INFN-MED
Imaging (software)

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Stato dell’arte

- Database (mammografico & polmonare)
- Elaborazione di immagini
  - Mammografia
  - **CAD CT polmonari**
  - Brain MRI / (DTI)

- Software di gestione dati
  - Analisi dati distribuiti
  - HealthBox
  - **Clinical Trial Protocols (ex. GITIL)**

Stato dell'arte

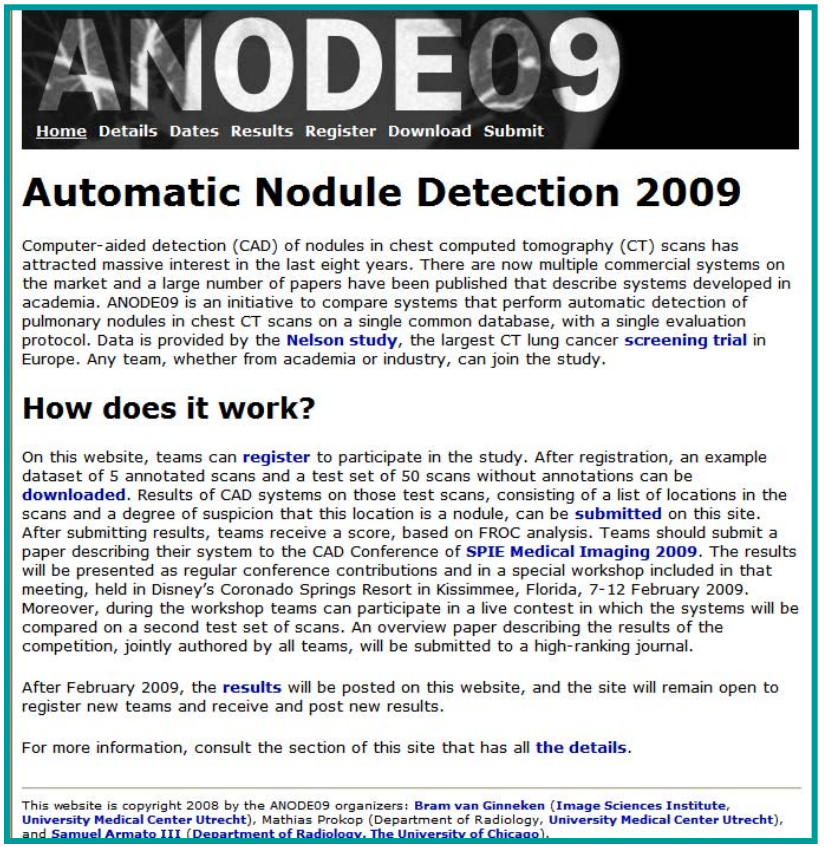
- CT polmonari
  - ✓ approccio "multi-thread"
  - ✓ **4 algoritmi**
    - **Dot-enhancement filter + Voxel-based Neural Approach (VBNA)**
    - **Region Growing (Med. Phys. 2007)**
    - **Isosurfaces (accepted by Med. Phys)**
    - **Virtual Ants**
      - **New 3D model for virtual ants (subm. To Pattern Recognition)**
      - **First results on lung analysis**

Stato dell'arte

- CT polmonari
  - ✓ the ANODE09 challenge (@ SPIE2009)
  - ✓ 5 (known) + 55 (unknown) CT scans, various conditions
  - ✓ Search for nodules down to ~ 3mm diameter
    - **Partecipazione con dot-enhancement, region growing, virtual ants**
    - **Figure of merit:**

$$fm = (1/7) * (S1/8 + S1/4 + S1/2 + S1 + S2 + S4 + S8)$$

The ANODE09 challenge



ANODE09

Home Details Dates Results Register Download Submit

Automatic Nodule Detection 2009

Computer-aided detection (CAD) of nodules in chest computed tomography (CT) scans has attracted massive interest in the last eight years. There are now multiple commercial systems on the market and a large number of papers have been published that describe systems developed in academia. ANODE09 is an initiative to compare systems that perform automatic detection of pulmonary nodules in chest CT scans on a single common database, with a single evaluation protocol. Data is provided by the **Nelson study**, the largest CT lung cancer **screening trial** in Europe. Any team, whether from academia or industry, can join the study.

