Initiation à la Recherche (IR)

Master Informatique

10/10/2017

De quoi s'agit-il ?

- UE de 3 crédits
- Début : maintenant ; Fin : janvier 2018
- 1er rendu (pour correction anglais) : fin décembre 2017

- Organisation (sujets, soutenances): responsables de spécialités
- Choix des sujets : liste (Moodle IR)
- Deadline : 16/10/2017 (23h) cf. news

- Rendu: synthèse de 4 pages en anglais, soutenance de 10 min

- Travail individuel (seul ou en binôme)

Elèves ingénieurs

- Rattachés à un parcours
- Attention aux News (masterinfo, masterinfo.officiel)
- Même calendrier/organisation que les étudiants de Master
- ATTENTION – cf. année précédente

Encadrement

- Encadrant principal : la personne ayant proposé l'article -> ATTENTION – réunions régulièrement !
- Enseignant d'anglais
- Pas de chargé de TD – travail personnel
- Autres cours : anglais, bibliographie, …

Objectifs

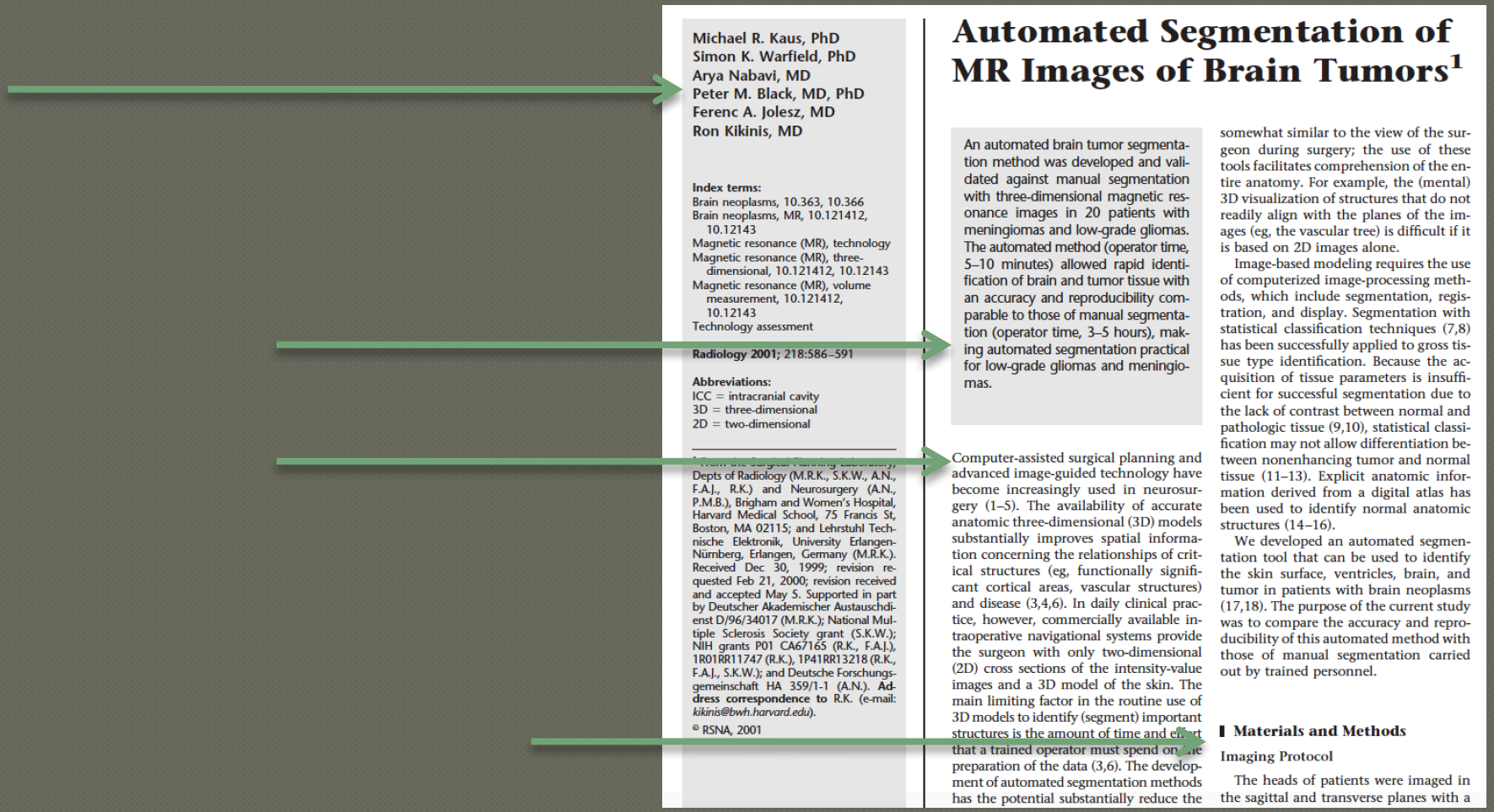
- Lecture d'un article de Recherche
- Compréhension + restitution (synthèse)
- Recul sur l'article / repositionnement

