Digital Brain Atlases

Семинар

24 марта 2008

What Is Computing?

In a general way, we can define computing to mean any goal-oriented activity requiring, benefiting from, or creating computers. Thus, computing includes designing and building hardware and software systems for a wide range of purposes; processing, structuring, and managing various kinds of information; doing scientific studies using computers; making computer systems behave intelligently; creating and using communications and entertainment media; finding and gathering information relevant to any particular purpose, and so on.

What is our Discipline?

I submit that by any reasonable criterion the discipline we call “computer science” is in fact not a science but a *synthetic,* an engineering, discipline. We are concerned with *making things*, be they computers, algorithms, or software systems.

If we perceive our role aright, we then see more clearly the proper criterion for success: a toolmaker succeeds as, and only as, the *users* of his tool succeed with his aid.

If our discipline has been misnamed, so what? Surely *computer science* is a harmless conceit. What’s in a name? Much. Our self-misnaming hastens various unhappy trends.

Computer Science

Computer science spans a wide range, from its theoretical and algorithmic foundations to cutting-edge developments in robotics, computer vision, intelligent systems, bioinformatics, and other exciting areas. We can think of the work of computer scientists as falling into three categories.

Computer Science (1)

They design and implement software. Computer scientists take on challenging programming jobs.

They also supervise other programmers, keeping them aware of new approaches.

Computer Science (2)

They devise new ways to use computers. Progress in the CS areas of networking, database, and human-computer-interface enabled the development of the World Wide Web. Now CS researchers are working with scientists from other fields to make robots become practical and intelligent aides, to use databases to create new knowledge, and to use computers to help decipher the secrets of our DNA.

Computer Science (3)

They develop effective ways to solve computing problems. For example, computer scientists develop the best possible ways to store information in databases, send data over networks, and display complex images. Their theoretical background allows them to determine the best performance possible, and their study of algorithms helps them to develop new approaches that provide better performance.

Computer Science (4)

Computer science spans the range from theory through programming. Curricula that reflect this breadth are sometimes criticized for failing to prepare graduates for specific jobs. While other disciplines may produce graduates with more immediately relevant job-related skills, computer science offers a comprehensive foundation that permits graduates to adapt to new technologies and new ideas.