How does it work?

On this website, teams can **register** to participate in the study. After registration, an example dataset of 5 annotated scans and a test set of 50 scans without annotations can be **downloaded**. Results of CAD systems on those test scans, consisting of a list of locations in the scans and a degree of suspicion that this location is a nodule, can be **submitted** on this site. After submitting results, teams receive a score, based on FROC analysis. Teams should submit a paper describing their system to the CAD Conference of **SPIE Medical Imaging 2009**. The results will be presented as regular conference contributions and in a special workshop included in that meeting, held in Disney's Coronado Springs Resort in Kissimmee, Florida, 7-12 February 2009. Moreover, during the workshop teams can participate in a live contest in which the systems will be compared on a second test set of scans. An overview paper describing the results of the competition, jointly authored by all teams, will be submitted to a high-ranking journal.

After February 2009, the **results** will be posted on this website, and the site will remain open to register new teams and receive and post new results.

For more information, consult the section of this site that has all **the details**.

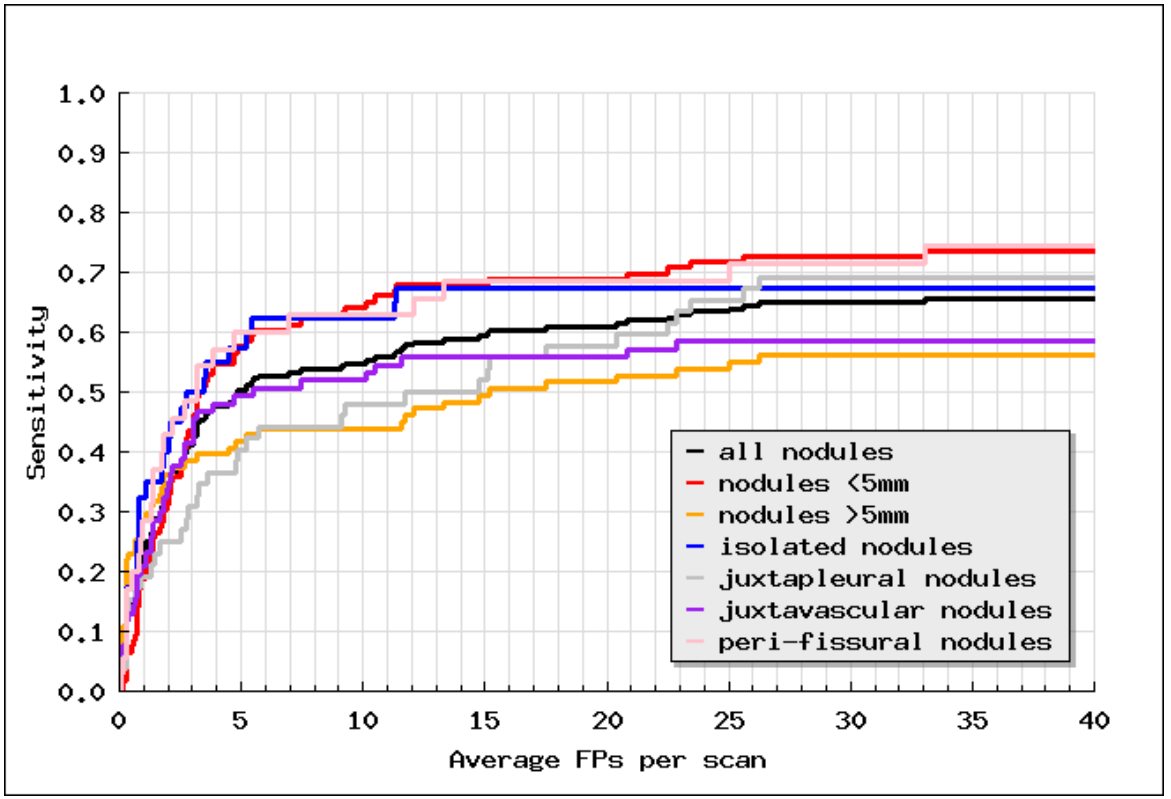
The ANODE09 International competition for Nodule Detection in chest CT

