DePaulCTI

Future Medical Imaging Research @ CTI

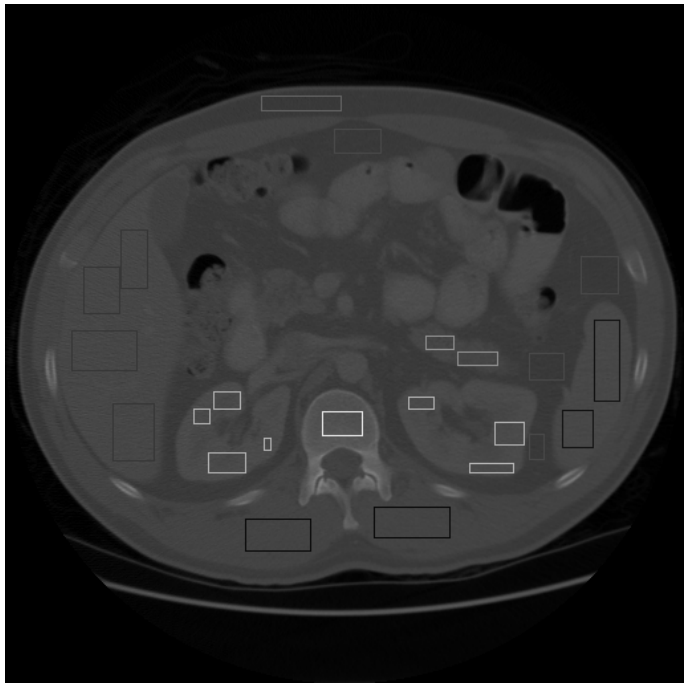
MedIX Workshop: Medical Informatics

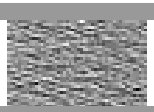
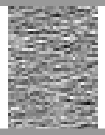
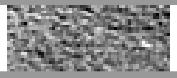
DePaul University

May 6th , 2005

Project1: A Texture Library for Normal Tissues

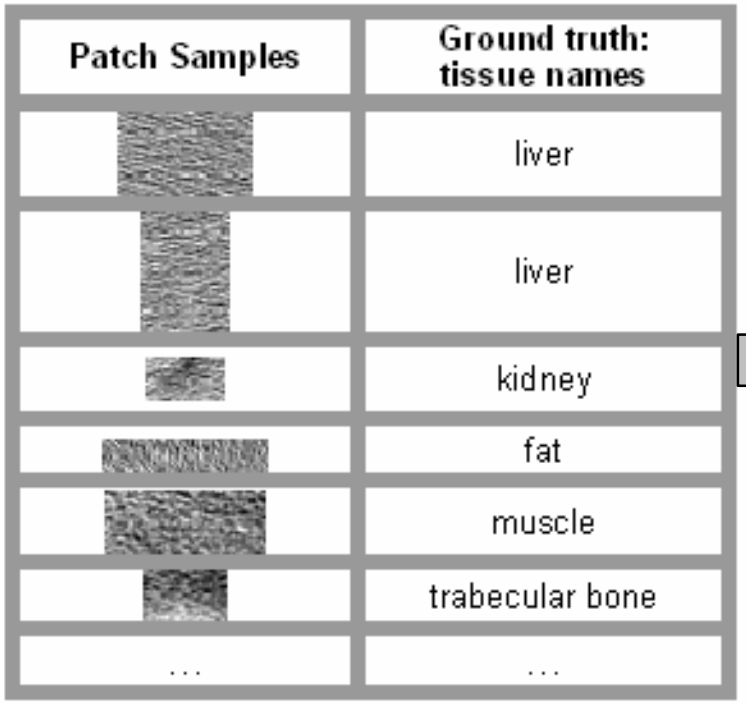
1. Develop a collection of region-of-interests (ROIs) of various tissues in normal computed tomography studies, across a large number of patients.