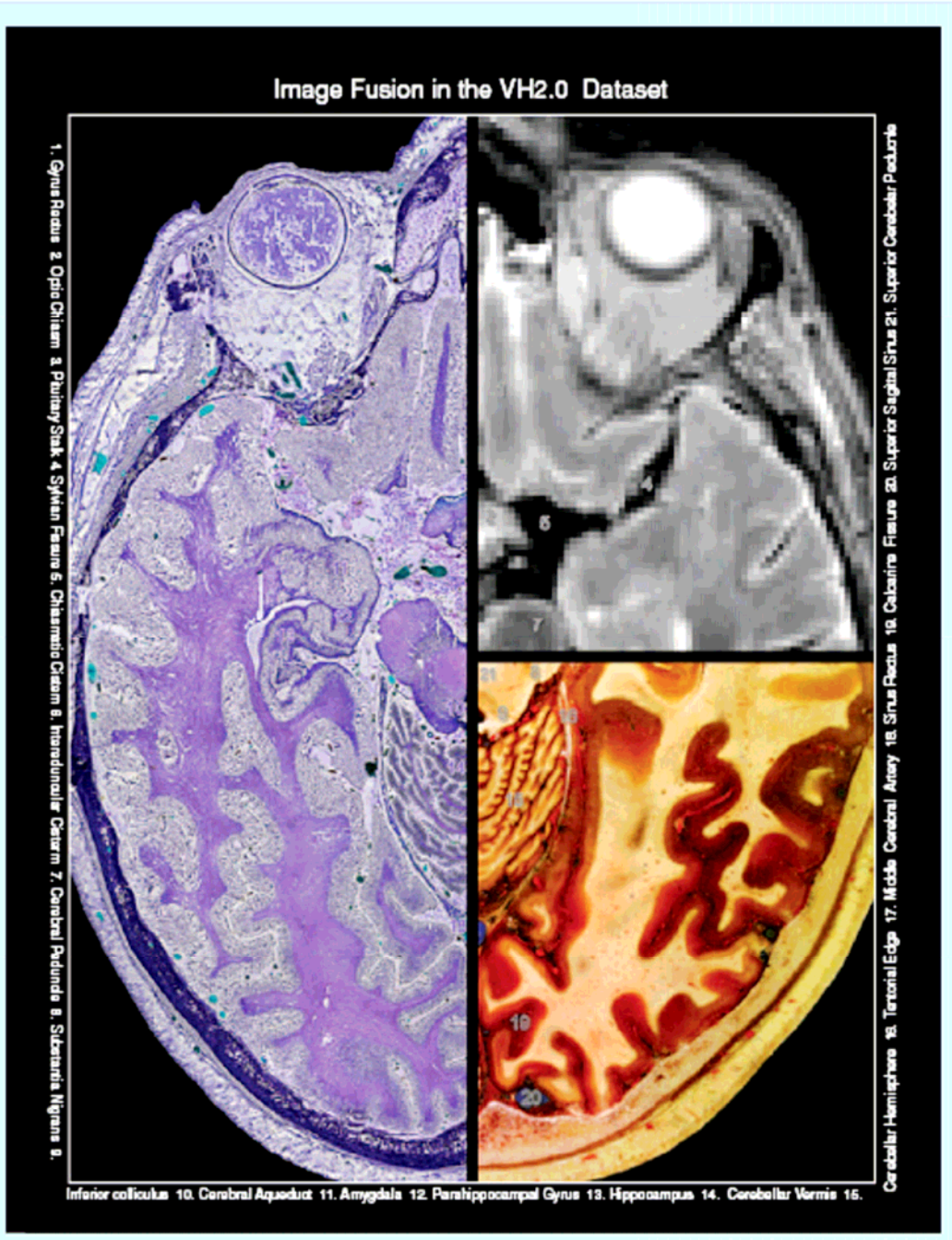
The Golden Age of Imaging

WE LIVE IN the golden age of imaging. Imaging research, development, and applications are growing at an astounding rate, and image-processing researchers can take credit for having created much of the enabling technologies that have fueled this growth. We are all familiar with the examples. The development of image and video coding standards, such as JPEG and MPEG, has enabled the web as a center for commerce and entertainment. Ubiquitous technologies, such as Direct TV, DVDs, BlueRay, and TiVo, depend on these standards; streaming internet video services, like iTunes' recently announced movie rental feature, are well on their way to replacing traditional analog broadcast video.

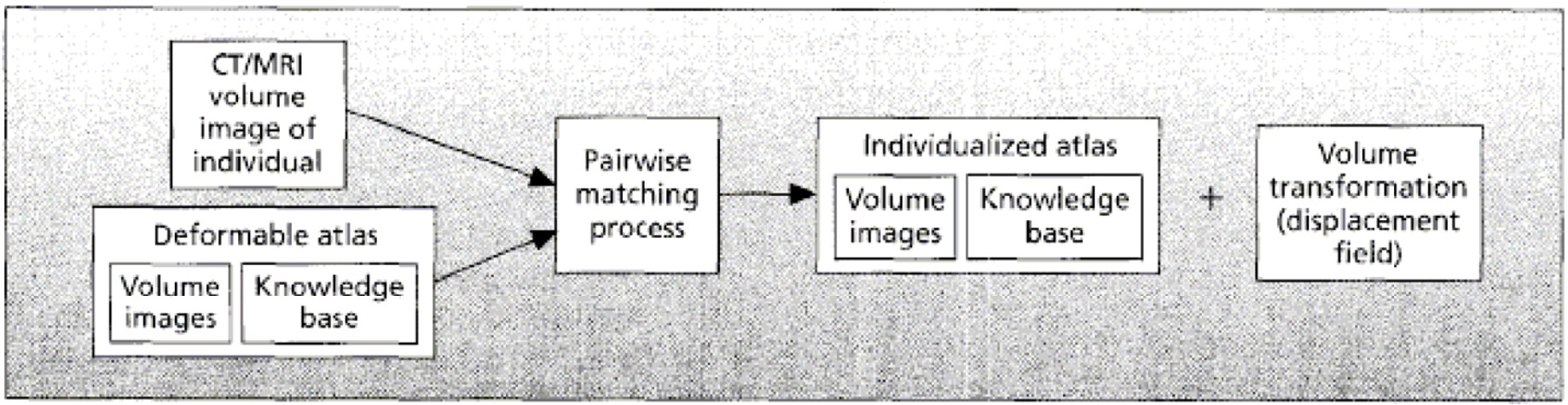
The Golden Age of Imaging

In fact, image-processing research has not just impacted consumer products; it has changed the nature of scientific investigation and human healthcare. From the Mars Rover's transmission of compressed digital video to the reconstruction of virus structure using cryo-electron microscopy, advanced digital imaging algorithms are at the heart of essential scientific investigation. In the field of healthcare, diagnostic imaging has revolutionized patient care. Any radiologist will tell you that volumetric CT and parallel acquisition MRI have changed medical imaging in the last decade by allowing dramatically faster and more accurate patient scans.