http://anode09.isi.uu.nl/

Results presented at SPIE Medical Imaging 2009

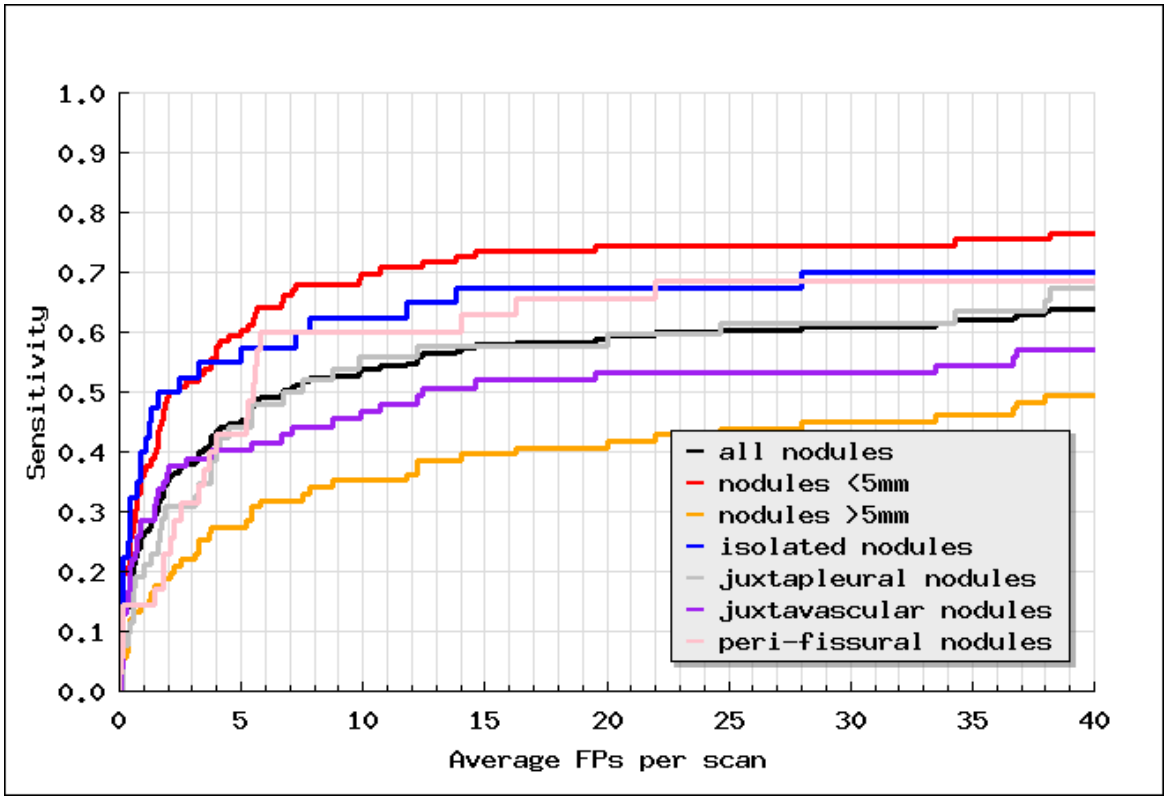
CAD Virtual Ants

Score (average sensitivity between 1/8 and 8 FP/scan): 0.262



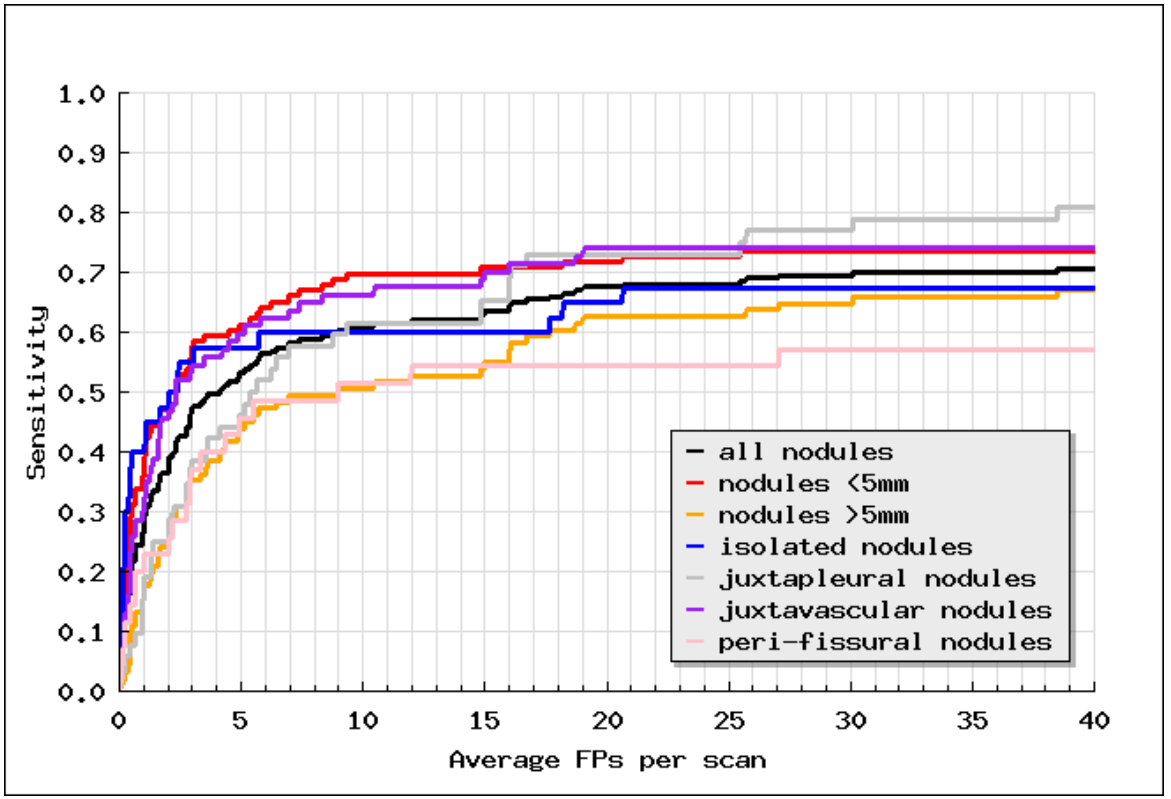
CAD RG-ACM

Score (average sensitivity between 1/8 and 8 FP/scan): 0.278

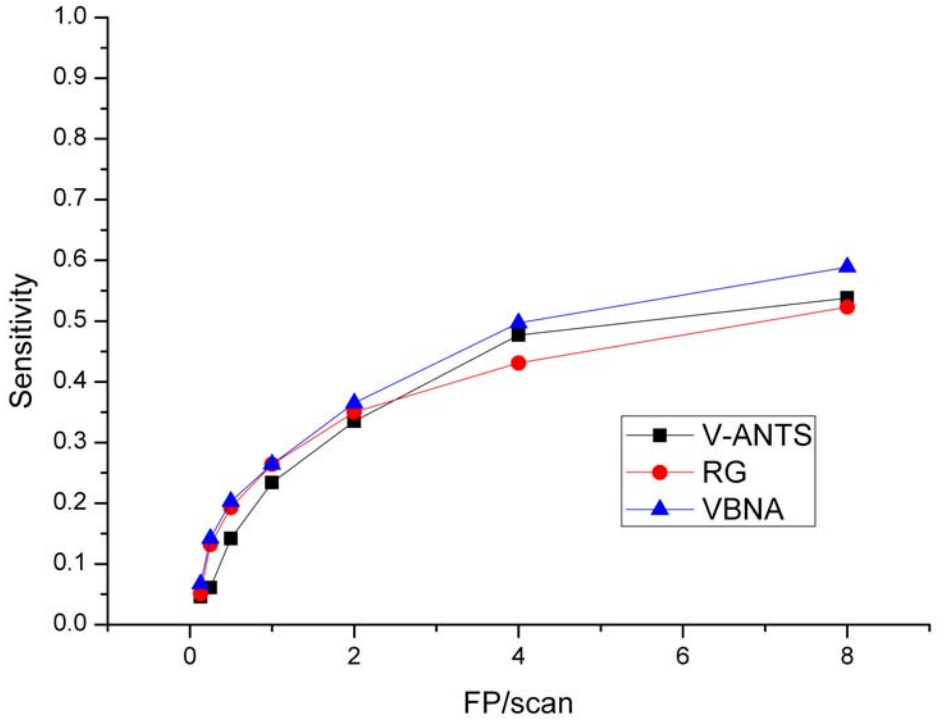


CAD VBNA

Score (average sensitivity between 1/8 and 8 FP/scan): 0.304



ANODE09 competition: ALL nodules



ANODE09 competition (50 CT)

	RG-VP	V-ANTS	VBNA
small	0.379	0.251	0.391
large	0.160	0.275	0.203
isolated	0.389	0.314	0.412
juxta-vascular	0.269	0.260	0.340