à noter : pas d'obligation de développement logiciel mais …

Article de Recherche

- Différents types :
  - Survey/Review
  - Méthodologie
  - Application
  - …
- Un schéma commun (plus ou moins marqué):
  - Problématique
  - Etat de l'art
  - Méthode(s) (voire « Matériels et Méthodes »)
  - Résultats
  - Discussion

Anatomie d'un article (1/3)



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Index terms:
Brain neoplasms, 10.363, 10.366
Brain neoplasms, MR, 10.121412, 10.12143
Magnetic resonance (MR), technology
Magnetic resonance (MR), three-dimensional, 10.121412, 10.12143
Magnetic resonance (MR), volume measurement, 10.121412, 10.12143
Technology assessment

Radiology 2001; 218:586–591

Abbreviations:
ICC = intracranial cavity
3D = three-dimensional
2D = two-dimensional

Depts of Radiology (M.R.K., S.K.W., A.N., F.A.J., R.K.) and Neurosurgery (A.N., P.M.B.), Brigham and Women's Hospital, Harvard Medical School, 75 Francis St, Boston, MA 02115; and Lehrstuhl Technische Elektronik, University Erlangen-Nürnberg, Erlangen, Germany (M.R.K.).
Received Dec 30, 1999; revision requested Feb 21, 2000; revision received and accepted May 5. Supported in part by Deutscher Akademischer Austauschdienst D/96/34017 (M.R.K.); National Multiple Sclerosis Society grant (S.K.W.); NIH grants P01 CA67165 (R.K., F.A.J.), 1R01RR11747 (R.K.), 1P41RR13218 (R.K., F.A.J., S.K.W.); and Deutsche Forschungsgemeinschaft HA 359/1-1 (A.N.). **Address correspondence to** R.K. (e-mail: *kikinis@bwh.harvard.edu*).

Automated Segmentation of MR Images of Brain Tumors[1]

An automated brain tumor segmentation method was developed and validated against manual segmentation with three-dimensional magnetic resonance images in 20 patients with meningiomas and low-grade gliomas. The automated method (operator time, 5–10 minutes) allowed rapid identification of brain and tumor tissue with an accuracy and reproducibility comparable to those of manual segmentation (operator time, 3–5 hours), making automated segmentation practical for low-grade gliomas and meningiomas.

Computer-assisted surgical planning and advanced image-guided technology have become increasingly used in neurosurgery (1–5). The availability of accurate anatomic three-dimensional (3D) models substantially improves spatial information concerning the relationships of critical structures (eg, functionally significant cortical areas, vascular structures) and disease (3,4,6). In daily clinical practice, however, commercially available intraoperative navigational systems provide the surgeon with only two-dimensional (2D) cross sections of the intensity-value images and a 3D model of the skin. The main limiting factor in the routine use of 3D models to identify (segment) important structures is the amount of time and effort that a trained operator must spend on the preparation of the data (3,6). The development of automated segmentation methods has the potential substantially reduce the somewhat similar to the view of the surgeon during surgery; the use of these tools facilitates comprehension of the entire anatomy. For example, the (mental) 3D visualization of structures that do not readily align with the planes of the images (eg, the vascular tree) is difficult if it is based on 2D images alone.

