Clinical NLP Workshop
Stockholm, Sweden
21 June 2012

NICTA

Machine Learning and Health at NICTA

Architectures and Analytics to Improve Human Performance

Research, business & teaching on application and evaluation of machine learning for health in Australia and Europe

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Health Business Team
2010-2 + 2012-5

Australian Government
Department of Broadband, Communications and the Digital Economy
Australian Research Council

NICTA Funding and Supporting Members and Partners
Australian National University
UNSW The University of New South Wales
NSW Government Trade & Investment
State Government Victoria
The University of Melbourne
The University of Sydney
Queensland Government
Griffith University
QUT Queensland University of Technology
The University Of Queensland Australia

G'Day Mates from NICTA

- Australia's National Centre of Excellence in Information and Communications Technology
- Five research labs in Brisbane, Canberra, Melbourne, and Sydney
- 700 staff including 270 PhD students
- Budget: ~$80M p.a. from Fed and State Govt.
- ~600 research papers/year
- ~100 patents and > 500 patent submissions
- > 190 prizes and awards

Research and Outcomes

NICTA

University Partners

- Machine Learning
- Software Systems
- Optimisation
- Networks
- Computer Vision
- Control & Sig. Processing

RESEARCH EXCELLENCE

- Broadband and the Digital Economy
- Health
- Infrastructure, Transport and Logistics
- Safety and Security
- Resources and Environment

