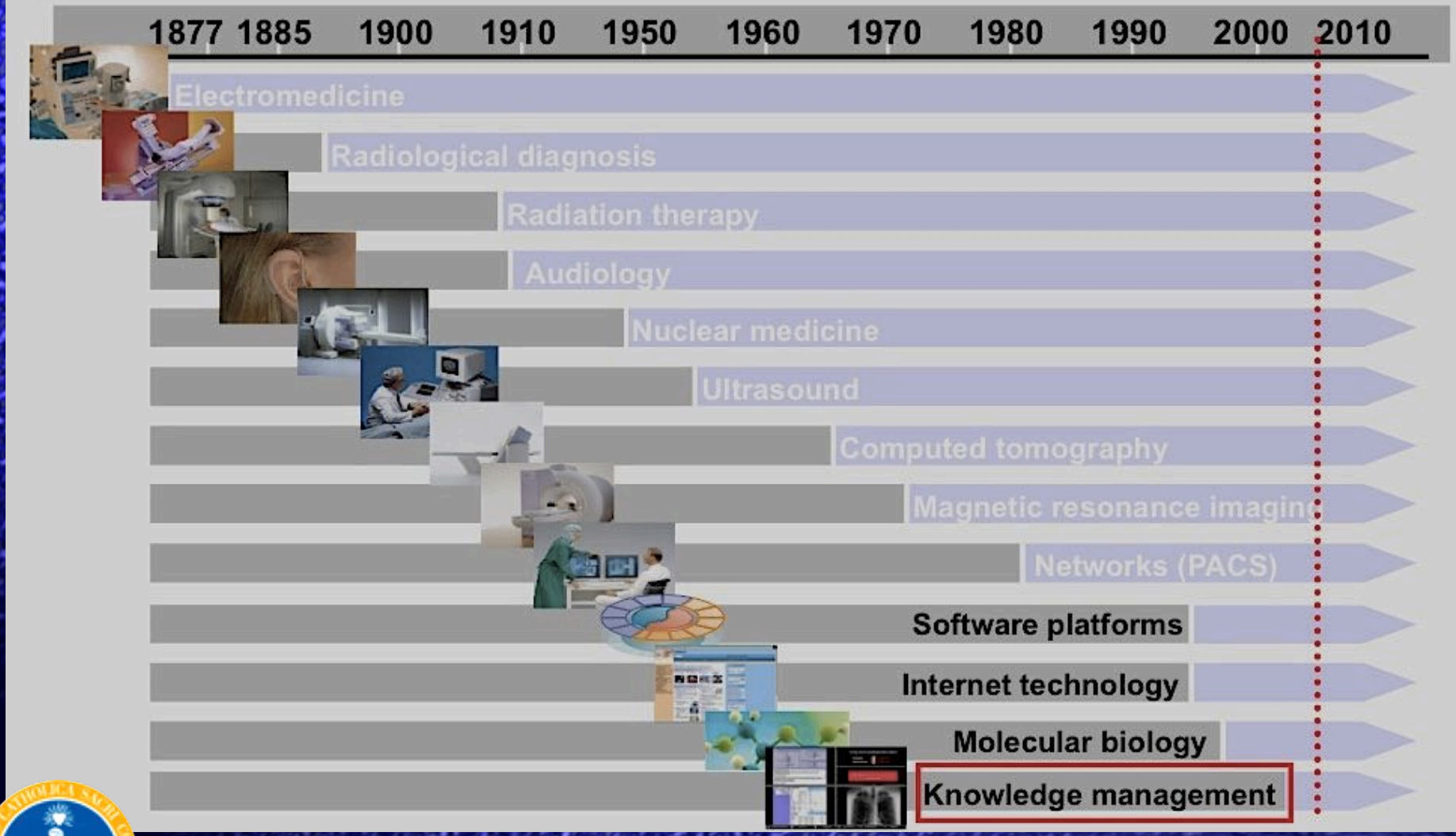
Il futuro della radioterapia oncologica: la 'Knowledge Based Oncology'

