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Hyperbaar Zuurstofcentrum

Ziekenhuis Oost-Limburg

Universiteit Antwerpen

Ontologists and Domain Experts focusing on Chronic Wounds : Different Worlds on the Same Planet?"

Sven Van Poucke, MD

Incentives

1. the prevalence and cost of managing chronic wounds continue to escalate, despite the availability of advanced wound care products, specialists and consultants, and the creation of risk assessment tools and wound healing centers,

2. serious morbidity and financial costs

3. a serious call is made to health care providers, payers, and policymakers to review the way such wounds are managed today: from clinical AND semantical perspective

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Chronic Wound Care

Chronic cutaneous wounds include leg ulcers (ulcus cruris), pressure ulcers, and diabetic foot ulcers.

Chronic wounds cost the UK over £1 billion each year
Chronic wounds cost the nation (USA) $20 billion to $25 billion a year

Harding, KG, Morris, HL and Patel, GK. "Healing chronic wounds." BMJ 324: 160-163, 2002

Chronic Wound Care

Wound bed preparation - a concept aimed at assisting clinicians in wound bed assessment and the development of strategies to maximise healing potential - is now recognised as an important aspect of care.

The Red-Yellow-Black-scheme is commonly used for classifying chronic wounds. Simplified direction for selecting appropriate dressings for open wounds by focusing on the phase of healing as evidenced by the predominant condition of the wound base

The associated development of the TIME framework (Tissue management; Inflammation and infection control; Moisture balance; Epithelial (edge) advancement) offers clinicians a practical tool for translating wound bed preparation into practice.

Growing demand for

randomized clinical trials
health technology assessments
an increasing economical pressure on health budgets

Key requirement for optimal data sharing *is standardization with agreements on types and definitions of structures, processes and formats used to access and share this data plus the implementation of consensus based, standardized terminologies and coding schemes.*

Wound measurement and assessment* is *important for several reasons including:

Tracking patient progress to ensure that healing of a specific wound is progressing with the selected treatment regime

Allowing institution managers to **audit patient progress** and **institution effectiveness**

Building a reliable and consistent database for **outcomes based studies** of wound care

Improving patient compliance

Consistently documenting patient care for **reimbursement purposes** and for protection of the health care provider against litigation.

something is missing

some efficiency

some efficacy

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Research Questions

- *Which **colorimetric and geometric parameters** are most relevant to analyse tissue repair in a time frame, (macroscopic and non-invasive)?*
- *Which **ultrastructural elements and techniques** could add significant value in this analysis?*
- *Which **biomarker(s)** might demonstrate any **prognostic value** in tissue repair?*

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Partners

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RWTH AACHEN

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UNIVERSITEIT GENT

STANFORD CENTER FOR BIOMEDICAL INFORMATICS RESEARCH
FORMERLY STANFORD MEDICAL INFORMATICS

Semantic Link

1. *Treatment decisions are based on **visual perception.***

2. *Descriptive analysis of wounds is **poorly standardized** and **rarely reproducible.***

3. *The assessment and measurement of the temporal changes of wounds using digital images can now be **calibrated**, reducing the difficulty of obtaining reproducible color content.*

*The color content of the images becomes **independently of any camera settings** and **illumination features.***

4. *Growing demand for randomized clinical trials, health technology assessments and increasing economical pressure on health budgets: **optimal data sharing** with standardization and agreements on universals and instances.*

5. ***Consistent, controlled and universally accepted vocabularies** seems essential for documenting, describing and comparing wounds.*

6. ***Ontologies** (controlled vocabularies) promise to help address many of the difficulties currently experienced in managing large image databases.*