Detailed anatomy from the Visible Human Project merges information from X-ray computed tomography, MRI, cryosections, and histological sections to produce anatomical images able to resolve fine structures as small as 25 microns



Индивидуальный нейроанатомический атлас



Преобразование системы координат деформируемого атласа до тех пор пока информация в атласе не будет соответствовать анатомии субъекта.

Деформируемый атлас или шаблон

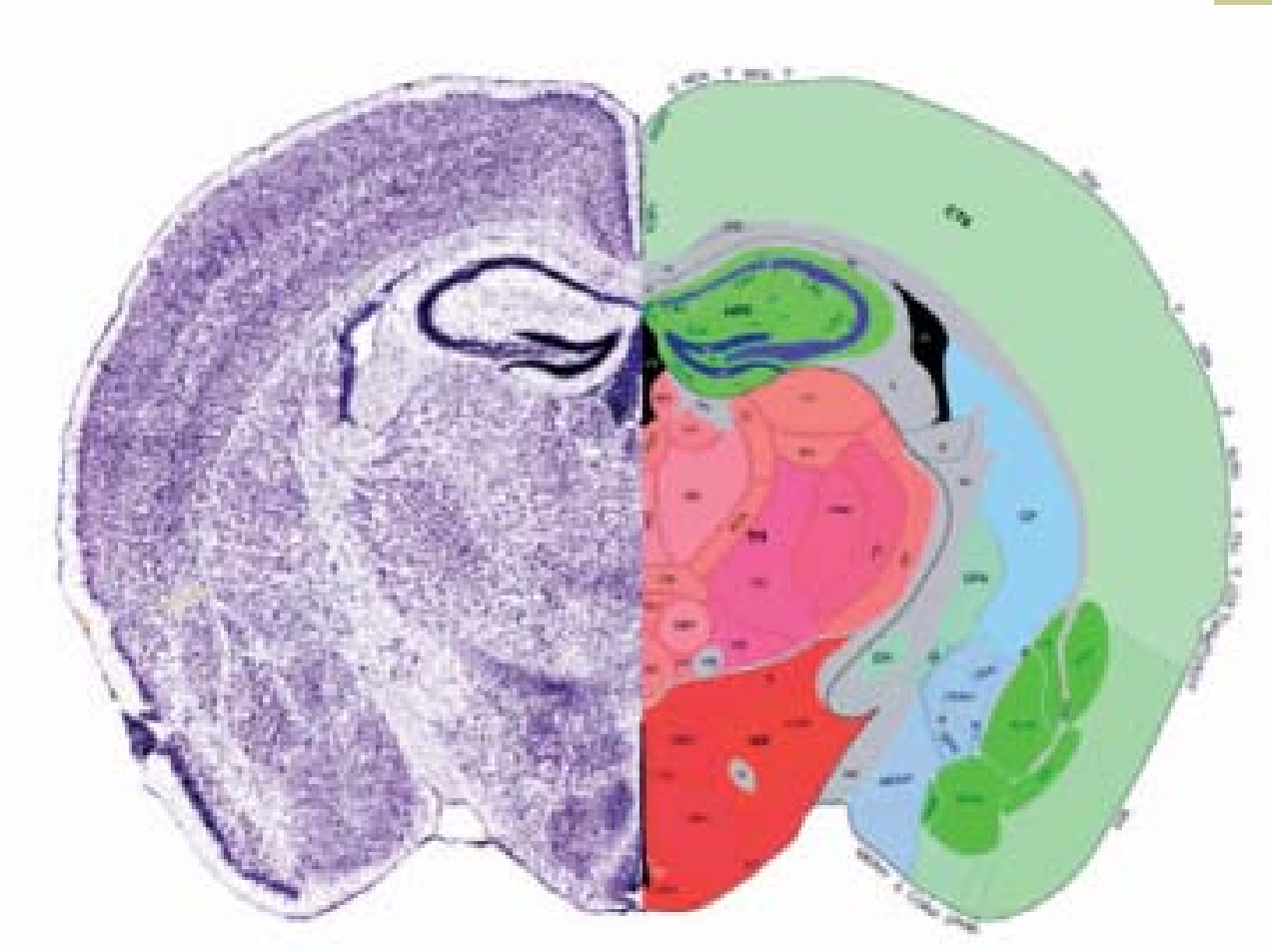
Деформируемый атлас или шаблон – это многозначная функция T, определенная в трехмерной системе координат.