V.Valentini

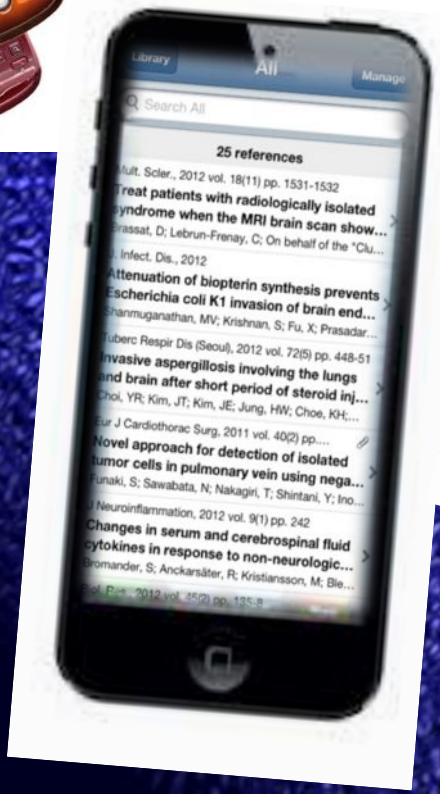
Università Cattolica S.Cuore – Rome

Accredited Center
2008-2011

Knowledge Based Technology

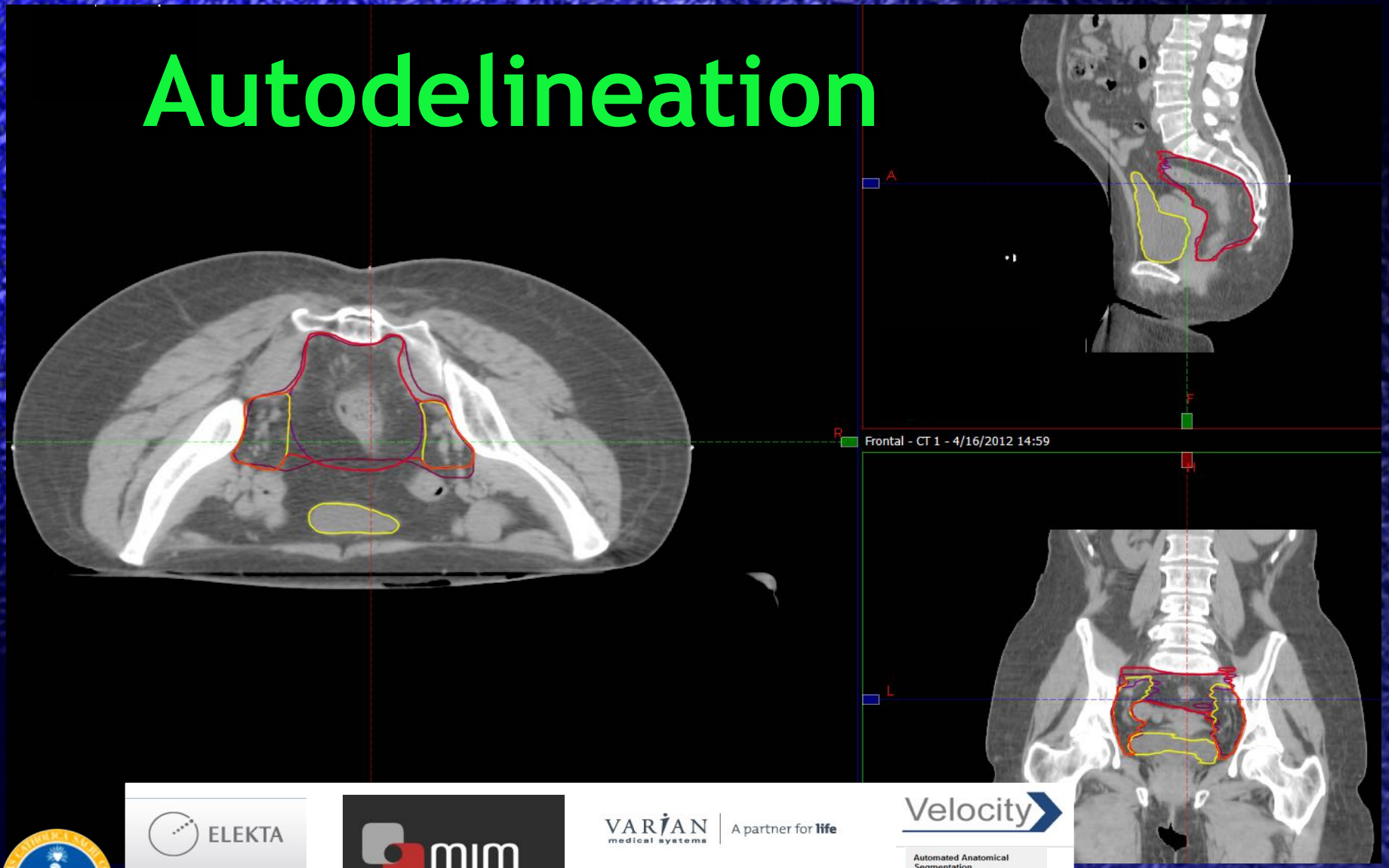


Knowledge Based Technology



Knowledge Based Technology

Autodelineation



ELEKTA
ABAS
Atlas-based Autosegmentation

mim SOFTWARE

VARIAN medical systems | A partner for life
Smart Segmentation™

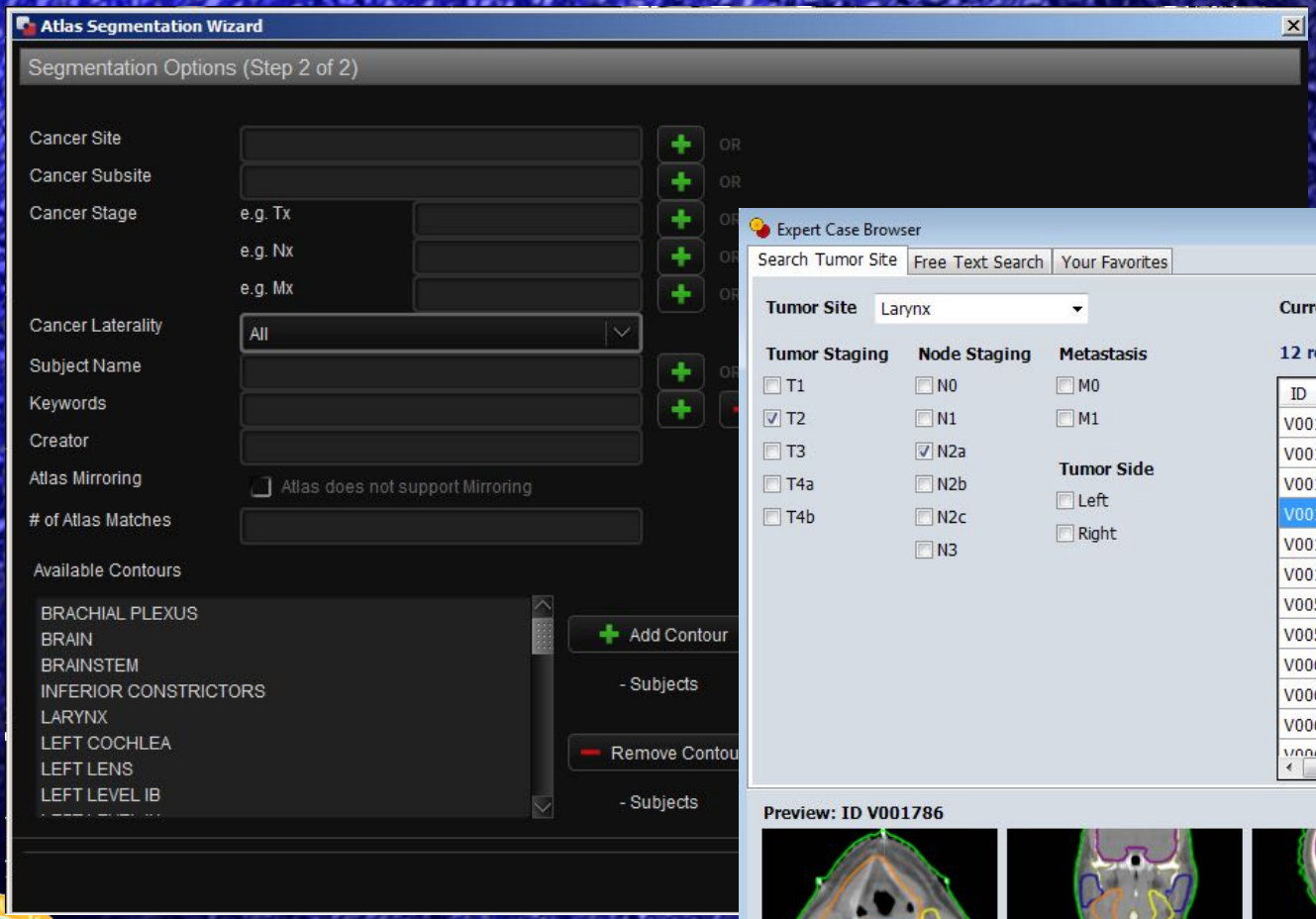
Velocity
Automated Anatomical Segmentation
- Deformable atlas-based segmentation
- Advanced contouring platform
- Automated PET contouring