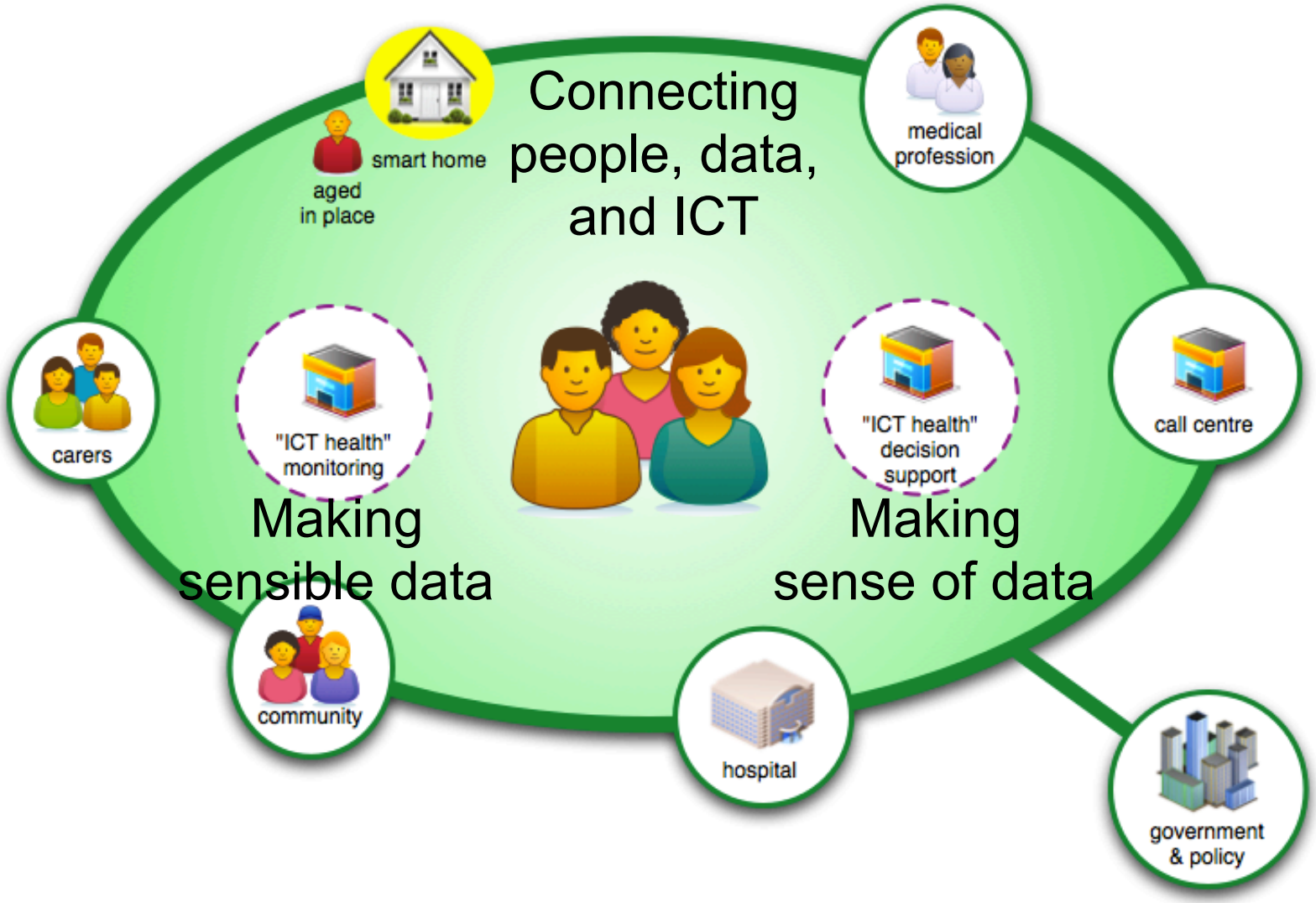
WEALTH CREATION

Industry and Government Partners

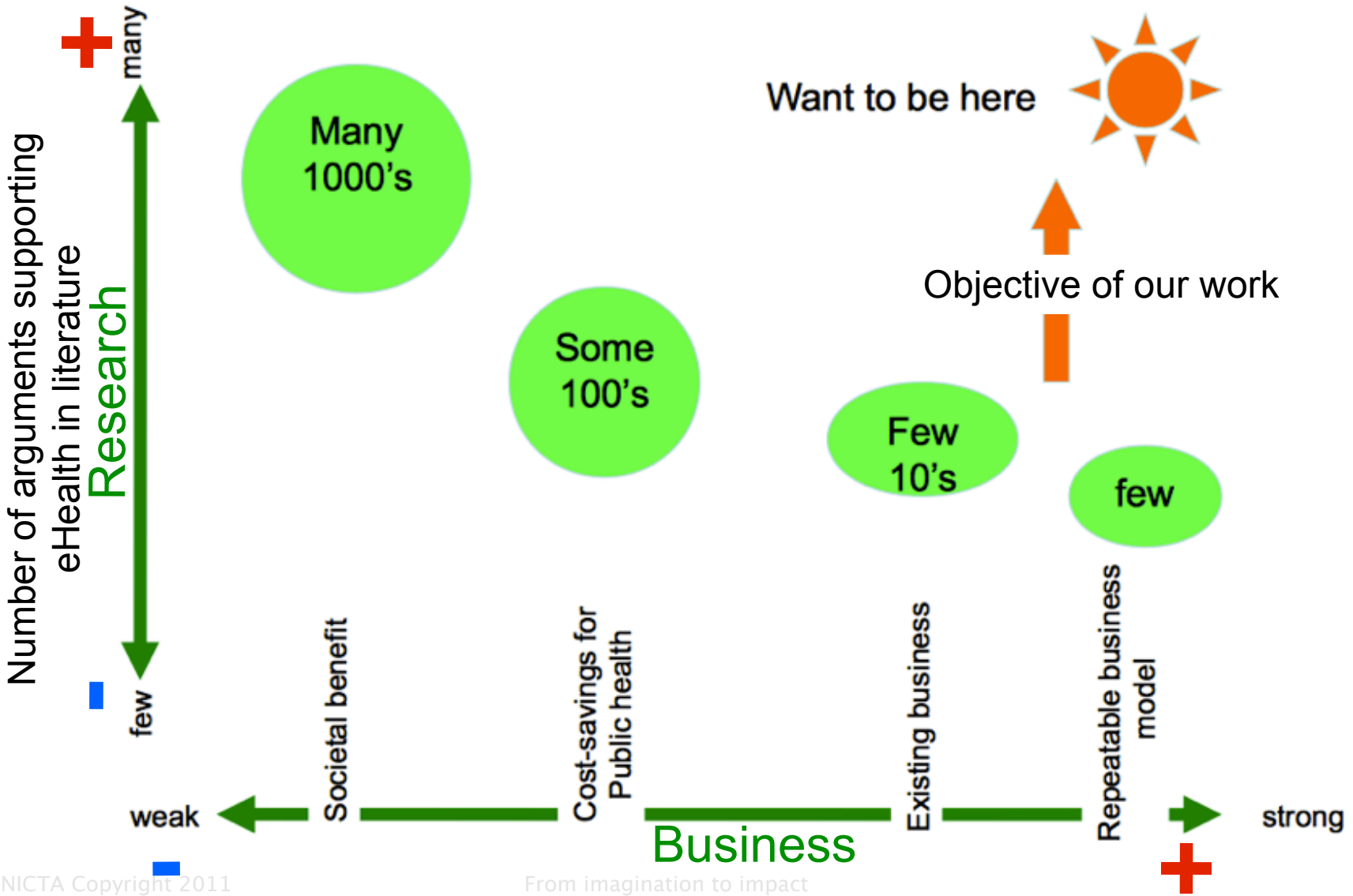
From imagination to impact

Data and Value Chain are the Key

eHealth is the use of ICT for health. -> Paradigm Shift. WHO



Approach



Outcomes

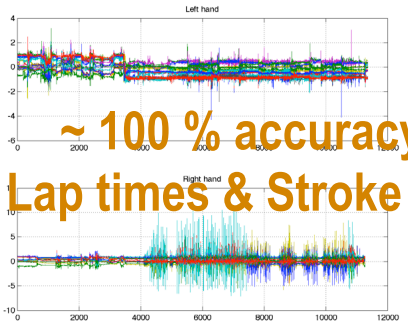
NICTA

Partnerships

health e cluster
Australian e-Health technology cluster

www.ehealthcluster.org.au

Real-life applications



~ 100 % accuracy in
Lap times & Stroke types

Awards

ACADEMY OF FINLAND

Research & Commercialisation Grants

Clinical Handover

Failures in information flow from clinical handover are:

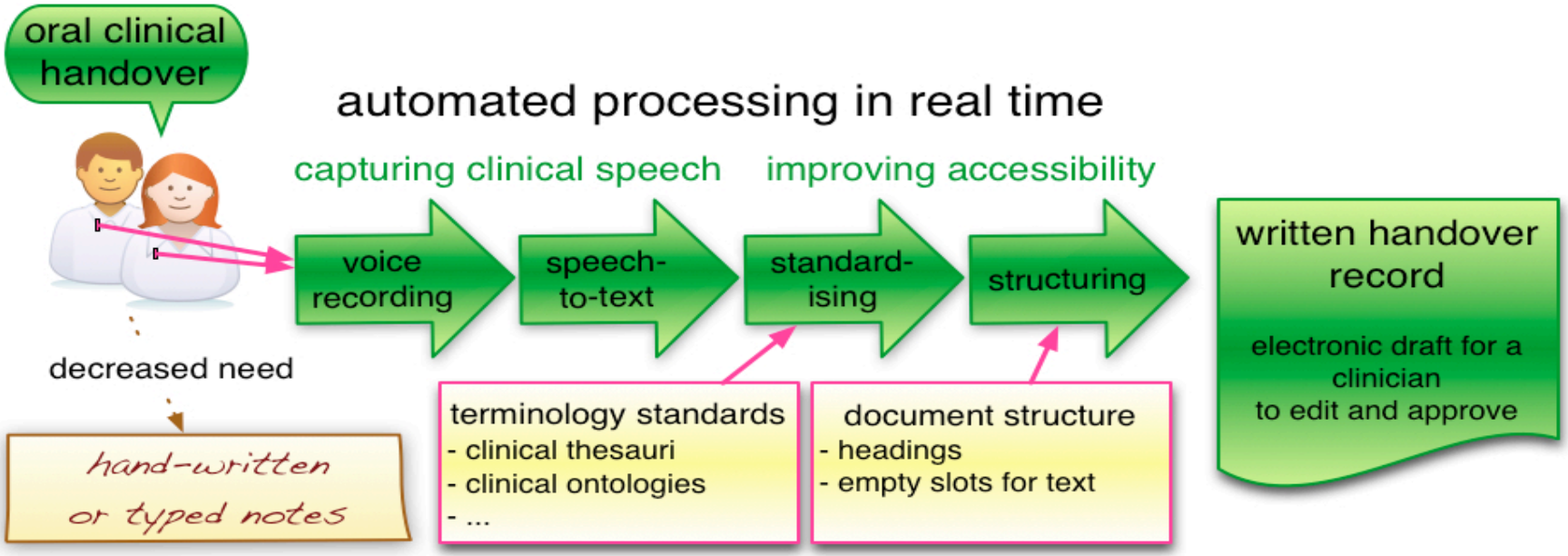
- The leading cause of sentinel events in the USA
- Associated in Australia with
  - ~ 50% of all adverse events
  - > 10% of preventable adverse events

Verbal handover provides a good picture of patient care.

But after 3-5 shifts, this information is lost or transferred incorrectly if notes are not taken or taken by hand.

Let Us Take Notes Automatically via

Clinical Speech to Text



The suitability of this structure has been shown by introducing a template to be populated by typing. Its implementation across 4 major teaching hospitals in Sydney is nearing completion.

Example

In 13B we've got Dorothy Dickson. She's an 86 year old lady. She came in acopia and acute confusion. She's got a history of hypertension, non-insulin dependent diabetic, obsessive compulsive disorder and osteoarthritis. This lady is on bd obs, her vitals and bd sugar level and the last reading of sugar level was 4.9. She is on diet control, diabetic and she's written for Lorazepam prn. The vitals are stable and she's on a diabetic diet. Nil known allergies. She has a new IVC IDC. Pleasant, cooperative, needs minimal assistance...and she's showering and dressing herself. But I think we are preparing her for discharging home after her OT kitchen assessment and social worker review.