juxta-pleural	0.231	0.212	0.223
peri-fissural	0.249	0.310	0.232
ALL	0.278	0.262	0.304

Results "ALL nodules" for the other systems: ***0.005. 0.195, 0.074***

trasferimento del lungCAD

- **due partner candidati**
  - ✓ **BRACCO Imaging**
  - ✓ **im3d**

trasferimento del lungCAD

- ✓ **BRACCO Imaging**
  - **Collaborazione con Pisa su sviluppo VBNA**
  - **Intenzione dichiarata di procedere con INFN**
  - **Rete di marketing legata al marchio della casa madre**
  - **1 prodotto in fase di validazione**

    CAD breast MRI

trasferimento del lungCAD

- ✓ **im3d**
  - **Societa' di ~ 20 persone focalizzata su CAD**
  - **1 prodotto sul mercato (CAD colon)**
  - **Workstation Linux con eccellente interfaccia grafica**
  - **CAD breast MRI in beta version**
  - **CAD polmonare entro fine 2010 (attualmente in collaborazione con ITALUNG/Firenze)**
  - **Obiettivo: integrazione progressiva di algoritmi nella workstation**

trasferimento del lungCAD

- ✓ **discussion in MAGIC-5**
  - **Choose the best option**
- ✓ **my (personal) opinion**
  - **im3d offre maggiori chances di successo**
  - **Idealmente, una collaborazione a 3 (ma non dipende da noi)**

Stato dell’arte

- Software di “data management”
  - HealthBox
  - **Clinical trials**
  - GRID based services