Knowledge Based Technology

Static vs dynamic Knowledge

Knowledge Based Technology

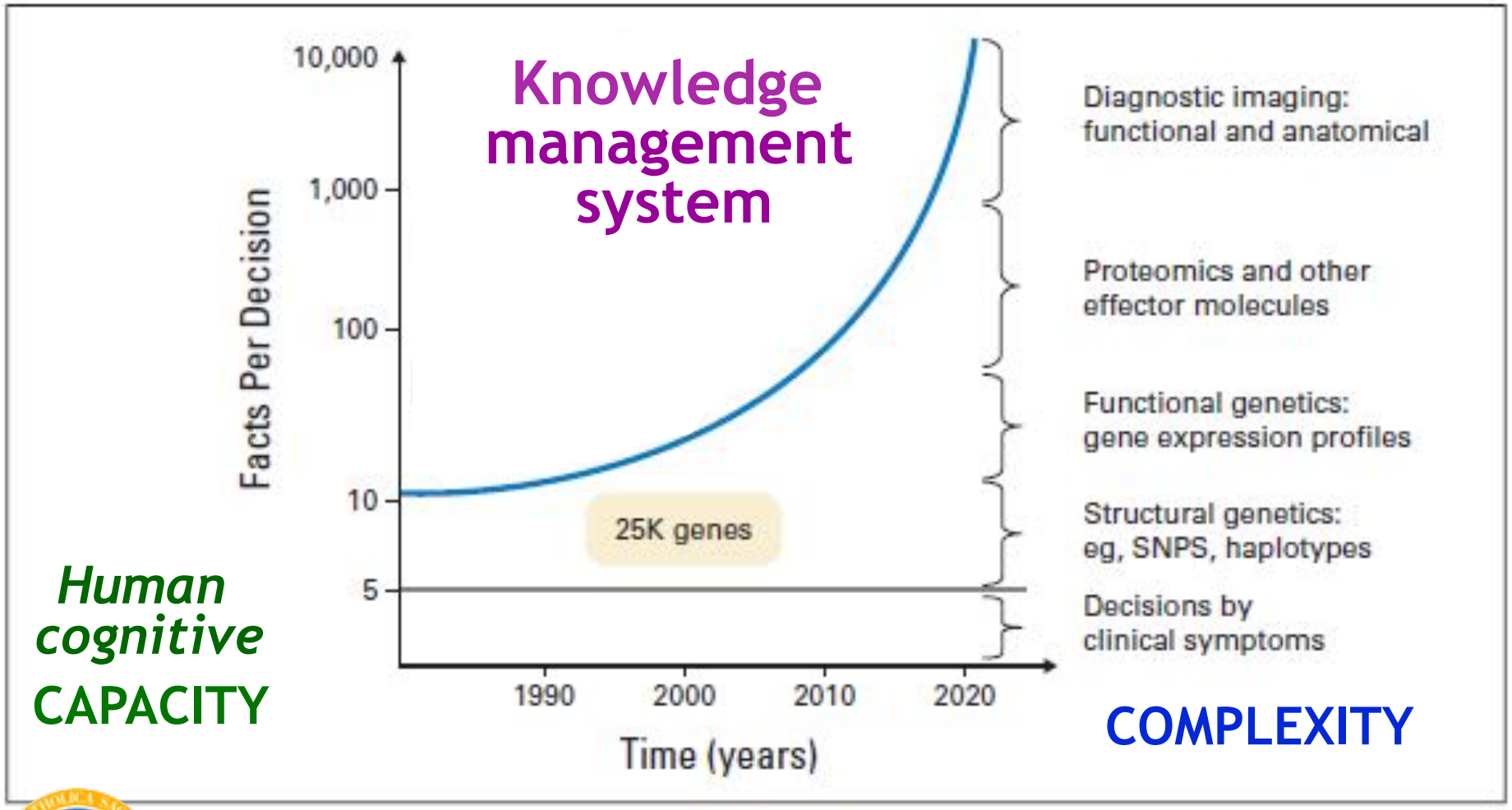
Ontology



Knowledge Based Technology

Static vs dynamic Knowledge

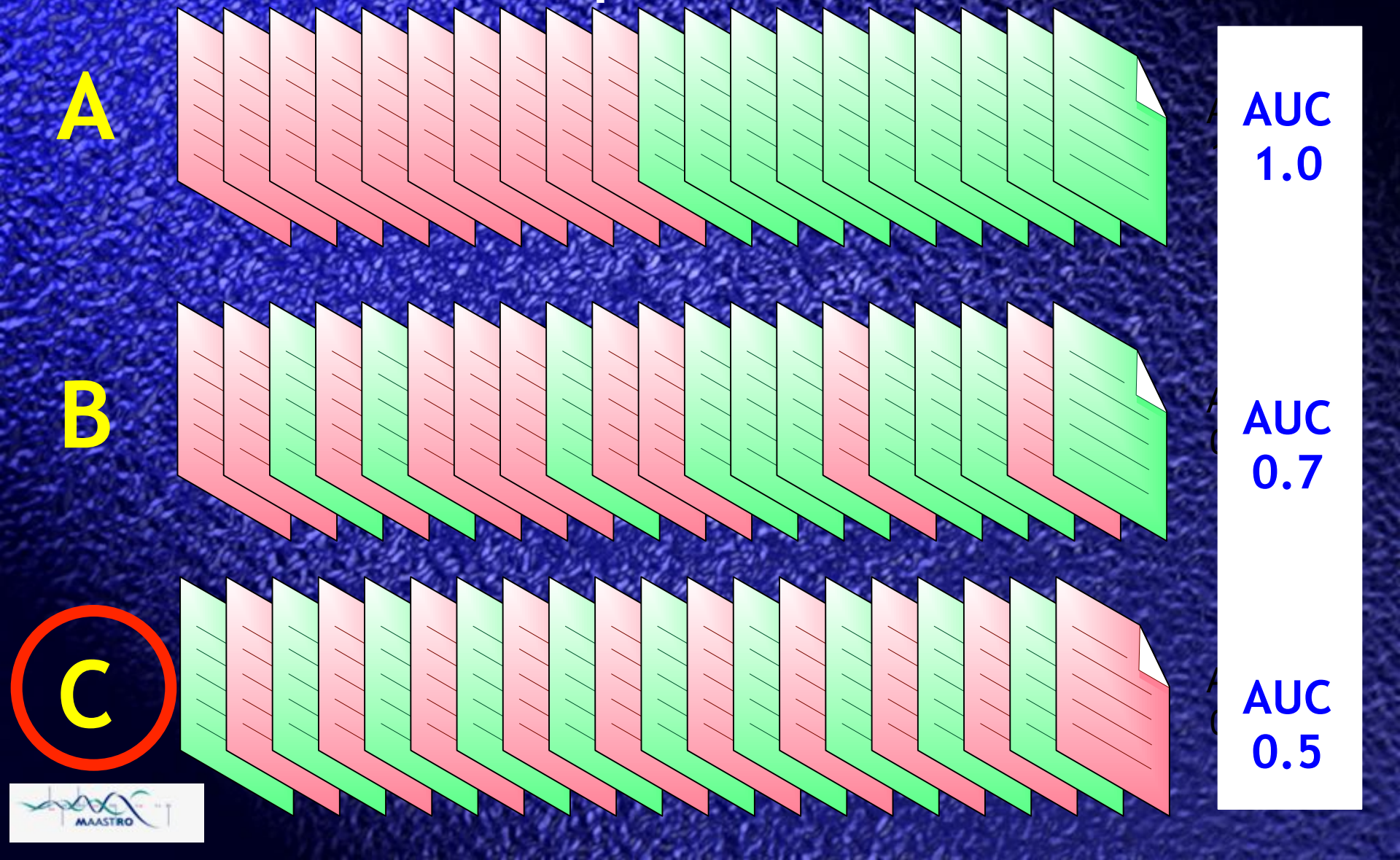
Complexity and Prediction



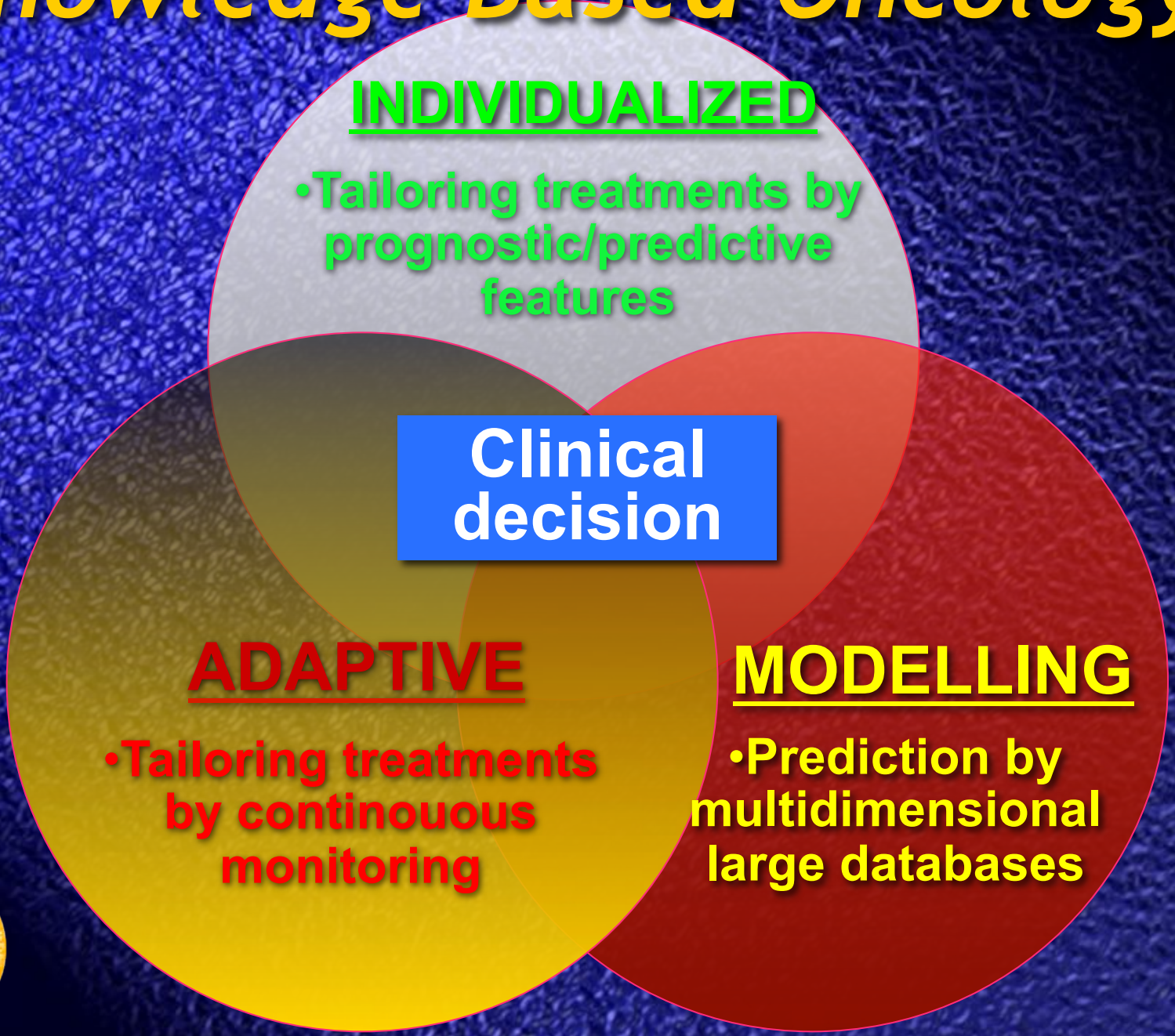
Abernethy AP et Al – JCO - 2010

Complexity and Prediction

Experiment



Knowledge Based Oncology



Clinical decisions (adaptive era)