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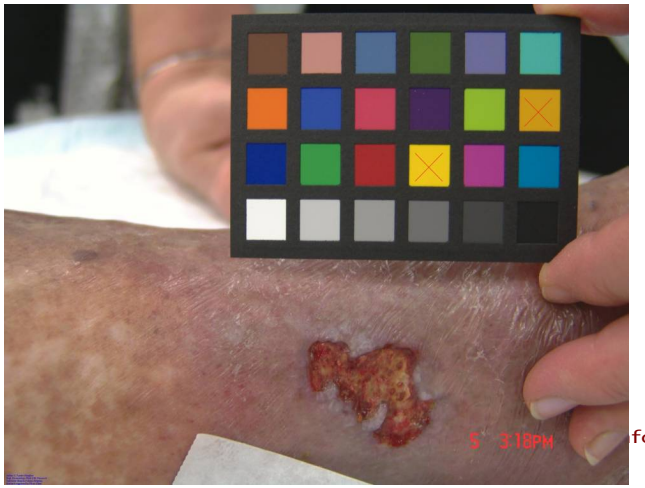
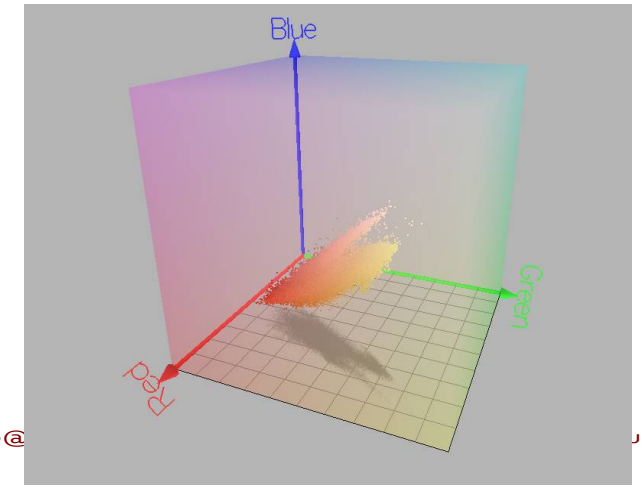
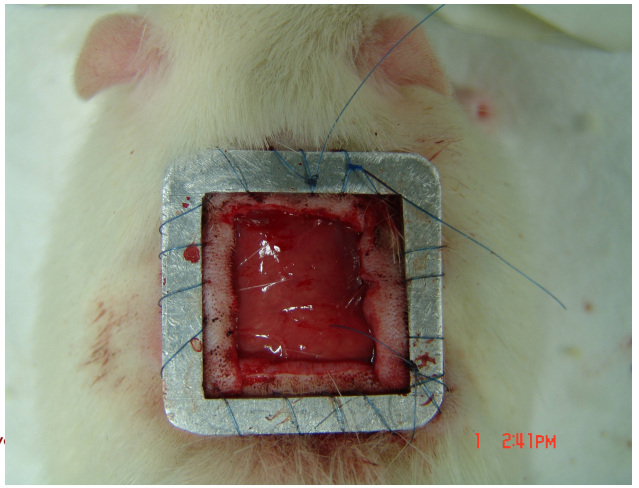
COP

a semi-open, international, virtual community of practice devoted to advancing the field of research in **non-invasive wound assessment by image analysis**, **ontology** and **semantic interpretation and knowledge extraction (content–based visual information retrieval)**.







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Groups

- Wound Image Base Working Group
- Wound Image Visual Diagnostic Expert Group
- Wound Image Colour, Texture and Shape Group
- Wound Image Ontology Working Group

Digital Images

Digital images *of wounds are considered semantic instruments for capturing aspects of the real world.*