Пример: Значение атласа в точке (0.5, 0.5, 0.5) есть

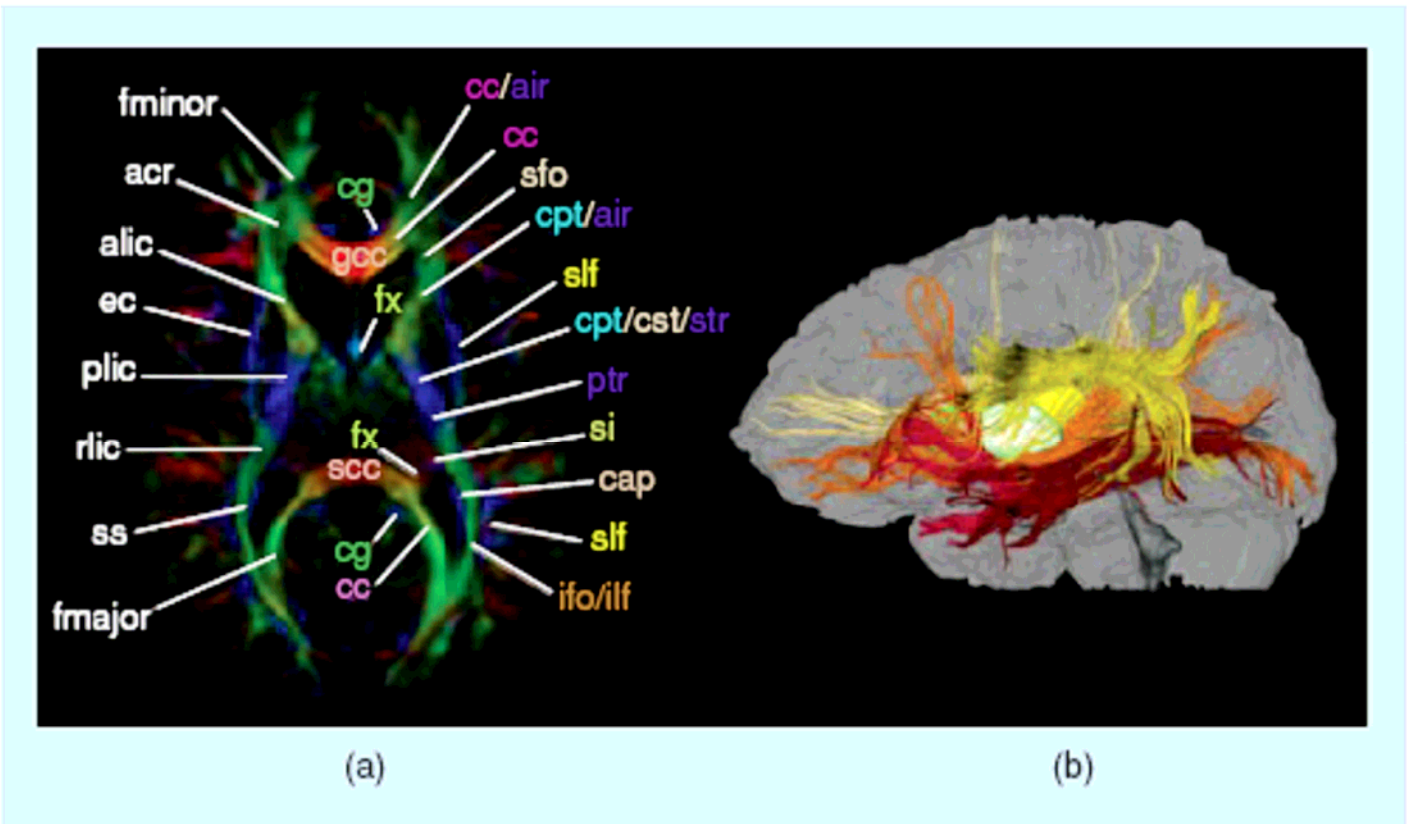
T (0.5, 0.5, 0.5) = (150, 1000, 30, (120,135,45), “*ventricle*”)

150 – интенсивность MRI, 1000 – CT, 30 – PET, (120,135,45) – RGB для cryosection image, а “*ventricle*” – метка в сегментации.