Name, Age, Gender, DOB, Bed, AMO, Alerts/Risks:

- Dorothy Dickson
- 86 yo.
- female
- Dr: A. Quack
- nil allergies known

Clinical Presentation:

- acute confusion
- difficulty coping at home (? acopia)

Clinical History:

- hypertension
- non-insulin dependent diabetes
- diet controlled diabetes
- obsessive compulsive disorder
- osteoarthritis

Clinical Status:

- [to be filled manually]

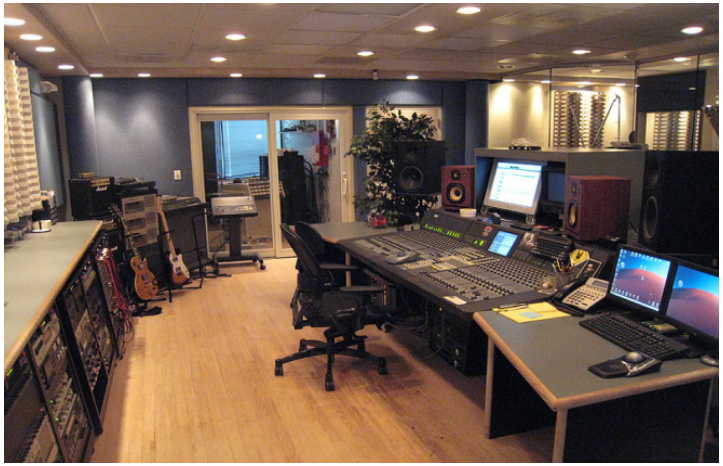
Care Plan:

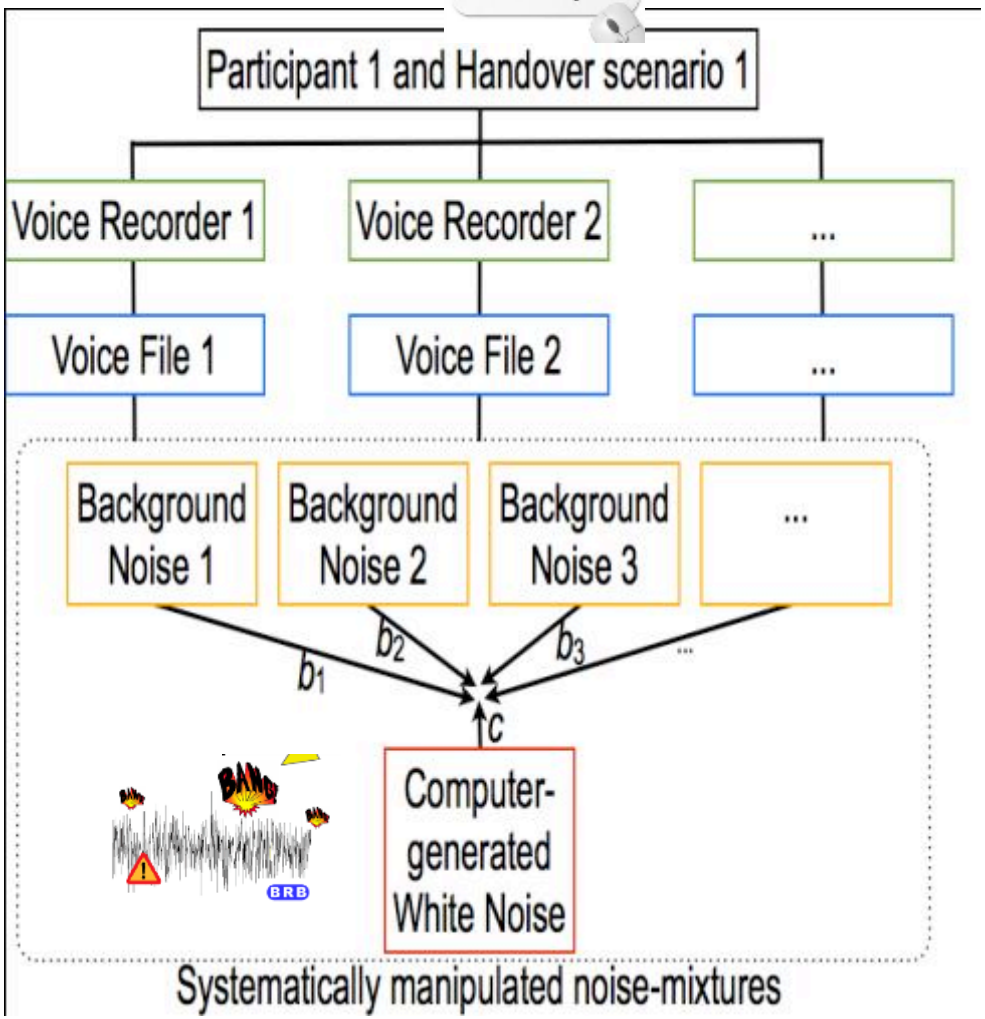
- bd obs
- bd sugar level
- vitals
- lorazepan prn
- diabetic diet
- new IVC
- new IDC
- pleasant,
- cooperative,
- requires minimal assistance.
- showering self
- dressing self
- preparing for discharge (possible)

Outcomes and Goals of Care:

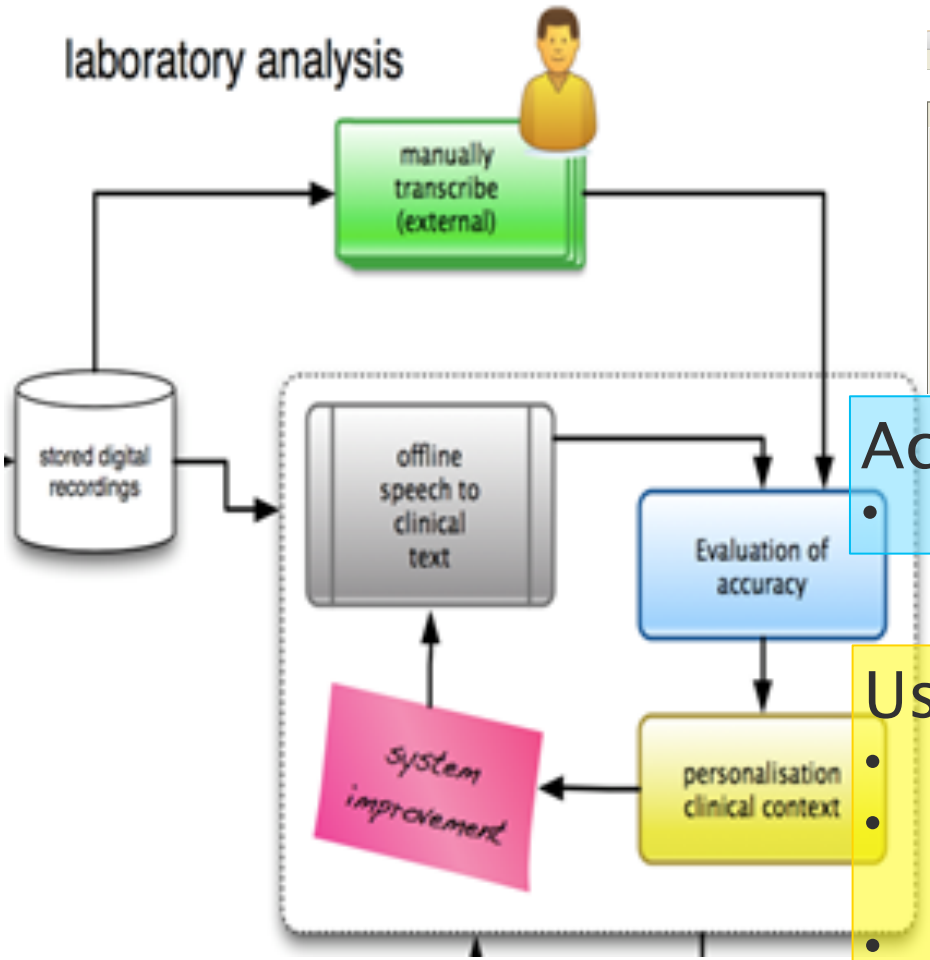
- bsl 4.9
- vitals stable
- OT kitchen review
- social worker review

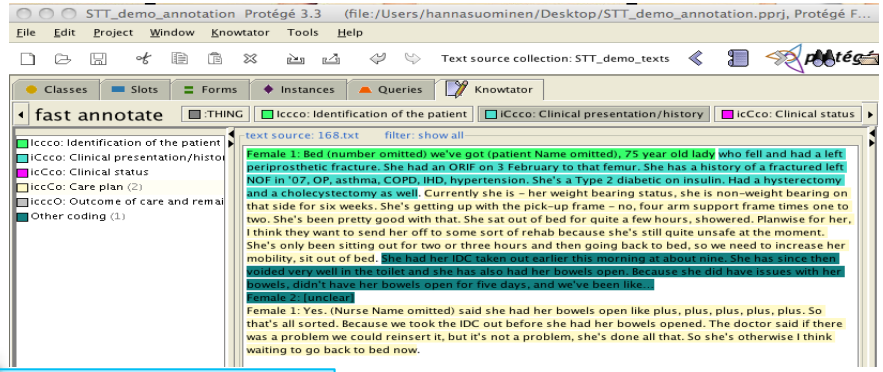
Current Status





Current Status

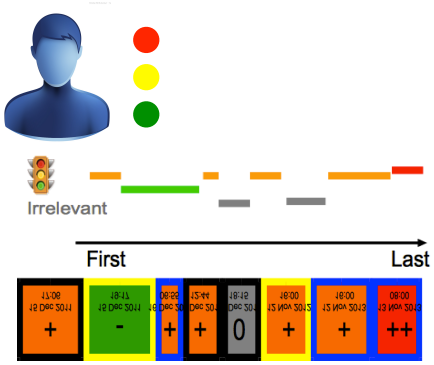


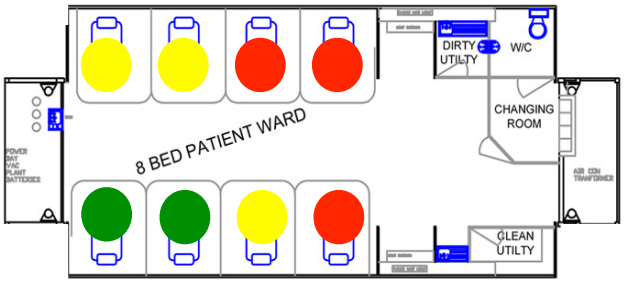


Accuracy:
- Statistics

Usability:
- Surveys
- Focus groups
- Interviews

In-Hospital Surveillance System





Home | Browse/Edit databases | Create databases | **Logout** | User ID: aspergillosis_demo_user