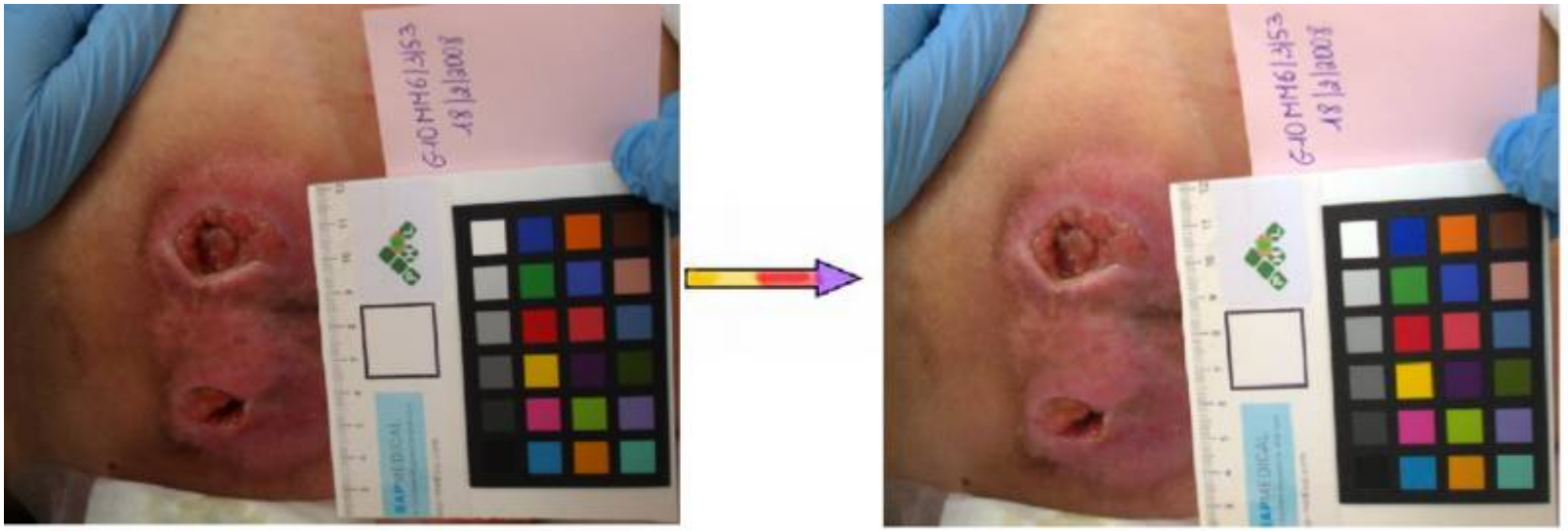
Novel bio-informatical technologies *are necessary (i.e. ontologies) to support, test and optimize these new approaches.*

Descriptive data on images *(such as a radiologists' protocol) seems essential because clinicians routinely report fewer features in a case than they subsequently agree are present.*

WIBG

"*deployment of a* ***searchable repository****,* ***up- and downloading features*** *of in-vivo digital wound images with calibration chart,* ***automatic and manual calibration*** *of images"*

www.colibrate.com



Before (left) and after (right) calibration.

Vander Haeghen Y and Naeyaert JM. Consistent cutaneous imaging with commercial digital cameras. Arch Dermatol 2006 Jan; 142(1) 42-6. doi:10.1001/archderm.142.1.42 pmid:16415385

WIBG

Only recently, assessment and measurement of the temporal changes of wounds using images taken with commercially available digital cameras can be ***calibrated****, reducing the difficulty of obtaining reproducible color content.*

After calibration, the color content of the images become ***independently of any camera settings*** *and* ***illumination features****, thereby closing the sensory gap*

WIBG

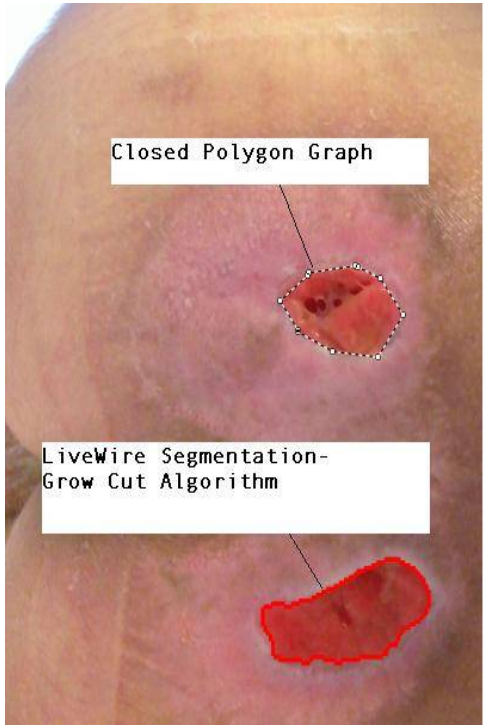
***Wound image**: as a 3-dimensional (2 dimensions in space, 1 in time) representational artifact, of a wound in the real world.*