Аннотированый атлас

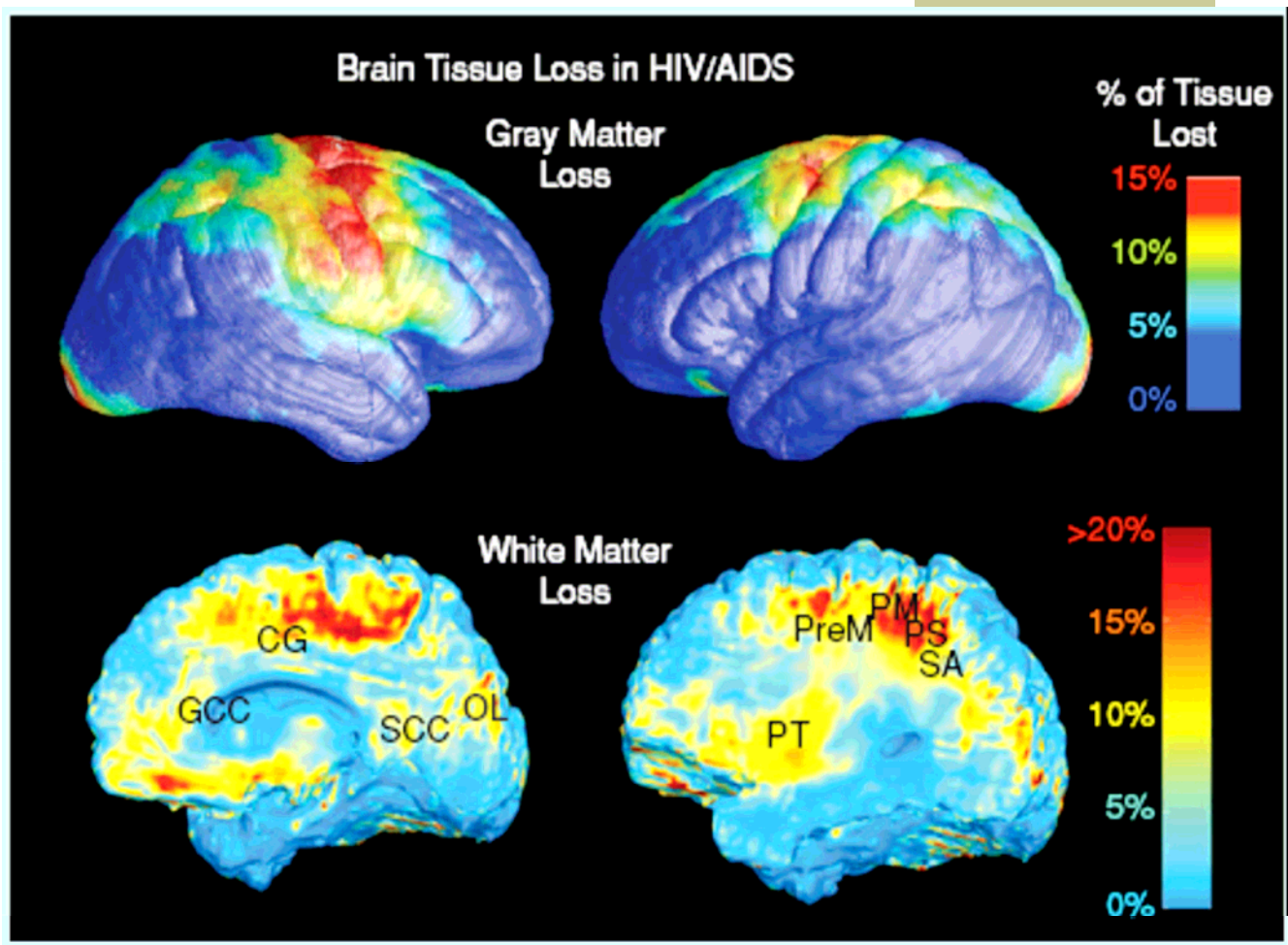


(Мульти)Модальности



Diffusion tensor imaging-based white matter atlas (a) with annotations and (b)tracts depicted in three dimensions

Selective cortical degeneration in patients with HIV/AIDS



Ссылки

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