainly made up of myelinated axons, also called tracts. Long thought to be passive tissue, white matter affects learning and brain functions, modulating the distribution of action potentials, acting as a relay and coordinating communication between different brain regions.

White matter is named for its relatively light appearance resulting from the lipid content of myelin. Its white color in prepared specimens is due to its usual preservation in formaldehyde. It appears pinkish-white to the naked eye otherwise, because myelin is composed largely of lipid tissue veined with capillaries.

Unsupervised learning

trained to good features, which can then be used as a module for other models, such as in a latent diffusion model. Tasks are often categorized as discriminative

Unsupervised learning is a framework in machine learning where, in contrast to supervised learning, algorithms learn patterns exclusively from unlabeled data. Other frameworks in the spectrum of supervisions include weak- or semi-supervision, where a small portion of the data is tagged, and self-supervision. Some researchers consider self-supervised learning a form of unsupervised learning.

Conceptually, unsupervised learning divides into the aspects of data, training, algorithm, and downstream applications. Typically, the dataset is harvested cheaply "in the wild", such as massive text corpus obtained by web crawling, with only minor filtering (such as Common Crawl). This compares favorably to supervised learning, where the dataset (such as the ImageNet1000) is typically constructed manually...

Metamaterial

$\{\kappa\}$, I is the identity matrix, N is a symmetric trace-free tensor, and J is an antisymmetric tensor. Such decomposition allows us to classify the

A metamaterial (from the Greek word μετά meta, meaning "beyond" or "after", and the Latin word materia, meaning "matter" or "material") is a type of material engineered to have a property, typically rarely observed in naturally occurring materials, that is derived not from the properties of the base materials but from their newly designed structures.

Metamaterials are usually fashioned from multiple materials, such as metals and plastics, and are usually arranged in repeating patterns, at scales that are smaller than the wavelengths of the phenomena they influence. Their precise shape, geometry, size, orientation, and arrangement give them their "smart" properties of manipulating electromagnetic, acoustic, or even seismic waves: by blocking, absorbing, enhancing, or bending waves, to achieve...

Andrew Budson

Farrar, D.; Budson, A. E. (2017). "The relationship between functional magnetic resonance imaging activation, diffusion tensor imaging, and training effects"

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As a cognitive behavioral neurologist, Budson has published over 150 papers and book chapters on clinical and cognitive neuroscience aspects of Alzheimer's disease (AD), Chronic Traumatic Encephalopathy (CTE), others dementias, and normal...

Ojibwe language

The Central languages share a significant number of common features. These features can generally be attributed to diffusion of features through borrowing:

Ojibwe (oh-JIB-way), also known as Ojibwa (oh-JIB-wə), Ojibway, Otchipwe, Ojibwemowin, or Anishinaabemowin, is an indigenous language of North America of the Algonquian language family. The language is characterized by a series of dialects that have local names and frequently local writing systems. There is no single dialect that is considered the most prestigious or most prominent, and no standard writing system that covers all dialects.

Dialects of Ojibwemowin are spoken in Canada, from southwestern Quebec, through Ontario, Manitoba and parts of Saskatchewan, with outlying communities in Alberta; and in the United States, from Michigan to Wisconsin and Minnesota, with a number of communities in North Dakota and Montana, as well as groups that were removed to Kansas and Oklahoma during the...

Research in dyslexia

influenced by diagnostic overlap. Magnetic resonance imaging (MRI) and diffusion tensor imaging (DTI) are the main neuroimaging methods used to study

Dyslexia is a reading disorder wherein an individual experiences trouble with reading. Individuals with dyslexia have normal levels of intelligence but can exhibit difficulties with

spelling, reading fluency, pronunciation, "sounding out" words, writing out words, and reading comprehension. The neurological nature and underlying causes of dyslexia are an active area of research. However, some experts believe that the distinction of dyslexia as a separate reading disorder and therefore recognized disability is a topic of some controversy.

Inverse problem

Problems in Science and Engineering Inverse Problems and Imaging Many journals on medical imaging, geophysics, non-destructive testing, etc. are dominated

An inverse problem in science is the process of calculating from a set of observations the causal factors that produced them: for example, calculating an image in X-ray computed tomography, source reconstruction in acoustics, or calculating the density of the Earth from measurements of its gravity field. It is called an inverse problem because it starts with the effects and then calculates the causes. It is the inverse of a forward problem, which starts with the causes and then calculates the effects.

Inverse problems are some of the most important mathematical problems in science and mathematics because they tell us about parameters that we cannot directly observe. They can be found in system identification, optics, radar, acoustics, communication theory, signal processing, medical imaging...

Machine learning

(2017), and found a 300,000-fold increase in the amount of compute required, with a doubling-time trendline of 3.4 months. Tensor Processing Units (TPUs)

Machine learning (ML) is a field of study in artificial intelligence concerned with the development and study of statistical algorithms that can learn from data and generalise to unseen data, and thus perform tasks without explicit instructions. Within a subdiscipline in machine learning, advances in the field of deep learning have allowed neural networks, a class of statistical algorithms, to surpass many previous machine learning approaches in performance.

ML finds application in many fields, including natural language processing, computer vision, speech recognition, email filtering, agriculture, and medicine. The application of ML to business problems is known as predictive analytics.

Statistics and mathematical optimisation (mathematical programming) methods comprise the foundations of...

Health informatics

Informatics, the CIIP (Certified Imaging Informatics Professional) certification was created by ABII (The American Board of Imaging Informatics) which was founded

Health informatics' is the study and implementation of computer science to improve communication, understanding, and management of medical information. It can be

viewed as a branch of engineering and applied science.

The health domain provides an extremely wide variety of problems that can be tackled using computational techniques.

Health informatics is a spectrum of multidisciplinary fields that includes study of the design, development, and application of computational innovations to improve health care. The disciplines involved combine healthcare fields with computing fields, in particular computer engineering, software engineering, information engineering, bioinformatics, bio-inspired computing, theoretical computer science, information systems, data science, information technology, autonomic...

Convolutional neural network

Here it should be noted how close a convolutional neural network is to a matched filter. In a CNN, the input is a tensor with shape: (number of inputs) ×

A convolutional neural network (CNN) is a type of feedforward neural network that learns features via filter (or kernel) optimization. This type of deep learning network has been applied to process and make predictions from many different types of data including text, images and audio. Convolution-based networks are the de-facto standard in deep learning-based approaches to computer vision and image processing, and have only recently been replaced—in some cases—by newer deep learning architectures such as the transformer.

Vanishing gradients and exploding gradients, seen during backpropagation in earlier neural networks, are prevented by the regularization that comes from using shared weights over fewer connections. For example, for each neuron in the fully-connected layer, 10,000 weights would...

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