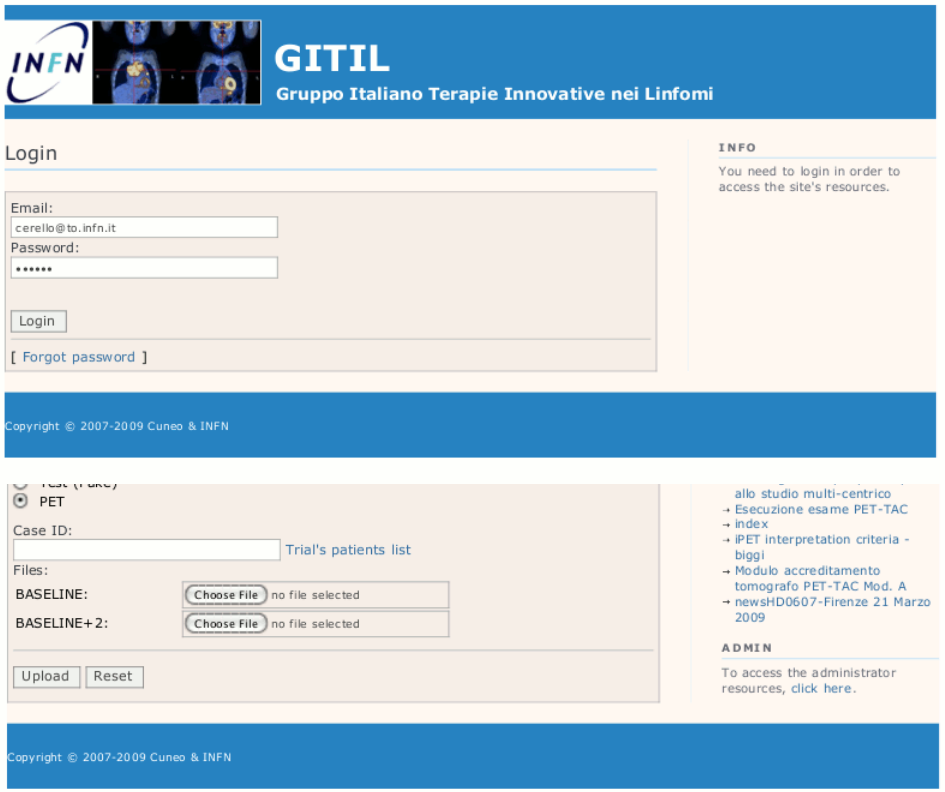
diXit

digital implementation X interactive trials

- GITIL (http://magic5.to.infn.it/gitil)
- In collaborazione con Ospedale di Cuneo
- 15 centri in tutta Italia
- Valutazione dell'andamento della terapia dei linfomi
  - Basata su diagnosi di PET/CT di "baseline" e dopo 2 cicli di trattamento
- Clinical Trial Protocol implementato e attualmente in funzione

- **Feedback molto positivo da parte degli utenti**

diXit per il trial GITIL



GITIL: Multicenter clinical trial for the evaluation of the effectiveness of lymphoma treatments. Web-based infrastructure for multi-centric analysis

diXit

- le idee
  - ✓ offrire un prodotto per l'implementazione sicura e guidata di trial clinici (distribuiti), che includa backup dei dati e possibilita' di analisi dei DB cosi' costruiti
  - ✓ salire di un livello di astrazione, consentendo al "cliente" di costruire dinamicamente il protocollo utilizzando "building blocks" disponibili
    - Il codice sarebbe scritto in modo semiautomatico e quindi economicamente piu' efficiente

diXit

- l’approccio piu’ efficiente
  - ✓ manpower da persone coinvolte
  - ✓ infrastruttura (macchine, ma soprattutto rete) da INFN
  - ✓ che forma di accordo?

diXit

- spin-off? quali regole? quando?
  - ✓ requisiti?
  - ✓ business plan?
  - ✓ assistenza legale?
- costituzione societa' e poi accordo con INFN?
  - ✓ occorre un ok preventivo (anche se informale) dell'INFN
- spin-off via universita'/politecnico?
- il tempo stringe…

Problema…

- le attivita’ di sviluppo di algoritmi / gestione di dati non sono affatto onerose dal punto di vista della strumentazione…
- …ma sarebbe fondamentale poter disporre di risorse per contratti/assegni di ricerca/borse di dottorato