Patch Samples	Ground truth: tissue names
	liver
	liver
	kidney
	fat
	muscle
	trabecular bone
…	…

A Texture Library for Normal Tissues

2. Analyze and quantify homogeneity and the texture characteristics of the assembled library.



Patch Samples	Ground truth: tissue names
	liver
	liver
	kidney
	fat
	muscle
	trabecular bone
...	...

Co-occurrence descriptors	Run-length descriptors	Gabor filters	...
$F_{11}...F_{1n}$	$F_{21}...F_{2p}$	$F_3...F_{3q}$	....
...	...	...	...

3. Distribute the library through the World Wide Web.

A Texture Library for Normal Tissues

Challenges in building the library:

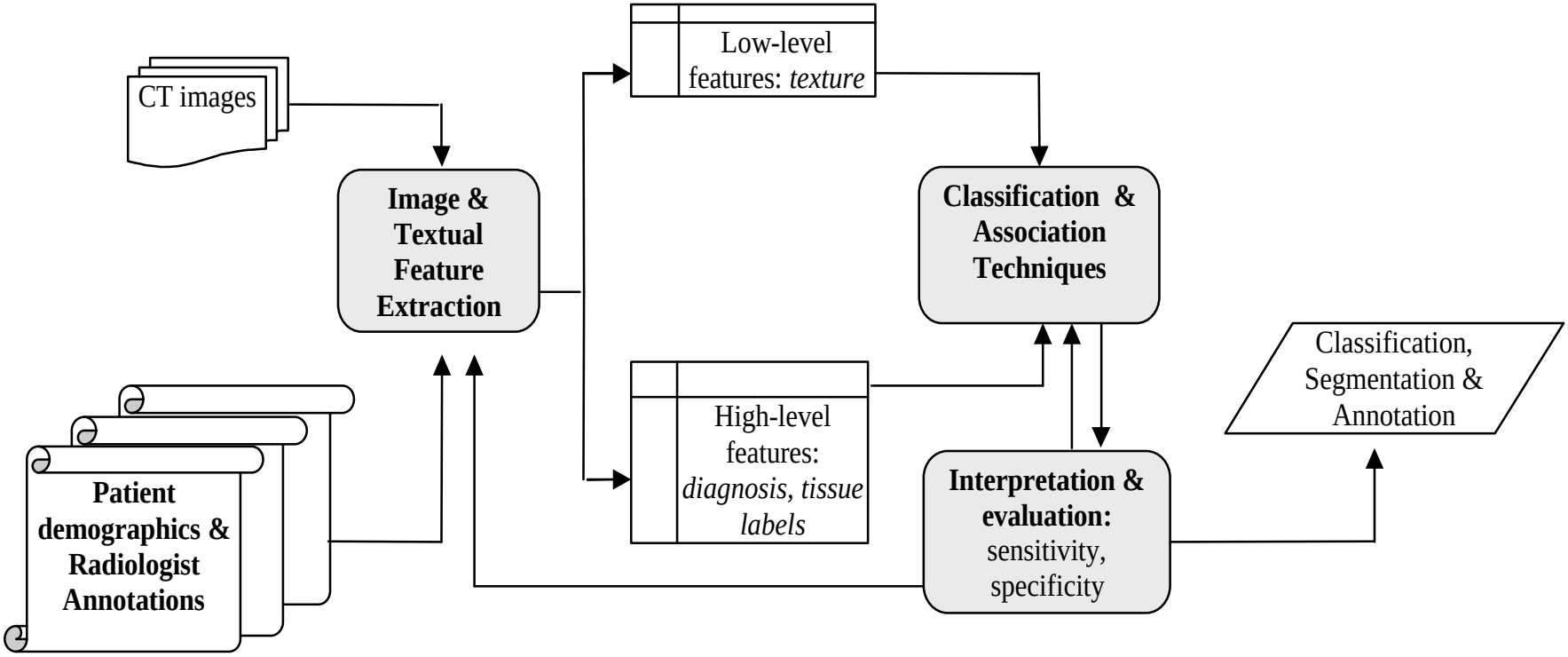
Optimal selection of an adequate set of textural features is a challenge, especially with the limited data we often have to deal with in clinical problems. Consequently, the effectiveness of any library will always be conditional on two things:

(a) how well the selected features describe the tissues

(b) how well the study group reflects the overall target patient population for the CAD tool that is going to be developed using the library.