INTENSIFICATION

Neoadjuvant regimen

ADAPTIVE 1

Surgery procedure

ADPTIVE 2

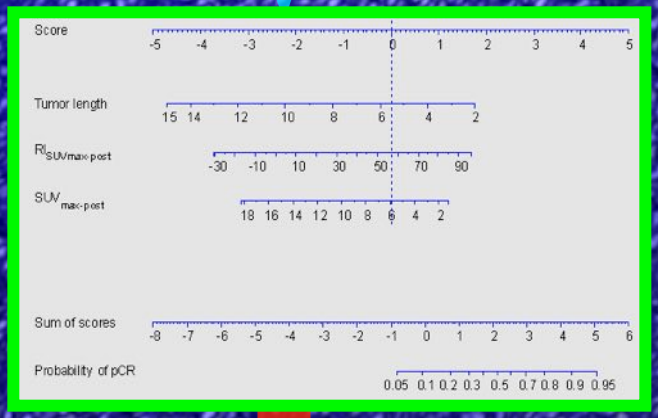
Adjuvant Chemo

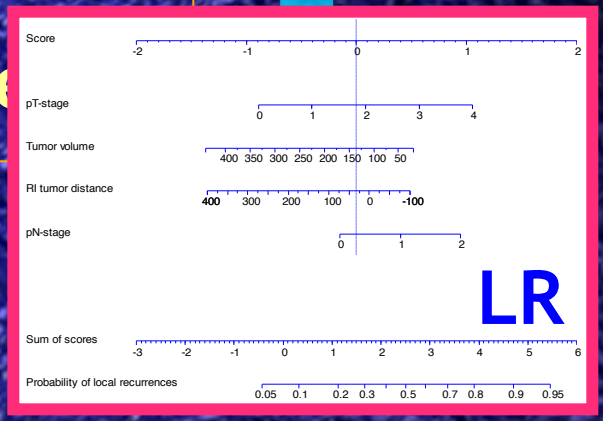
Follow-up density

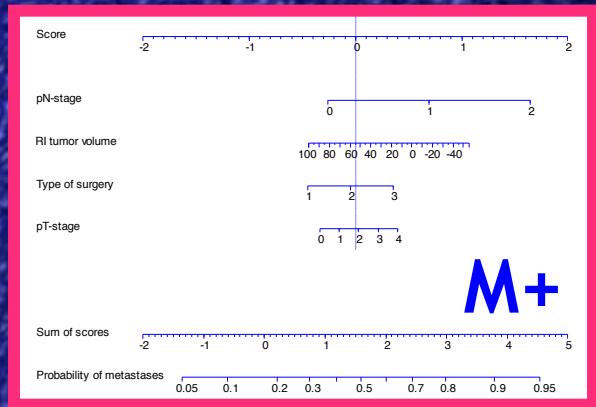
RT±CT

Surge

cStad



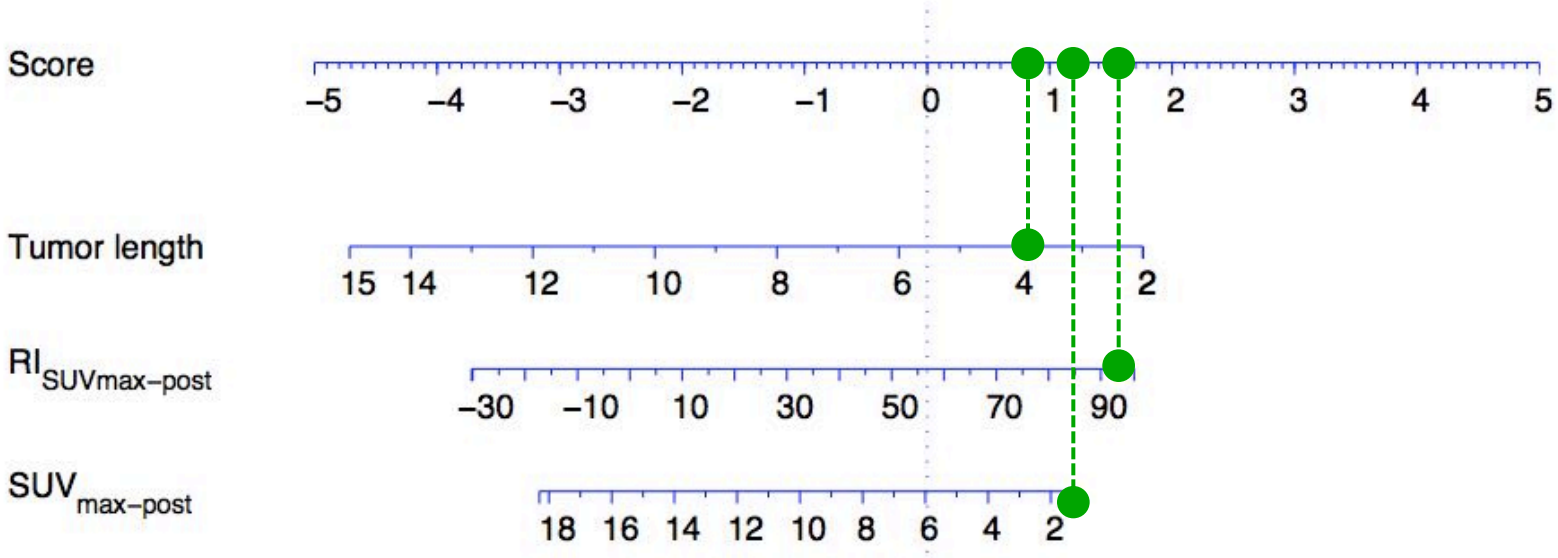




Imaging

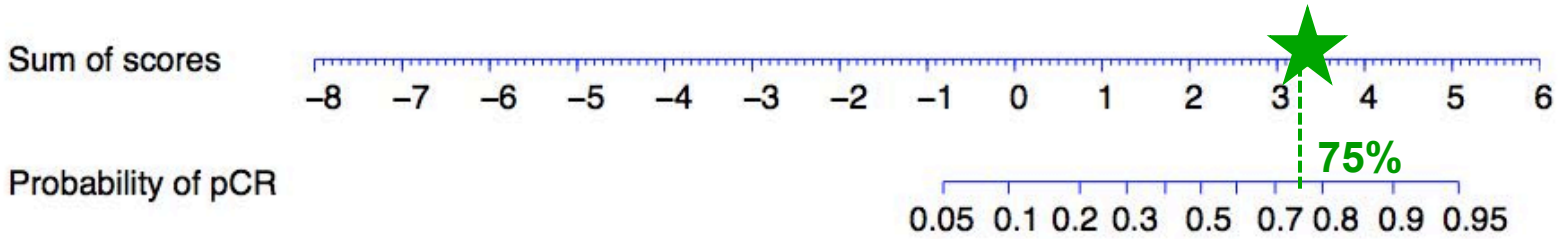
Nomogram

pCR



Sum of scores 3.3

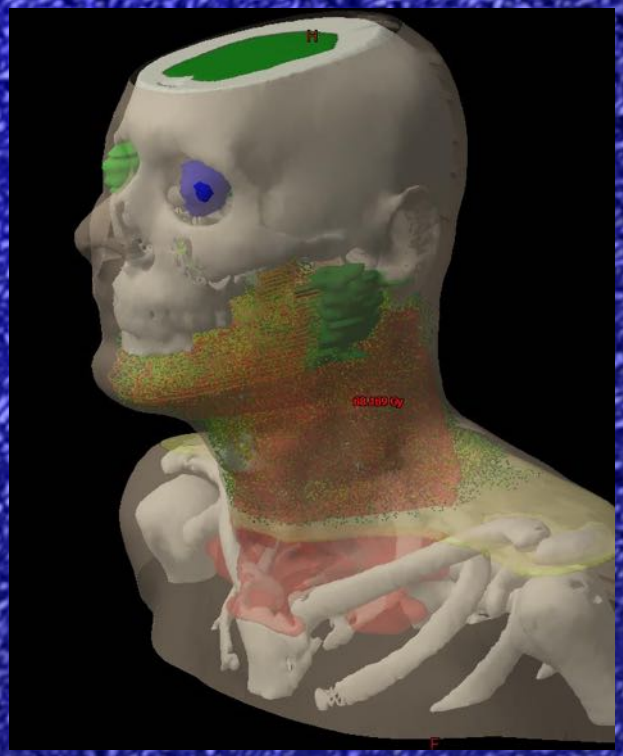
AUC = 0.86



Van Stiphout R, V.Valentini et Al - *Radioth Oncol* – 2011

Knowledge Based Oncology

The Radiation Oncology privilege



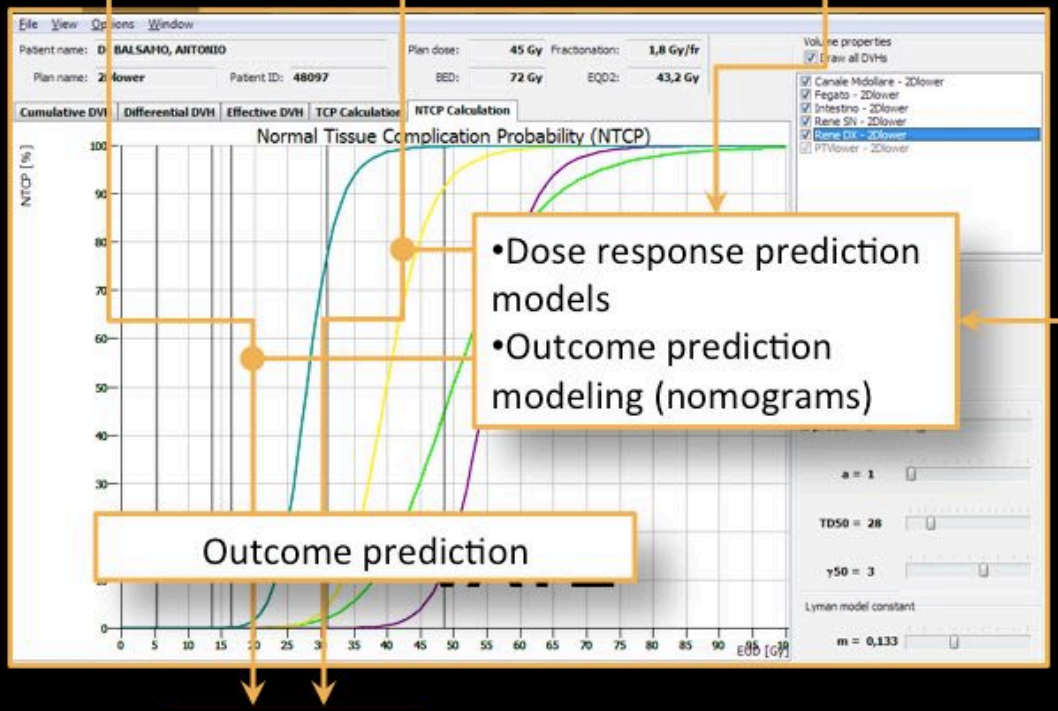
Knowledge Based Oncology

Clinical case data

Physical dose distribution

Single center (on site) database

Multicenter (reference) database



- Dose response prediction models
- Outcome prediction modeling (nomograms)

