PROVA ORALE CONCORSO N.9 – BUSTA A

1. Cosa sono e rappresentano i tempi di rilassamento T1/T2/$T2^*$?
2. Cos'è un software Open Source e in cosa si contraddistingue dagli altri tipi di software?
3. Legga e traduca il seguente abstract tratto dalla letteratura scientifica

Dentatorubrothalamic tract in human brain: diffusion tensor tractography study

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Abstract
Introduction The dentatorubrothalamic tract (DRTT) originates from the dentate nucleus in the cerebellum and terminates in the contralateral ventrolateral nucleus (VL) of the thalamus after decussating to the contralateral red nucleus. Identification of the DRTT is difficult due to the fact that it is a long, multisynaptic, neural tract crossing to the opposite hemisphere. In the current study, we attempted to identify the DRTT in the human brain using a probabilistic tractography technique of diffusion tensor imaging.

Methods Diffusion tensor imaging was performed at 1.5-T using a synergy-L sensitivity encoding head coil. DRTTs were obtained by selection of fibers passing through three regions of interest (the dentate nucleus, the superior cerebellar peduncle, and the contralateral red nucleus) from 41 healthy volunteers. Probabilistic mapping was obtained from the highest probabilistic location at 2.3 mm above the anterior commissure–posterior commissure level.

Results DRTTs of all subjects, which originated from the dentate nucleus, ascended through the junction of the superior cerebellar peduncle and the contralateral red nucleus and then terminated at the VL nucleus of the thalamus. The highest probabilistic location for the DRTT at the thalamus was compatible with the location of the VL nucleus.

Conclusions We identified the DRTT in the human brain using probabilistic tractography. Our results could be useful in research on movement control.

Keyword Dentatorubrothalamic tract · Diffusion tensor tractography · Diffusion tensor imaging · Ventrolateral nucleus · Thalamus

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PROVA ORALE CONCORSO N.9 – BUSTA B

1. Descriva l'effetto BOLD e gli step di analisi di uno studio fMRI
2. Cos'è Excel e a cosa serve?
3. Legga e traduca il seguente abstract tratto dalla letteratura scientifica.

Advanced magnetic resonance imaging in glioblastoma: a review

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Free article

Abstract

Glioblastoma, the most common and most rapidly progressing primary malignant tumor of the central nervous system, continues to portend a dismal prognosis, despite improvements in diagnostic and therapeutic strategies over the last 20 years. The standard of care radiographic characterization of glioblastoma is magnetic resonance imaging (MRI), which is a widely utilized examination in the diagnosis and post-treatment management of patients with glioblastoma. Basic MRI modalities available from any clinical scanner, including native T1-weighted (T1w) and contrast-enhanced (T1CE), T2-weighted (T2w), and T2-fluid-attenuated inversion recovery (T2-FLAIR) sequences, provide critical clinical information about various processes in the tumor environment. In the last decade, advanced MRI modalities are increasingly utilized to further characterize glioblastomas more comprehensively. These include multi-parametric MRI sequences, such as dynamic susceptibility contrast (DSC), dynamic contrast enhancement (DCE), higher order diffusion techniques such as diffusion tensor imaging (DTI), and MR spectroscopy (MRS). Significant efforts are ongoing to implement these advanced imaging modalities into improved clinical workflows and personalized therapy approaches. Functional MRI (fMRI) and tractography are increasingly being used to identify eloquent cortices and important tracts to minimize postsurgical neuro-deficits. A contemporary review of the application of standard and advanced MRI in clinical neuro-oncologic practice is presented here.

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PROVA ORALE CONCORSO N.9 – BUSTA C

1. Quali sono le tecniche trattografiche di maggior utilizzo? Ne descriva vantaggi e svantaggi.
2. Cos'è Matlab e a cosa serve?
3. Legga e traduca il seguente abstract tratto dalla letteratura scientifica.

Automatic Quality Assessment in Structural Brain Magnetic Resonance Imaging

Bénédicte Mortamet,[1*] Matt A. Bernstein,[2] Clifford R. Jack, Jr.,[2] Jeffrey L. Gunter,[2] Chadwick Ward,[2] Paula J. Britson,[2] Reto Meuli,[4] Jean-Philippe Thiran,[3] Gunnar Krueger[1]; and the Alzheimer's Disease Neuroimaging Initiative

MRI has evolved into an important diagnostic technique in medical imaging. However, reliability of the derived diagnosis can be degraded by artifacts, which challenge both radiologists and automatic computer-aided diagnosis. This work proposes a fully-automatic method for measuring image quality of three-dimensional (3D) structural MRI. Quality measures are derived by analyzing the air background of magnitude images and are capable of detecting image degradation from several sources, including bulk motion, residual magnetization from incomplete spoiling, blurring, and ghosting. The method has been validated on 749 3D T_1-weighted 1.5T and 3T head scans acquired at 36 Alzheimer's Disease Neuroimaging Initiative (ADNI) study sites operating with various software and hardware combinations. Results are compared against qualitative grades assigned by the ADNI quality control center (taken as the reference standard). The derived quality indices are independent of the MRI system used and agree with the reference standard quality ratings with high sensitivity and specificity (>85%). The proposed procedures for quality assessment could be of great value for both research and routine clinical imaging. It could greatly improve workflow through its ability to rule out the need for a repeat scan while the patient is still in the magnet bore. **Magn Reson Med 62:365–372, 2009.**

Key words: magnetic resonance imaging; automatic quality assessment; image quality; artifact detection

MRI quality can be affected by a wide variety of artifacts. They can be broadly classified into two categories: those that are machine-specific and those that are related to the patient. Some of the machine-specific artifacts are not visually obvious, yet can potentially degrade images. This can cause inaccurate diagnosis or dramatically affect the efficiency of automated quantitative image analysis algorithms that are increasingly used in clinical practice and research. These techniques offer promise for improved clinical workflow, including clinical research studies, such as longitudinal monitoring of the evolution and the treatment of degenerative and inflammatory diseases (e.g., dementias, multiple sclerosis, Parkinson disease). In this context, recognizing artifacts becomes fundamental.

Recently, various investigators have proposed standardized quality assurance (QA) protocols and methodologies to test machine-related artifacts (1–3). These protocols are often based on specially designed phantoms to analyze image quality-related system parameters, such as: gradient linearity (4), geometric accuracy, high-contrast resolution, slice thickness/position accuracy, image intensity uniformity (5–7), percent signal ghosting, and low-contrast object detectability (8,9). These QA tests are of high interest to monitor scanner performance and retrospectively correct human images for drifts or discontinuities in gradient calibration (10,11).

Although QA tests are performed as standard procedure during tune-up and service of MR systems and are used in several clinical studies, very little has been reported about detecting and analyzing patient-related artifacts. The importance of such quality control might have been downplayed so far under the assumption that an experienced radiologist is able to "read-through" artifacts. Nevertheless, this issue has been investigated (12,13) and some

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