Image-based modeling requires the use of computerized image-processing methods, which include segmentation, registration, and display. Segmentation with statistical classification techniques (7,8) has been successfully applied to gross tissue type identification. Because the acquisition of tissue parameters is insufficient for successful segmentation due to the lack of contrast between normal and pathologic tissue (9,10), statistical classification may not allow differentiation between nonenhancing tumor and normal tissue (11–13). Explicit anatomic information derived from a digital atlas has been used to identify normal anatomic structures (14–16).

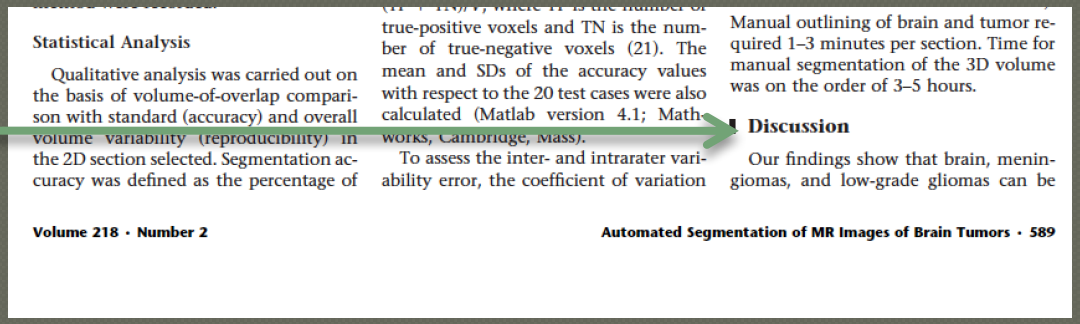
We developed an automated segmentation tool that can be used to identify the skin surface, ventricles, brain, and tumor in patients with brain neoplasms (17,18). The purpose of the current study was to compare the accuracy and reproducibility of this automated method with those of manual segmentation carried out by trained personnel.

Materials and Methods

Imaging Protocol

The heads of patients were imaged in the sagittal and transverse planes with a

Anatomie d'un article (2/3)



Statistical Analysis

Qualitative analysis was carried out on the basis of volume-of-overlap comparison with standard (accuracy) and overall volume variability (reproducibility) in the 2D section selected. Segmentation accuracy was defined as the percentage of

true-positive voxels and TN is the number of true-negative voxels (21). The mean and SDs of the accuracy values with respect to the 20 test cases were also calculated (Matlab version 4.1; MathWorks, Cambridge, Mass).

To assess the inter- and intrarater variability error, the coefficient of variation

Manual outlining of brain and tumor required 1–3 minutes per section. Time for manual segmentation of the 3D volume was on the order of 3–5 hours.

Discussion

Our findings show that brain, meningiomas, and low-grade gliomas can be

Anatomie d'un article (3/3)

the patterns are also $v_i = [v^1_i, \ldots, v^5_i]^T$. For the second tumor segmentation cycle, the patterns are $v_i = [v^1_i, \ldots, v^6_i]^T$, where v^1_i for i = 1–5 are defined as above but with the additional pattern $v^6_i = T_6[A(x_i)]$, T_6: distance transform of initial tumor segmentation where I_b is the resultant image of the first tumor segmentation.

Acknowledgments: The authors thank Rick Schwarz, MD, for helpful comments, and Fatma Ozlen, MD, for help with the manual segmentations.

References

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Une démarche différente

- Identification d'une problématique
- Etat de l'art
- Proposition (nouvelle méthode par exemple)
- Discussion (points forts, points faibles, limites …)

Travail attendu

- Compréhension
- Etat de l'art (avec compléments)
- Explication
- Recul
- SYNTHESE

Pourquoi ?

- Démarche Recherche
- Faire un état de l'art
- Connaissance plus pointue d'une problématique ou d'un domaine
- Recul

Intérêts (autres que pédagogiques)

- Vision Recherche
  - Premier contact avant le stage Recherche
  - Peut déjà être dans le domaine du futur stage (voire avec le même encadrant !)
  - Problématique/état de l'art/discussion …
- Vision Pro (et futurs ingénieurs)
  - Démarche Recherche parfois différente de la démarche Ingénierie
  - Demande de certaines entreprises (ex: startups « innovantes » mais aussi certaines SSII)
  - Dispositifs de type CIR ou JEI