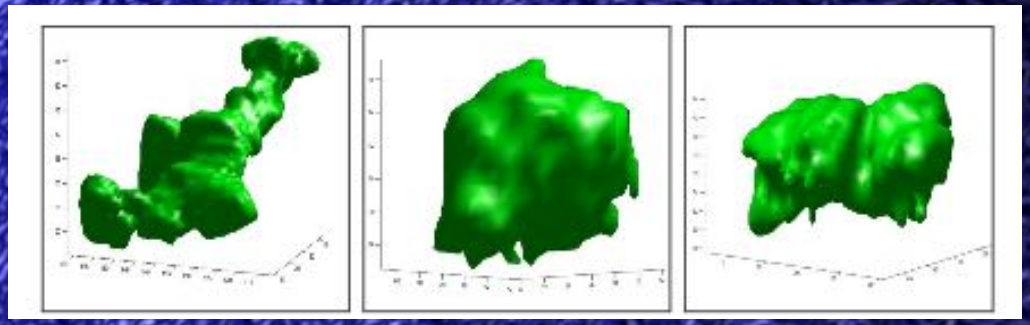
Outcome prediction

VATE 1.0

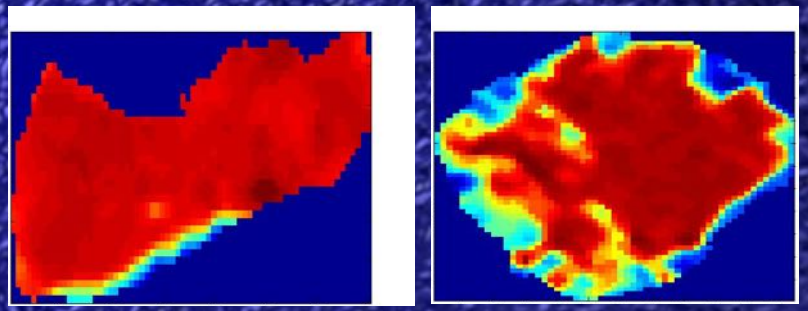
Radiomics: Imaging Feature Extraction

First order statistics

Shape based features

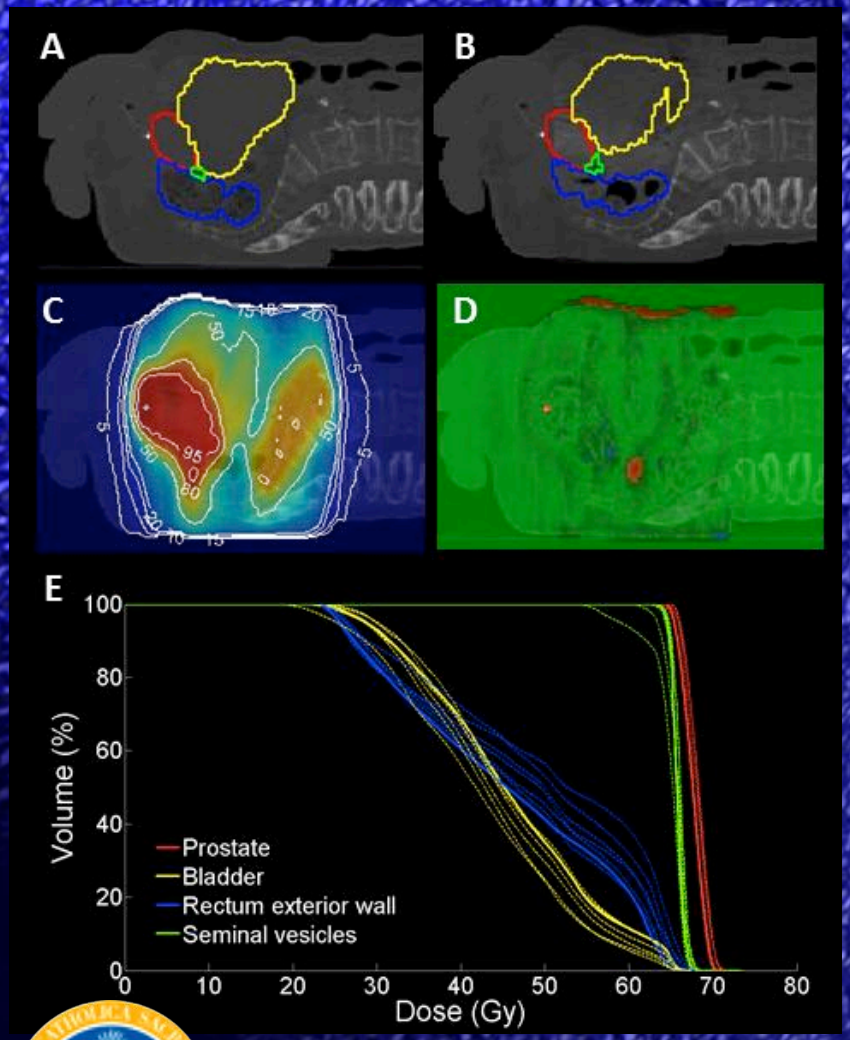


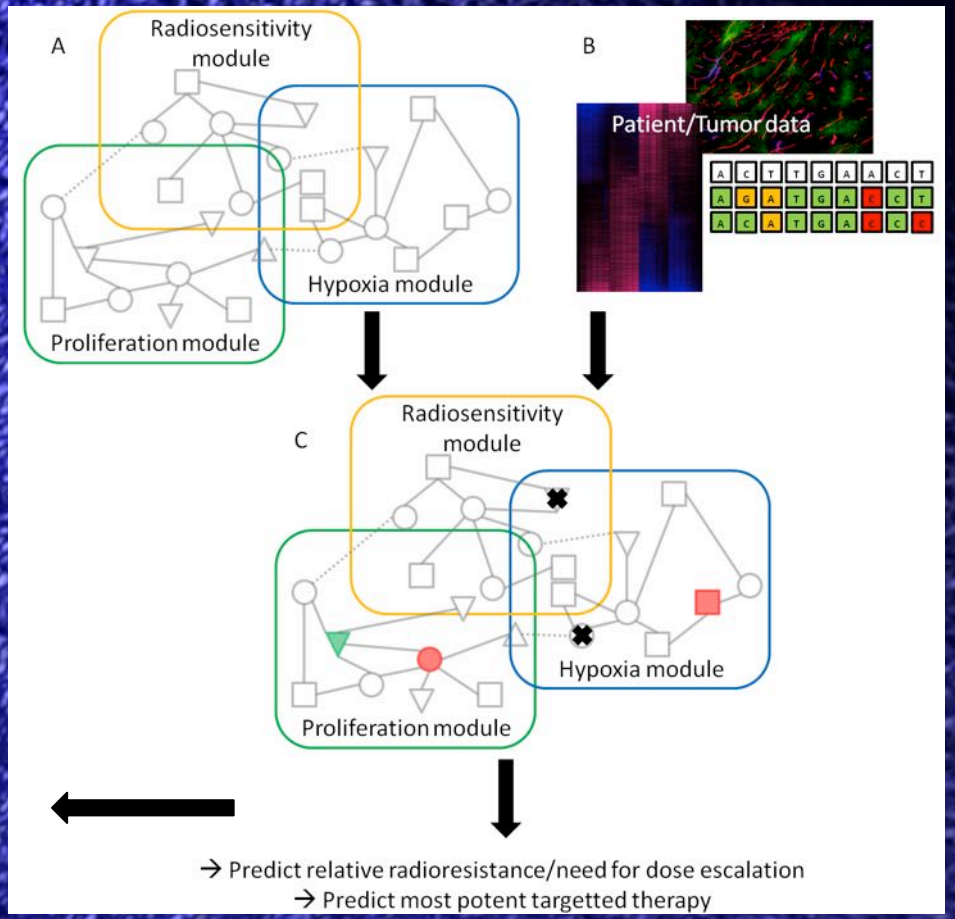
3D texture analysis



Lambin P et Al - Eur J Onc - 2012