NICTA Epicure

Back to query page

Database name: aspergillosis2; Document ID: RMH_101_1_r

Risk Indicator for Patient RMH_101: ; DiagTimeIFIorNone: [2011, 6, 26, 0, 0, 0]

Reports for the selected patient: RMH_101		
Click a tag below to display a report		
Result date	**Report Grade**	**Text Highlight**
[2011, 7, 29, 16, 37, 0]	2	2 C
[2011, 6, 27, 19, 42, 0]	1	1 2 3 C

Content of the Selected Report: RMH_101_1_r

Select a tag to highlight important text: Mich_grade_3

ReportType	r	Hospital_name	RMH	Patient_ID	RMH_101

Final_report	Yes	**Result_date**	[2011, 6, 27, 19, 42, 0]
Result_title	CTCHEHI	**Result_type**	CT Chest Hi Resolution
Result_status	Modified	**Encounter_info**	RMH, Inpatient, 23/06/11 - 29/06/11
Reported_by	Dr Marcus Scott	**Reporting_date**	[2011, 6, 27]
Reporting_time	[19, 42, 0]	**Performed_by**	Contributor_system, PARIS-ALF on 27 June 2011 19:42
Verified_by	Contributor_system, PARIS-ALF on 27 June 2011 19:42		

Report_content	CT-05-012345 CT scan of the chest
CTCHEHI	This document has an image CT Chest Hi Resolution
History	AML. Neutropenia. Bilateral pneumonia with ongoing fevers despite broad-spectrum antibiotics. ? Fungal infection.
Procedure	High-resolution scans were performed through the chest without contrast.
Findings	There are several areas of parenchymal opacification scatted throughout both lungs with a few smaller nodules seen in the upper lobes. These have a peripheral predominance and there are areas of surrounding ground-glass opacification. Air bronchograms are seen in some of these areas but no central cavitation present. No pleural effusions present. Within the mediastinum that there are slightly enlarged lymph nodes which are probably reactive within the pre tracheal, precarinal and subcarinal areas. The lower abdomen is unremarkable. There are 2 small calcified foci seen in the spleen most likely incidental calcified granulomas.
Comment	Extensive areas of airspace consolidation in both lungs. While these changes may well be due to a bacterial infection, the surrounding ground-glass opacification is suspicious of fungal infection in this clinical setting.

YouTube Broadcast Yourself

http://youtu.be/TuqQvvFnJSw

Current Performance

288 IFD and 291control patients from 3 hospitals in Melbourne.

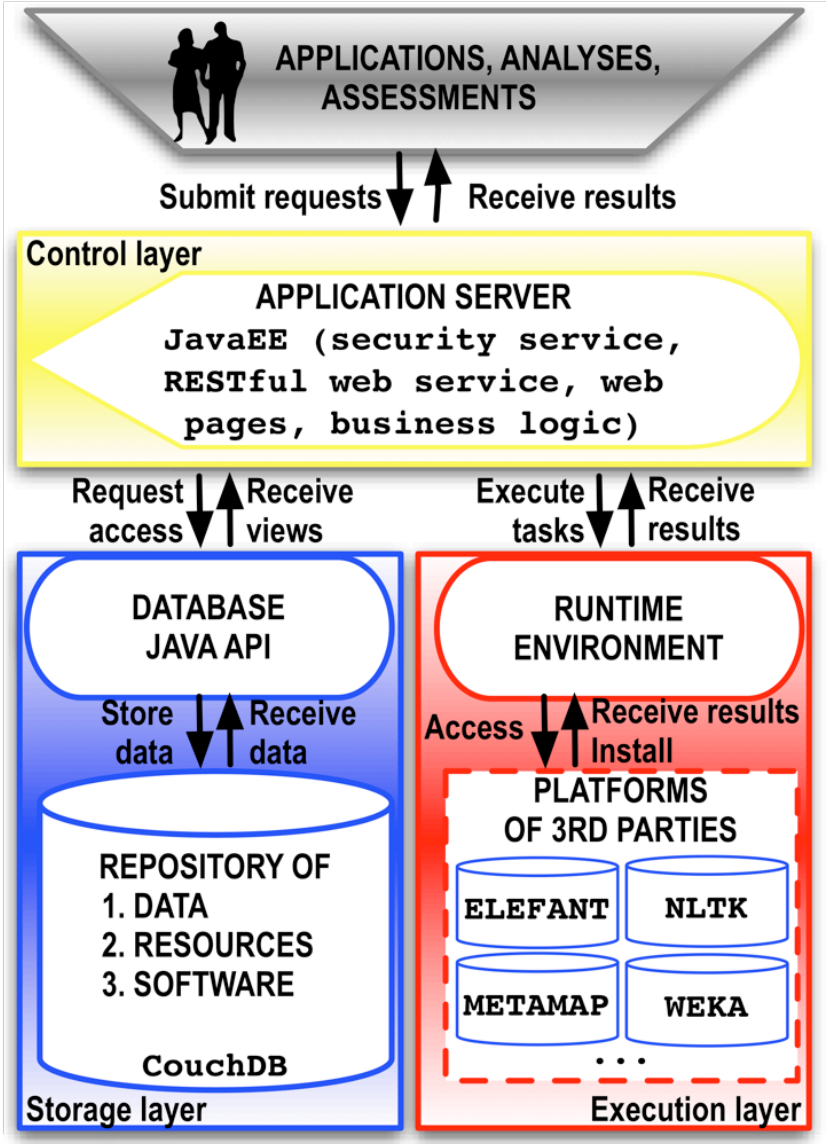
Annotated sample of 73 IFD and 59 control patients.

