Why Segmentation?

Measurement of anatomic structure
Visualization

How?
Thresholding
I1 < I < I2 structure x
Why should this work: unlike photographic imaging in CT and MR, the value of a pixel/voxel is a property of the tissue (there is not projection)
expect some coherence in the tissue properties

While tissue values in CT/MR are coherent we expect some variation, because
noise in measurement from the device
noise due to movement
non-uniformity in the tissue
variation near the boundary (Partial Volume Effect)
makes the boundaries blurred
introduces a range of values between inside and outside
These variations lead to a distribution, often resembling a Gassuian with some mean and std
thresholding with a minimum and maximum sounds like an effetive method to segment
When does this not work in CT/MR images?
significantly overlapping distributions prevent thresholding
Spatial information is important in delineating various tissue types
- limit spatial location of pixels matching intensity distribution
- spatial continuity
- non-uniformities in the imaging process

We need more than just thresholding

Segmentation techniques.
A formal definition of segmentation is a partitioning of the image into segments
R1, R2, ..., Rn
segmentation to be complete I = Union of Ri
segments not to share or intersect Ri Intersection Rj = empty

Space of all partitioning is HUGE

Region Growing, seeded region growing

The notion of growing effectively restricts the spatial context for segmentation
what is the growth criterion?

Algorithm 1
select seeds A, B, C, etc
for each seed identify immediate neighboring pixels
apply inclusion criterion to each, I1 < I < I2 where I1 and I2 are the distributions threholds for object A

statistical model for the interior of A: mean and std