Project 2: Tissue Classification

- Creating tissue classifiers using classification and regression trees, neural networks and other statistical classifiers that use this texture information.
- Comparing the results of the tissue classifiers to that of the ground truth of the data and validating the models



Tissue Classification

Challenges in building classification models:

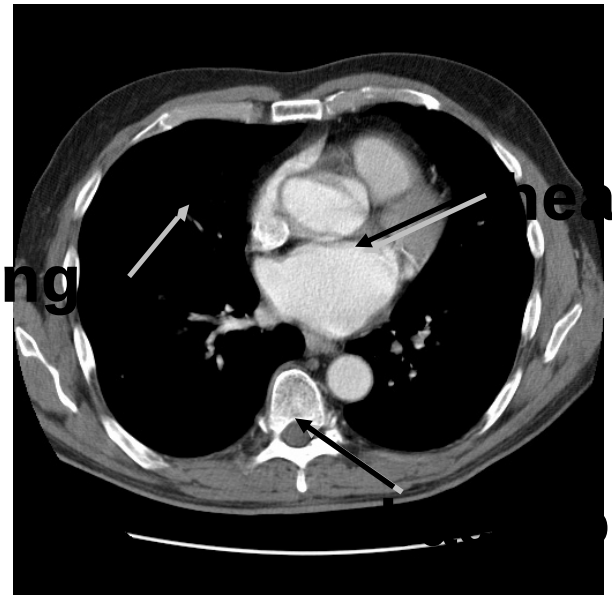
(a) how stable the classification models are

(b) how other type of information (diagnosis, life style) can be incorporated into the classification models

(c) how well the classification models can provide *context-sensitive tools* for abnormality detection & classification.

CAD tools for lung cancer:

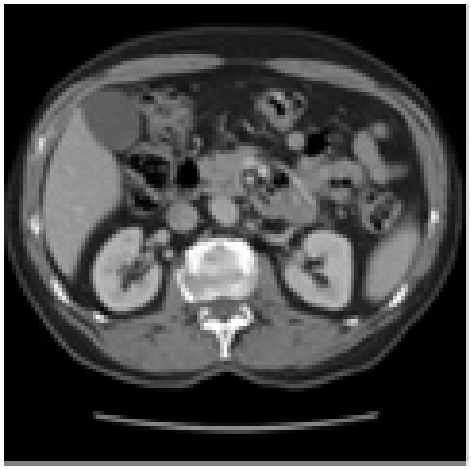
- Tool 1
- Tool 2
- ...

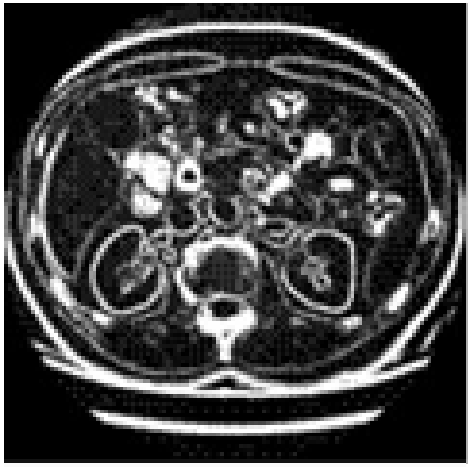


Project 3: Automatic Segmentation

Creation of automatic segmentation algorithms based on both intensity and pixel level texture.