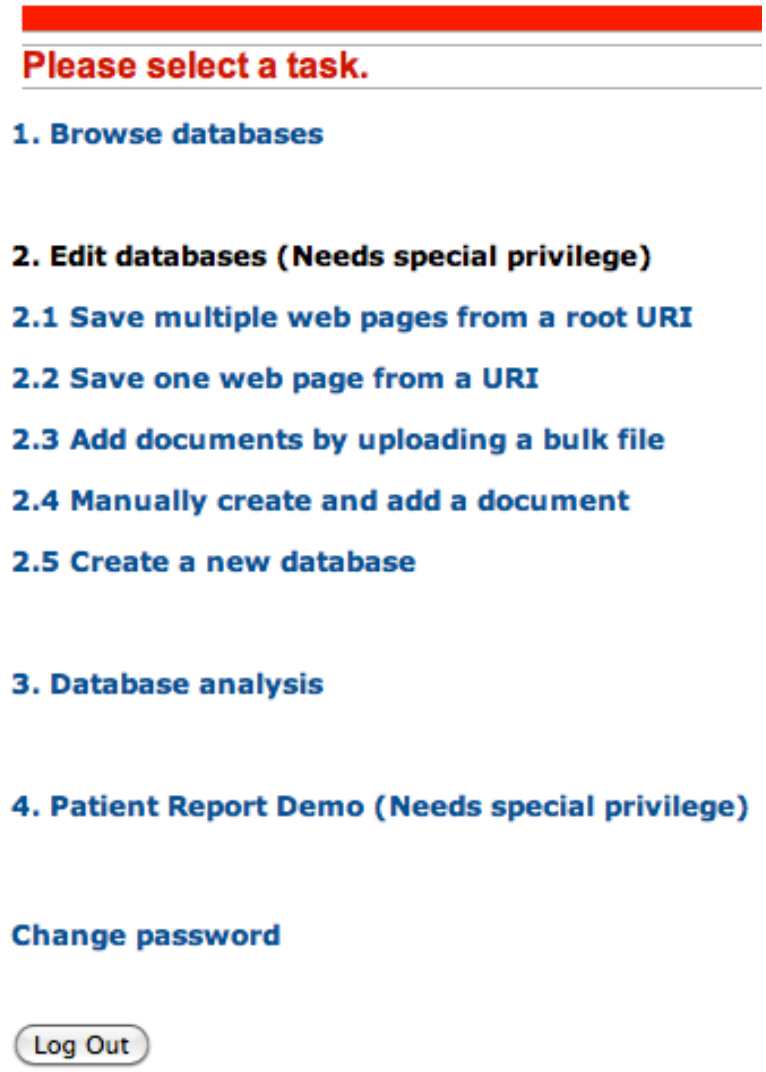
The expert annotators' agreement over IFD-positive and IFD-negative sentences was 0.64 and 0.58 respectively, using Cohen's kappa.

Level	Sensitivity	Specificity	Positive PV	Negative PV
Report	0.94	0.76	0.83	0.91
Patient	1.0	0.51	0.73	1.0

