

Brain Tumour Analysis Project



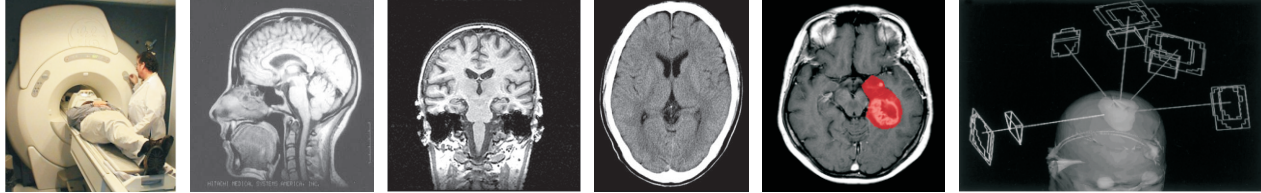
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Automatic Brain Tumour Segmentation

- Doctors must locate brain tumours
 - ▶ Segment Magnetic Resonance (MR) images (separate tumour from non-tumour)
- Typically done by hand
 - ▶ labour intensive and often inaccurate / inconsistent
- We developed **automated** segmenter
 - ▶ program that *automatically* separates tumour from normal, without human input
 - ▶ program was *learned* from prior segmented images
- More accurate than other automated tumour segmentation algorithms



Visible Tumour (red) + 2cm (yellow)
Yellow region contains cancerous+healthy tissue

Brain Tumour Growth Modelling

- Brain tumours have
 - regions VISIBLE in MRI scans and
 - regions INVISIBLE (radiographically occult)
- ▶ Treating ONLY visible region is not sufficient!
- ▶ Currently: doctors treat VISIBLE + 2cm border
- ▶ *But... kills some healthy tissue, spares some cancer cells!*
- Implemented system that **predicts** how brain tumours will grow based on scan + properties of the patient, tumour
 - ▶ Learned from MRI scans of earlier patients
 - ▶ More accurate than other growth predictors



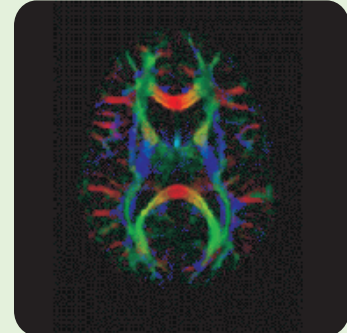
Better treatment region
Target occult cells, avoid healthy tissue

How do our Systems Work?

- Segmentation based on two approaches:
 1. Probabilistic approach - conditional random fields
 2. Variational approach - level sets
 - ▶ Both approaches involve training on 100's of expert-labeled patient scans.
- Growth prediction: Incremental "growth" process, trained with time sequence of labelled MR images for many different patients

Current Projects

- Better accuracy using improved Machine Learning algorithms
- Fast (if approximate) algorithms
- New modalities: Diffusion tensor images, Magnetic resonance spectroscopy
- Database of previous labelled images, for fast recall and use
- Translate from prototype to working, deployed system



Sample DTI Image
Shows neuronal fibre orientations

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Making IT happen

Computing Science