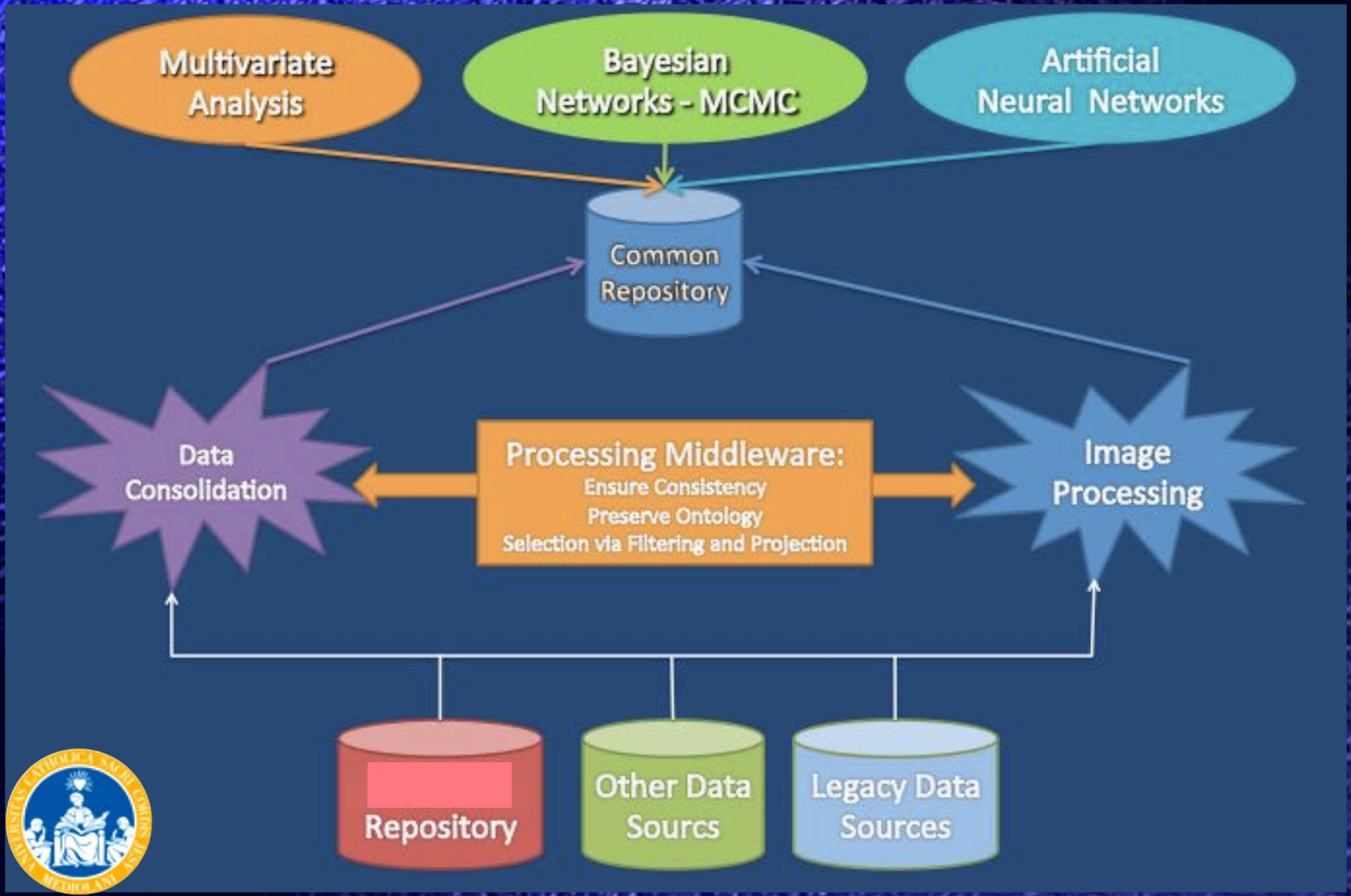
Radiomics: Imaging Feature Extraction



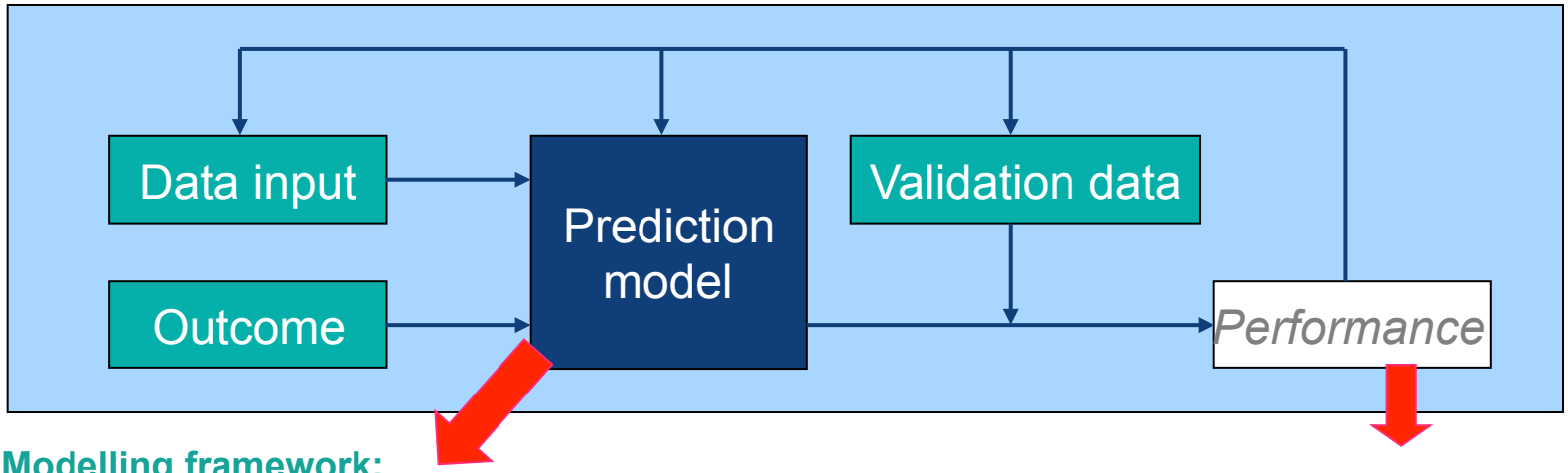


Lambin P, V.Valentini et Al - Nature Review – in press

Knowledge Based Oncology

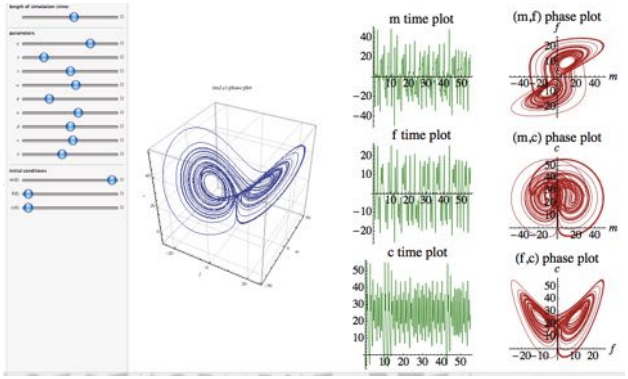


Knowledge Based Oncology

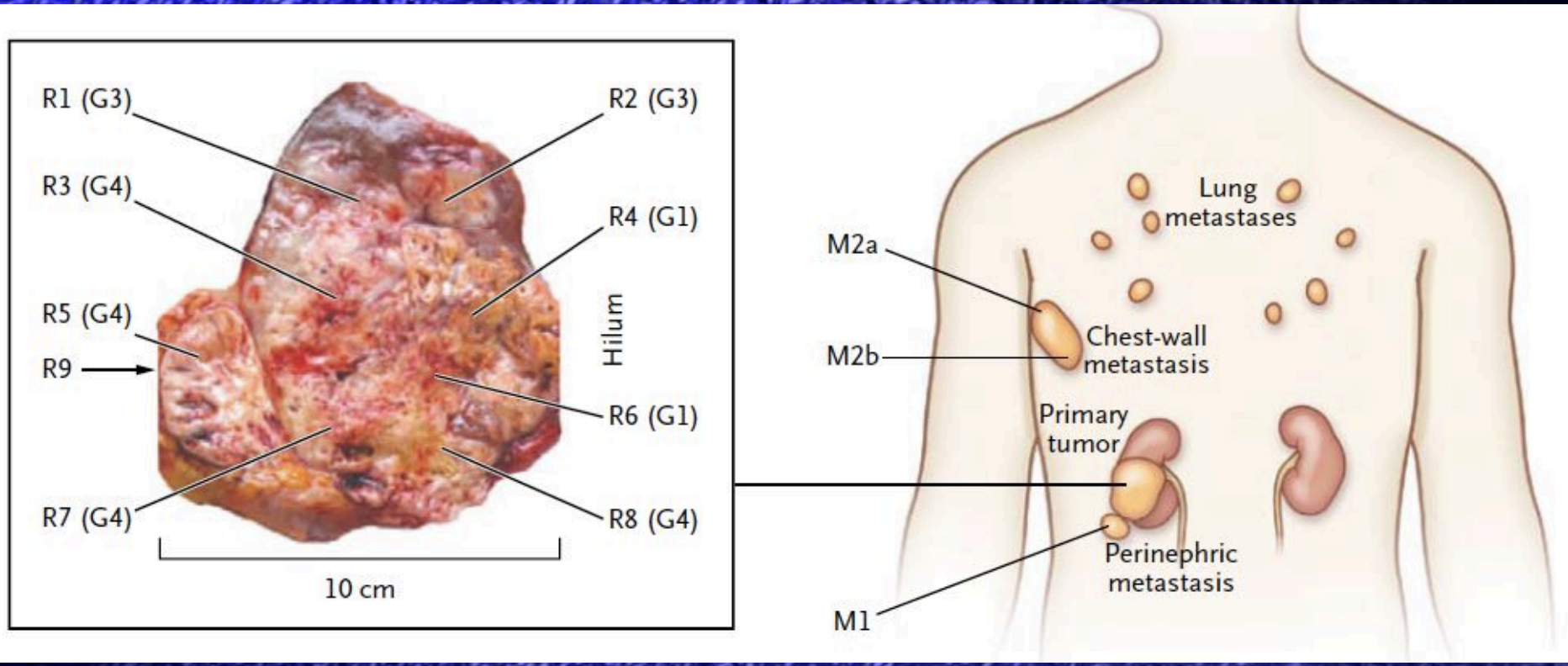


Modelling framework:

Chaos Theory

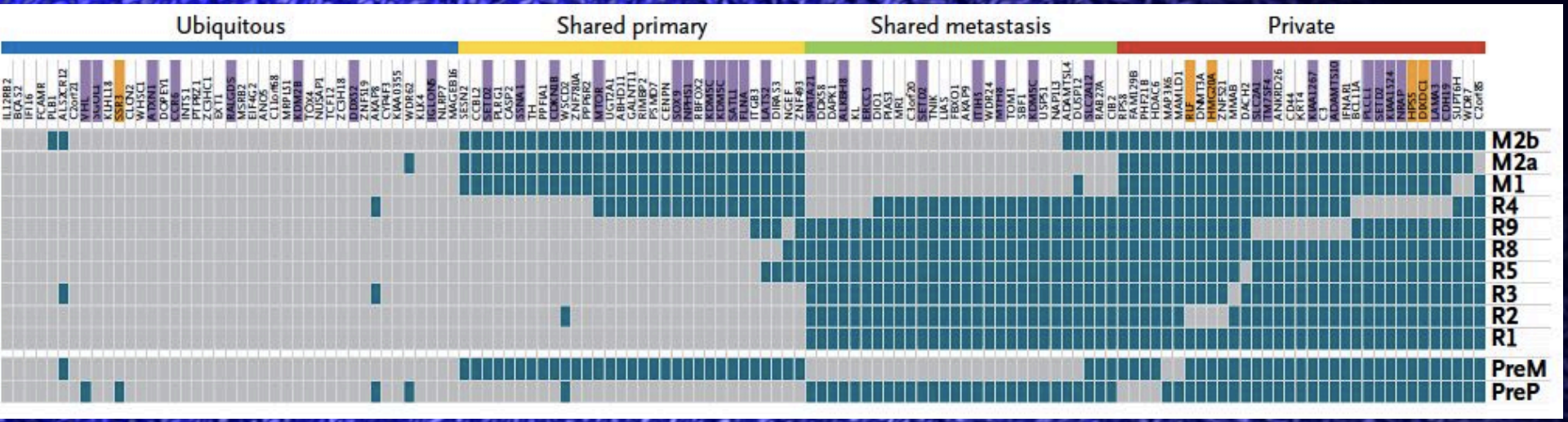


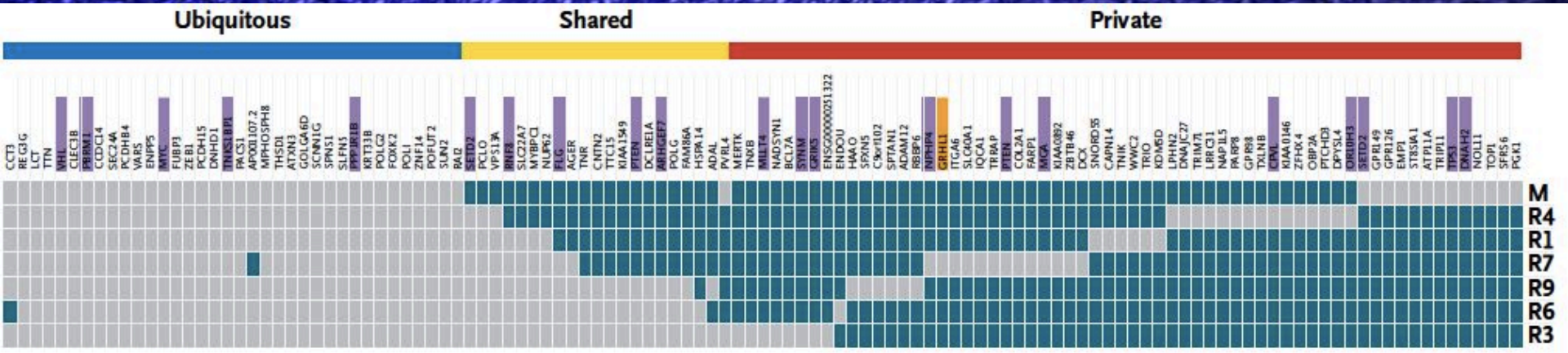
Knowledge Based Oncology



Gerlinger M et Al – NEJM - 2012

Knowledge Based Oncology





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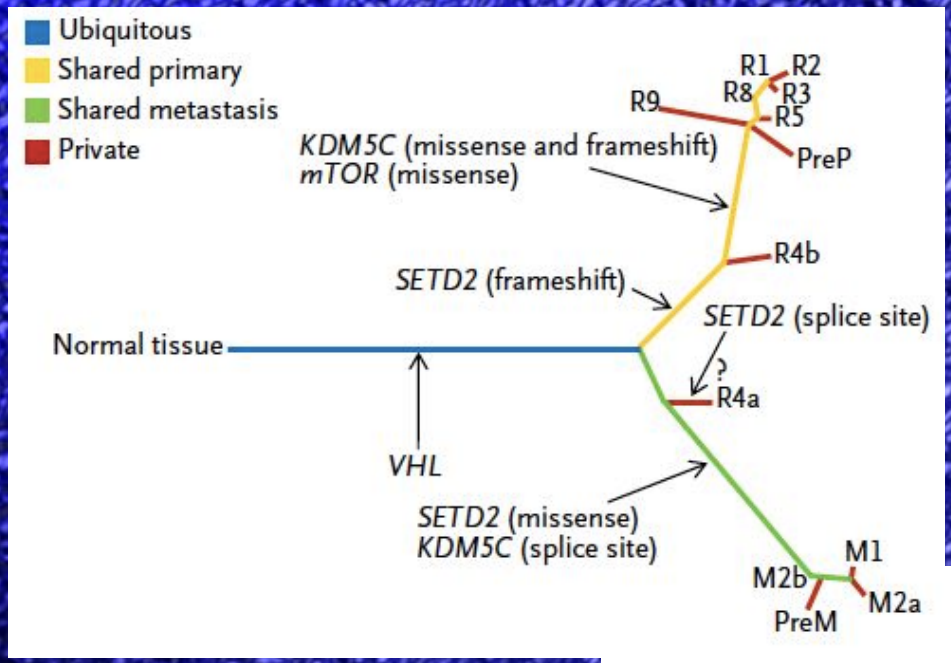

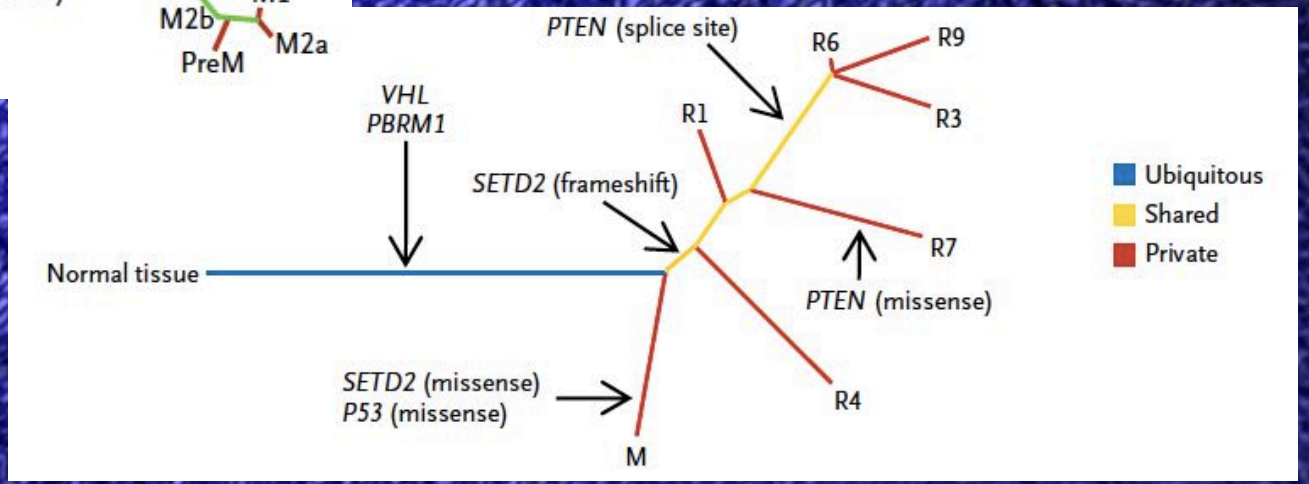

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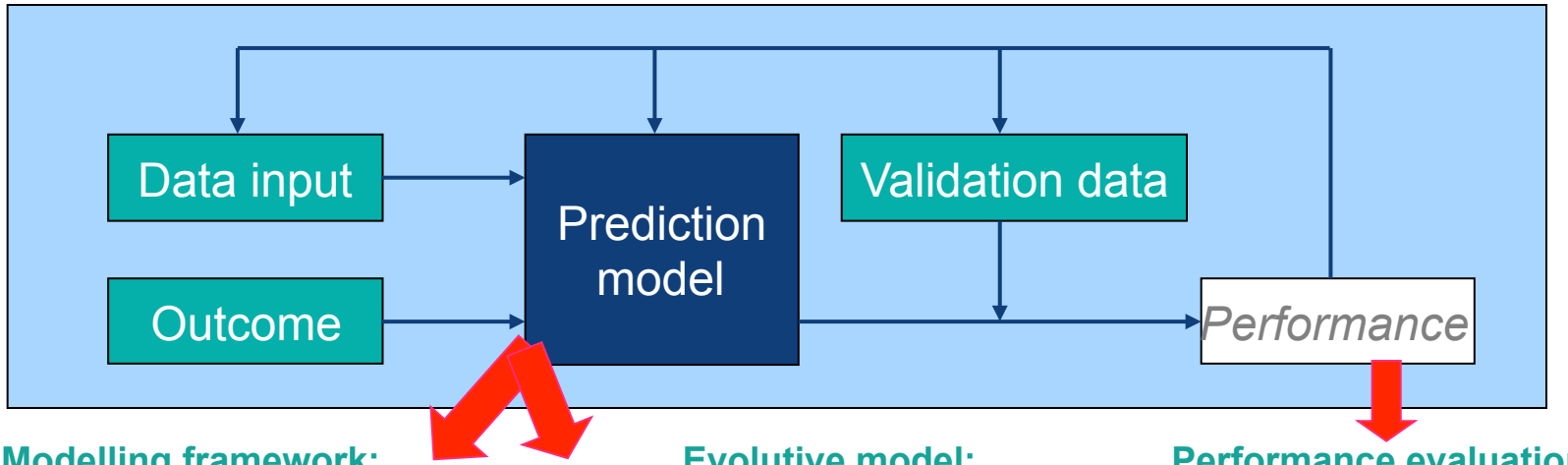


Modelling framework:

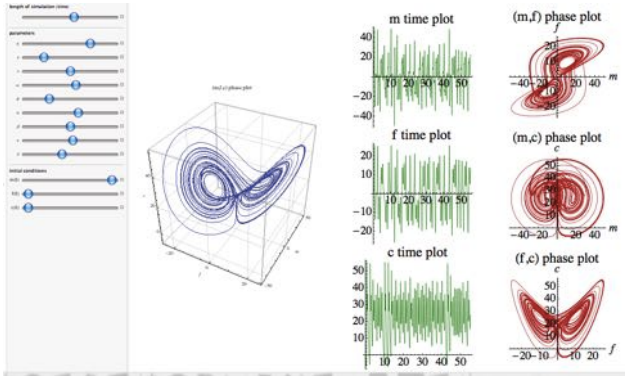
Chaos Theory

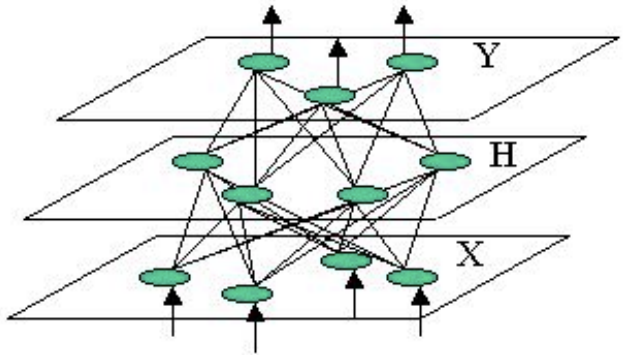
Evolutive model:

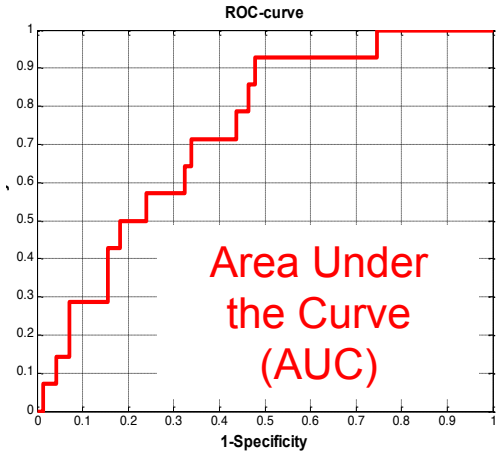
Simulated Neural Network

Performance evaluation:

