Next Generation Neonatal Health Informatics with Artemis

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Motivation: Earlier Onset Detection

- Hourly spot readings from medical devices recorded on paper or electronic charts.
- Babies weight between 2.5-3kg at discharge. Paper notes can weight 6kg
Motivation
Motivation: Earlier Onset Detection

Absolute times

15/11/06

16/11/06

Baby 1

Baby 2

Baby 3

Diagnosis

Diagnosis

Diagnosis
Motivation

• Behaviour of physiological data streams that describe respiratory and cardiac function . . .
  – Pneumothorax (McIntosh et al, 2000)
  – Nosocomial infection (Griffin and Moorman, 2001)
  – Periventricular leucomalacia (Shankaran et al, 2006)
  – Intraventricular haemorrhage (Fabres et al, 2006; Tuzcu et al, 2009)
Knowledge Translation Challenge

• Retrospective Analysis
• Not implemented in clinical practice
• Not scalable
• Either or combination of:
  – Patient centric
  – Condition centric
  – Stream centric
Objectives

• The provision of this knowledge requires a multidimensional approach:
  – multiple conditions
  – multiple streams of data
  – for which multiple behaviours can exist

• In addition, integrate of
  – real-time synchronous medical device data
  – asynchronous clinical data
Artemis

Data Acquisition

Online Analysis

Result Presentation

IBM InfoSphere Streams Runtime

CapsuleTech Server

Clinical Information System

CIS Adapter

Configuration Server

HR Source Op

SpO2 Source Op

BP Source Op

CIS Source Op

(i)ntel

Rule Modifier

Deployment Server

Alert Sink

Op

QRS

BP

RR

PET

AR

WT

AR

Sepsis

BPA

EP

WTA

HR Source Op

SpO2 Source Op

BP Source Op

CIS Source Op

(A)ctal

Knowledge Extraction

Stream Persistency

<User Interface>

Medical Data Hub

CapsuleTech

Server

Cognos

Data Acquisition

Online Analysis

Result Presentation

(Re)deployment

Knowledge Extraction

Stream Persistency

DE IDE

Knowledge Extraction
SickKids (a)
SickKids (a)

• Clinical research into new earlier onset detection of LONS.
• 174 patients, representing 4.1 patient years of data.
• Currently supporting eight concurrent patients and collecting approximately 1250 readings a second
WIHRI

- Clinical research into neonatal instability
- Enrolled 203 patients, representing 10.6 patient years of data
- Spot readings every minute
• Clinical research into new earlier onset detection of LONS.
• Nearly two years of 30 second spot reading data
• Obtained from 1151 patients
Conclusion

• Artemis provides clinical decision support in a flexible and transparent manner and instantiate clinical knowledge into the information processing pathway.

• This is in direct contrast to many CDSSs based on complex mathematical processing, such as artificial neural networks, which from the clinicians’ viewpoint operate as black boxes
Future Work

• Artemis has quickly become ubiquitous as it is used to support the clinical research
• Clinical result publication is pending
• We are currently installing Artemis in two NICUs in China to support cross cultural clinical research
• We expanding the clinical research studies
Political Map of the World, April 2007
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