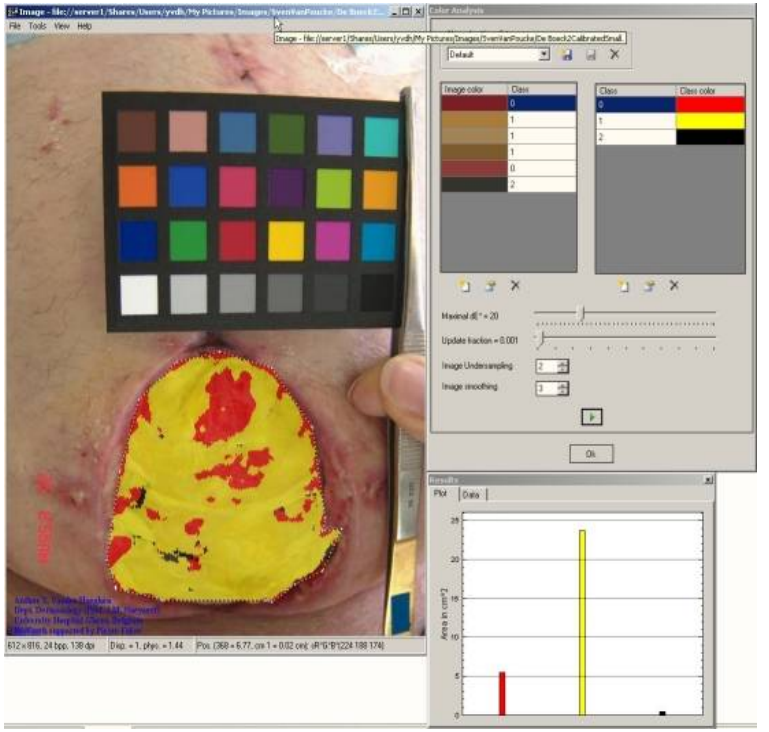
*Digital images of human wounds plus a **reference chart** (the **Mac- Beth ColorChecker Chart Mini** [MBCCC] or the **QP Card 201** are uploaded via a smart client tool.*

The illumination of the reference chart should be homogeneous over the field of view

wound?
chronic wound
wound bed?
wound edge?
wound border?
granulation tissue?
fibrin?
necrosis?.....

Roi-annotation-...

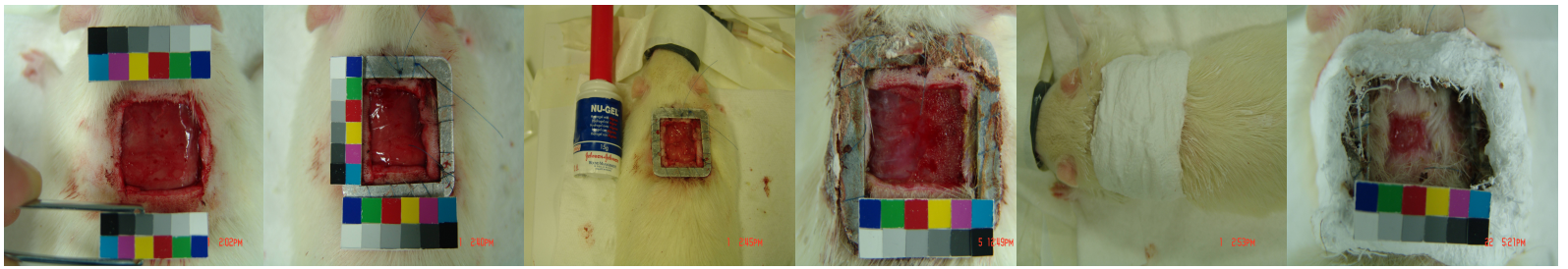




WIVDEG

Sprague Dawley ratten

- splinting
- dorsale excisioneel
- plaaster



WICTSG

*Growth in **mathematical models** designed to explain and extend the understanding of **wound healing**.*

*Multiple **algorithms to analyse colors, patterns, textures and shapes** of all sorts of objects*

*The same goal in mind: **disambiguation faced during interpretation** of and communication on images.*

*Problems related to the photographical analysis of wounds can be partially solved with the current insights used in **geo-spacial sciences and satellite imaging**.*

A standardized protocol for extracting reliable color, texture and shape features from ROIs.