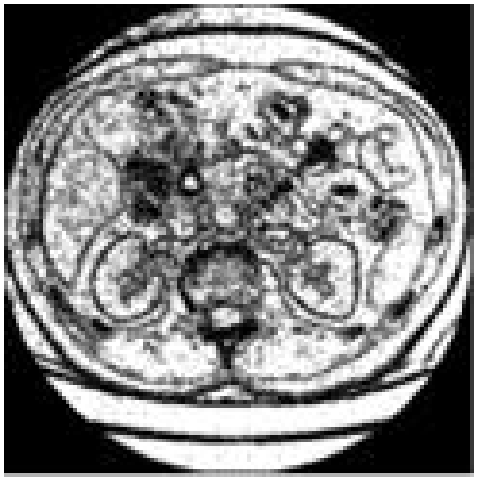
Original Image

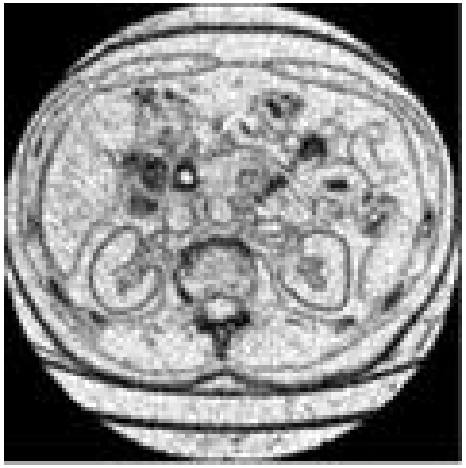




Cluster tendency

Energy

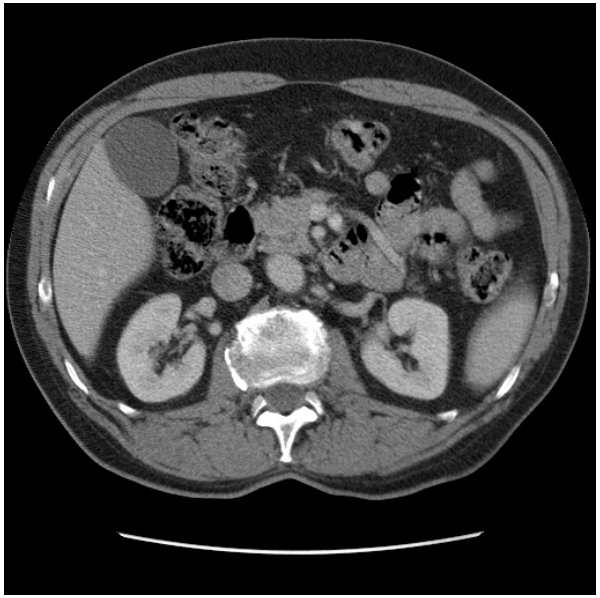




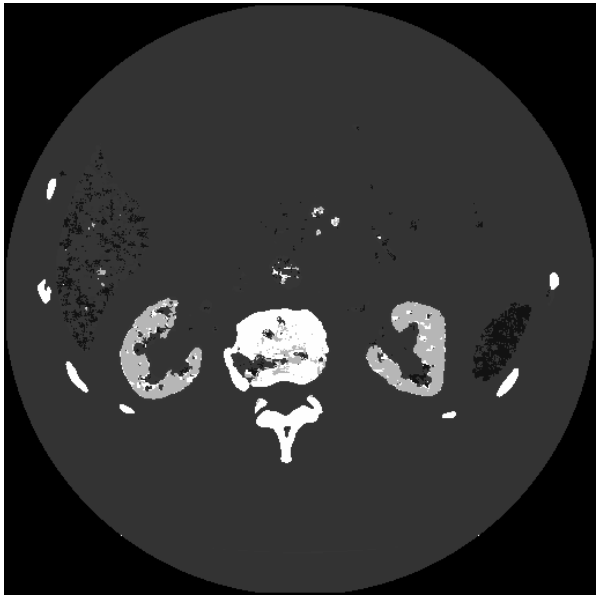
Inverse Difference Moment

Automatic Segmentation

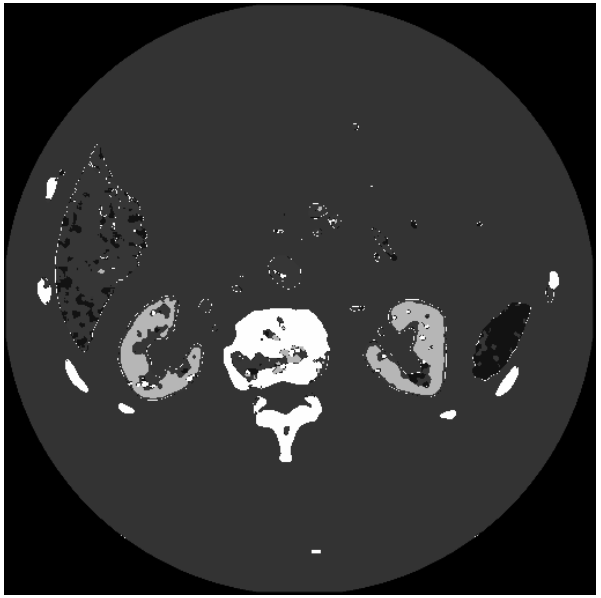
Original Image



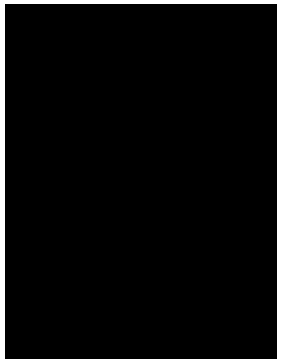
Raw Segmentation



Segmentation after post-processing



Note: The figures represent the visual representation of the decision tree pixel classification before and after median filter.



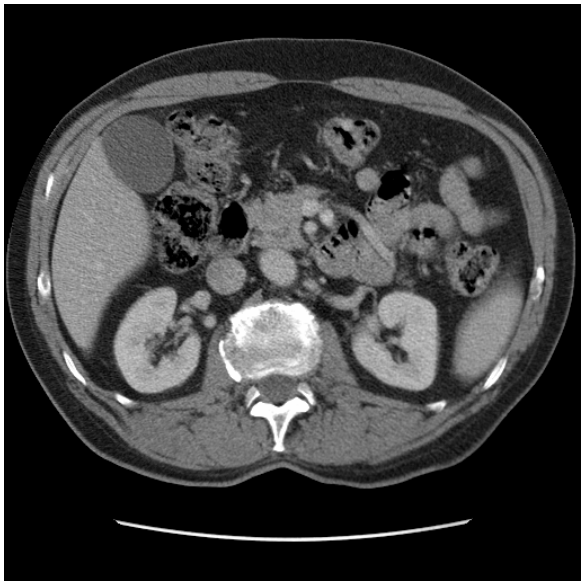
Automatic Segmentation

Challenges for automatic tissue segmentation:

(a)segmentation evaluation is based on ground truth; how easy is to determine the ground truth?

(b) how well the segmentation algorithm performs on a sequence of slices?

(c) how much the segmentation results can be improved by using combined or alternative segmentation algorithm?



NSF REU MedIX Program

MedIX: Medical Informatics eXperiences in undergrad. research

Goals:

- promote the possibility of graduate studies for bright, talented undergraduates
- promote and encourage *interdisciplinary studies in Computer Science and Medical Informatics* to undergraduate students

Sample MedIX Projects

Summer 2005:

- Binning Strategies for Texture Analysis in Computed Tomography (CT) studies
- Volumetric texture
- Development of Context Sensitive Reporting Tools
- Tissue Segmentation

Mentors:

CTI: L. Dettori, PhD, J. Furst, PhD., D. Raicu, Ph.D

Northwestern University: D. Channin, MD

MedIX: Medical Informatics Workshop

Questions????

Thank you for your participation in the Workshop!