ROC curve







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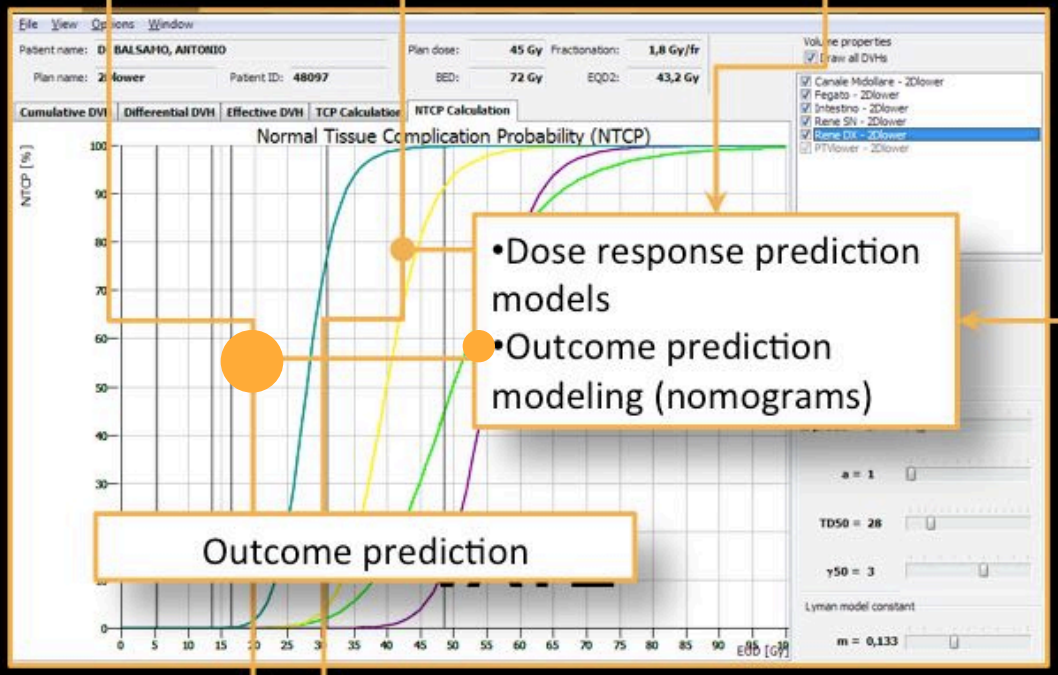
Multicenter (reference) database



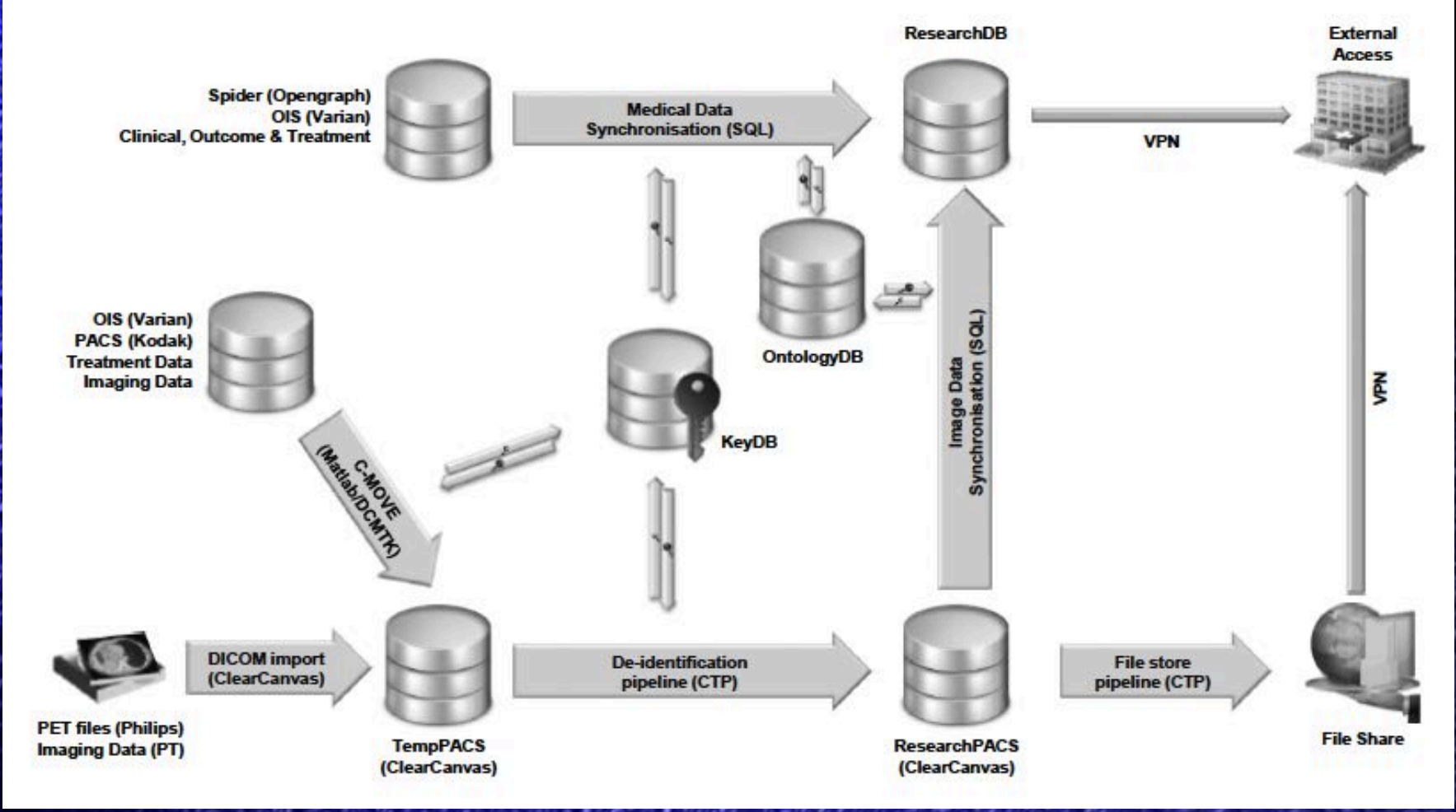
- Dose response prediction models
- Outcome prediction modeling (nomograms)

Outcome prediction

87 ± 7 %

VATE 1.0

Facilitated data transfer



Dekker A, Valentini V et Al *- in press*

Knowledge Based Oncology

Clinical case data

Physical dose distribution

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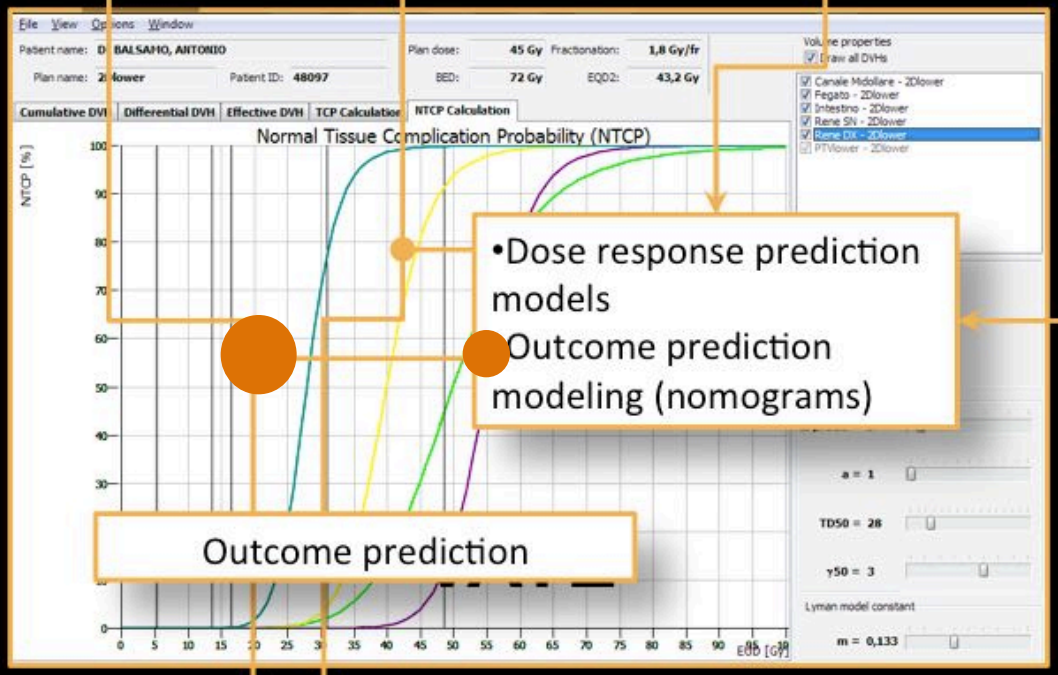
Multicenter (reference) database



- Dose response prediction models
- Outcome prediction modeling (nomograms)

Outcome prediction

94 ± 5 %

VATE 1.0

The meaning of a decision

We can distinguish between
«**weak evaluations**»,
when it is about the **results of the action**,

and «**strong evaluations**».
about **the quality of its motivations**.

(Ch. Taylor)

The meaning of a decision

The **diagnostic and therapeutic** actions,
but also the **cooperative and managerial** ones,
insert the element of will, of choice,
of direct engagement in the exercise
of the **scientific and technical competence**.

F.Botturi – *ESTRO 31* – 2012

The meaning of a decision

Such elements answer to questions like:
what was the meaning of our looking for
the most efficient therapeutic line?

- Avoiding **legal troubles**?
- Displaying **personal excellence** to the colleagues?
- Looking for **career advancements**?
- Being faithful to human **dignity of the medical profession**?
- Living up to certain meanings of the relationship with **the needs and suffering of other people**?

Classic Ethics

By "**ethics**" we mean the **reflection**

on **man's freewill** in various fields

(politics, economics, medicine, etc..),

aiming at a **responsible behavior**,

consistent with principles and values

related to a **particular conception of man and society**.

ESTRO Strategy Meeting

Radiotherapy and Oncology 103 (2012) 99–102

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ESTRO Vision 2012

ESTRO 2012 Strategy Meeting: Vision for Radiation Oncology

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European SocieTy for Radiotherapy and Oncology (ESTRO), Brussels, Belgium

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[5] On behalf of Strategy Meeting Participants (*Strategy Meeting participants:* Cai Grau, Joanna Kazmierska, Vincent Khoo, Tommy Knöös, Yolande Lievens, Ben Mijnheer, Filipe Moura, Ludvig Muren, Richard Pötter, Umberto Ricardi, Christine Verfaille, Brad Wouters, Daniel Zips).

ESTRO Vision

Every cancer patient in Europe
will have **access** to
state of the art radiation therapy,
as part of a **multidisciplinary approach**
where treatment is **individualised**
for the specific patient's cancer,
taking account of
the **patient's personal circumstances**.

ESTRO

ESTRO Vision – Radiother Oncol – 2012