One of the initial tasks: the extraction of available algorithms for color, shape and texture analysis and the identification strengths and weaknesses of the algorithms for the domain of chronic wound images.

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Types of ontologies

	Upper-level integrating ontologies	Domain ontologies
Ontologies in support of science	*BFO (Basic Formal Ontology)* *DOLCE, SUMO*	*GO* *FMA* *SNOMED*
Administrative ontologies (e-commerce, etc.)	*FOAF top level: person, topic, document, primary topic ...*	*Amazon.com ontology* *Library of Congress Catalog*

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***CODS Server**:*

*A **joint BMIR/CIM3 project** to develop the infrastructure to host an open Collaborative Ontology Development Service and Ontology Repository for the ontology community at large.*
The infrastructure is based on the Multiuser Protégé Server hosted on a Tier-1 facility provided by CIM3.NET.

1. CODS Server access details at:

http://protege.cim3.net/cgi-bin/wiki.pl?CODS

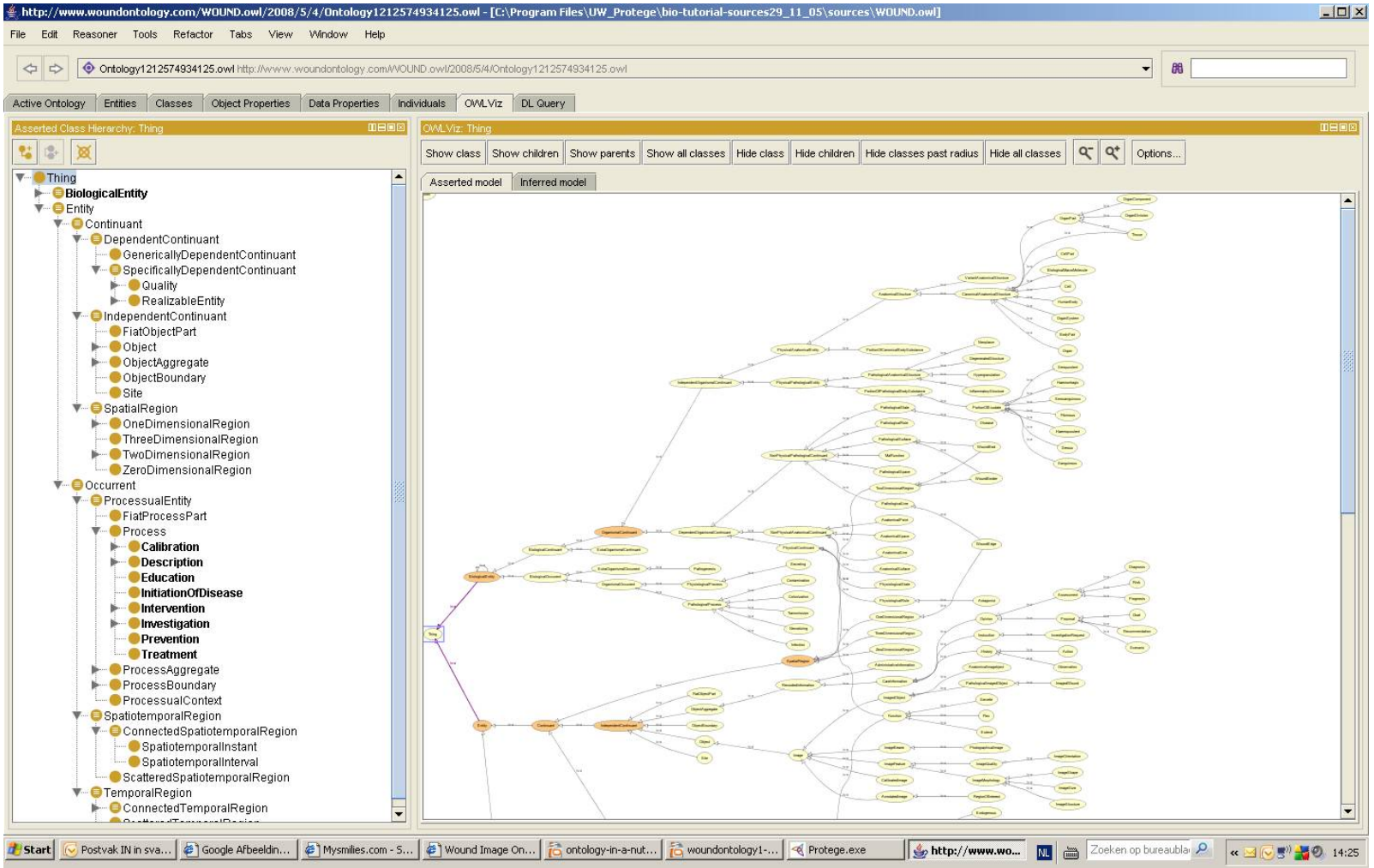
2. directions on how to connect to the server are detailed at:

http://protege.cim3.net/cgi-bin/wiki.pl?CODS#nid9ZT

WIOWG

subversion (SVN) repository *:*

Simple:
http://protege1.cim3.net/svn1/ontology/wound/
Advanced:
http://protege1.cim3.net/svn2/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File Edit Reasoner Tools Refactor Tabs View Window Help
Ontology1212574934125.owl http://www.woundontology.com/WOUND.owl/2008/5/4/Ontology1212574934125.owl
Active Ontology Entities Classes Object Properties Data Properties Individuals OWLViz DL Query
Asserted Class Hierarchy: Thing
Thing
BiologicalEntity
Entity
Continuant
DependentContinuant
GenericallyDependentContinuant
SpecificallyDependentContinuant
Quality
RealizableEntity
IndependentContinuant
FiatObjectPart
Object
ObjectAggregate
ObjectBoundary
Site
SpatialRegion
OneDimensionalRegion
ThreeDimensionalRegion
TwoDimensionalRegion
ZeroDimensionalRegion
Occurrent
ProcessualEntity
FiatProcessPart
Process
Calibration
Description
Education
InitiationOfDisease
Intervention
Investigation
Prevention
Treatment
ProcessAggregate
ProcessBoundary
ProcessualContext
SpatiotemporalRegion
ConnectedSpatiotemporalRegion
SpatiotemporalInstant
SpatiotemporalInterval