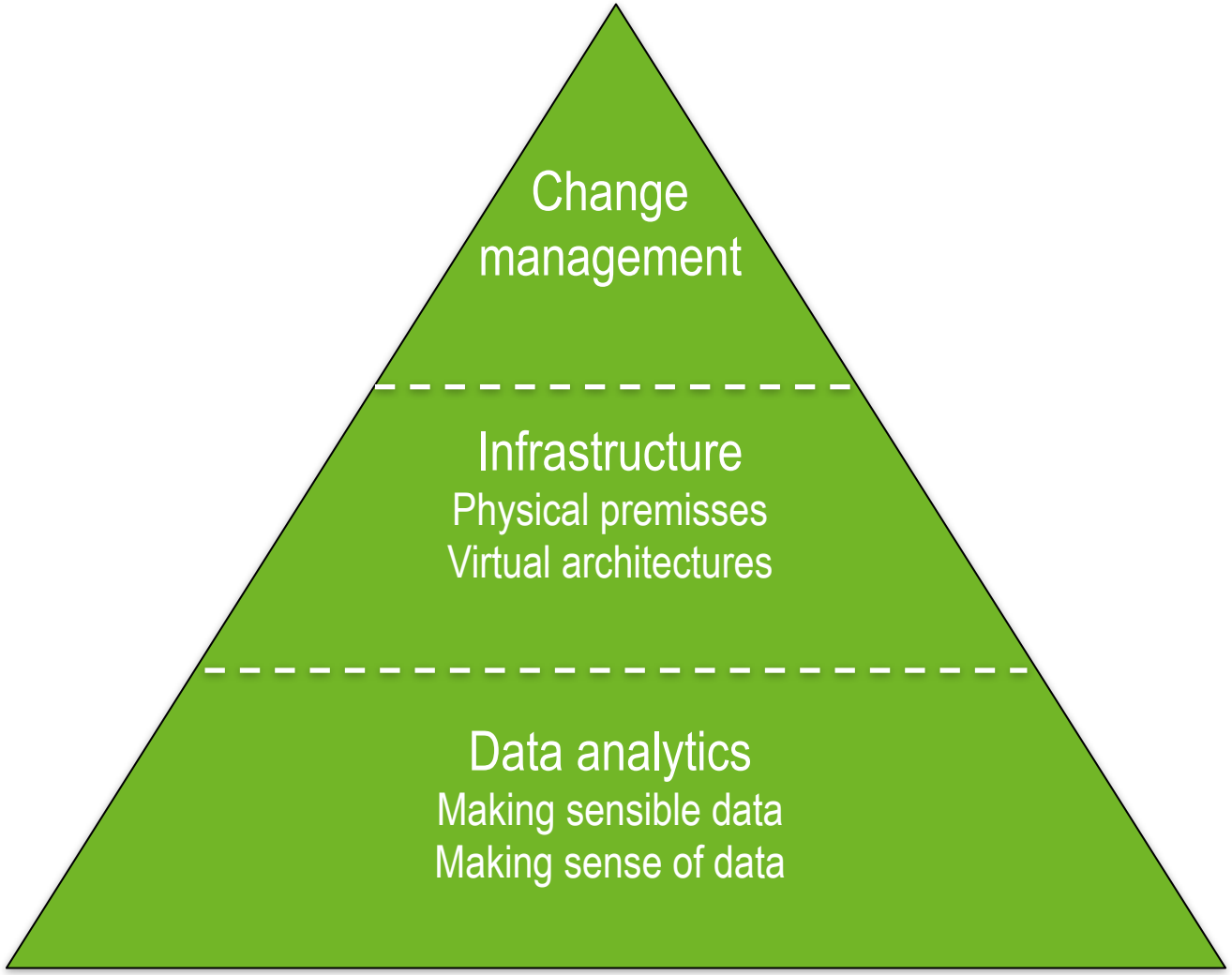
Table 1. Performance at the report and patient levels. PV = predictive value

NICTA Epicure



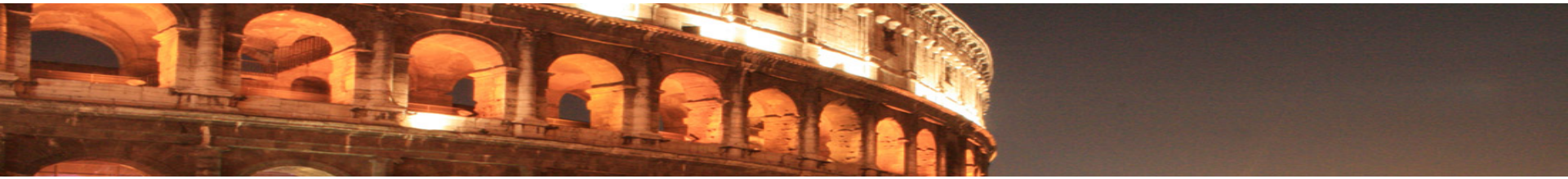


eHealth pyramid



Thank you!

NICTA



1. Workshop

CLEF INITIATIVE

ROME 2012 CLEF CLEFeHealth2012 NICTA

Rome, Italy; 17-20 Sep 2012

2. Summer School & Workshop

LOUHI '13 NICTA

The 4th International Workshop on Health Document Text Mining and Information Analysis

www.nicta.com.au/louhi2013 Sydney, NSW, Australia **11-12 February 2013**

Australian Health Informatics Summer School

Sydney, Australia, 4-8 Feb 2013

6 pp. by 15 Oct 2012

Sydney, NSW; 4-8 + 11-12 Feb 2013

3. Special Issue