ScatteredSpatiotemporalRegion
TemporalRegion
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OWLViz: Thing
Show class Show children Show parents Show all classes Hide class Hide children Hide classes past radius Hide all classes Options...
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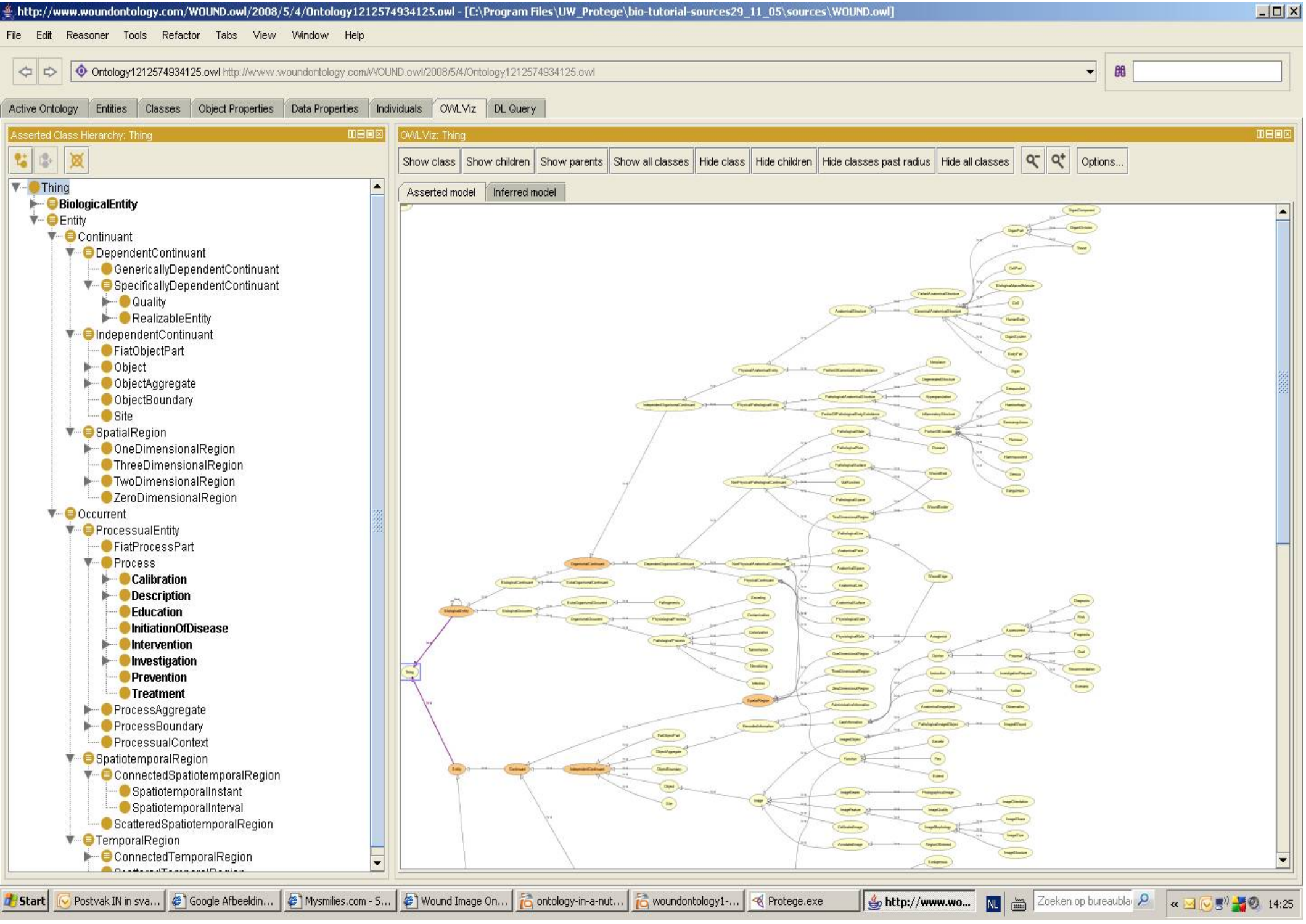
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OWLViz: Thing
Show class
Show children
Show parents
Show all classes
Hide class
Hide children
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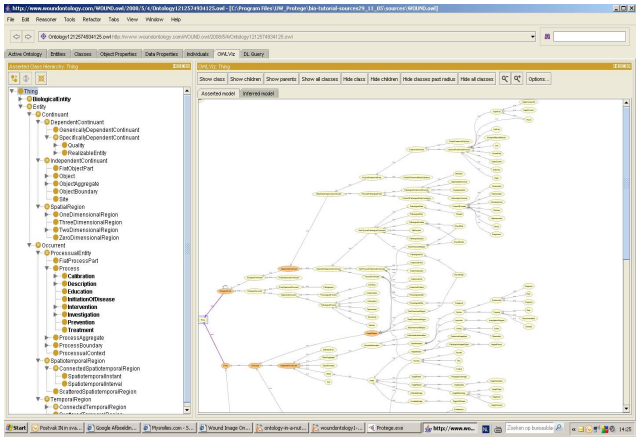

Different Worlds on the Same Planet?

Different Worlds on the Same Planet?

1 life time 2 B ontologist
1 life time 2 B wound care specialist

How will I look the moment I can manage both?
OR
Is the ontolog community able to reduce the gap between the worlds?

Woundontology Consortium

The Woundontology Consortium is a semi-open, international, virtual community of practice devoted to advancing the field of research in non-invasive wound assessment by image analysis, ontology and semantic interpretation and knowledge extraction .

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