A Universal Exchange Language for Healthcare
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Abstract
We have defined a Universal Exchange Language (UEL) for healthcare that takes a green field approach to the development of a novel “XML-like” language. We consider here what given a free hand might mean: a UEL that incorporates an advanced mathematical foundation that uses Dirac’s notation and algebra. For consented and public information, it allows probabilistic inference from UEL semantic web triplet tags. But also it is possible to use similar thinking to maximize the security and analytic characteristics of private health data by disaggregating or “shredding” it. Both are scalable to millions of records that could be spread across the Internet.

Keywords: standards; probability; semantics; information storage and retrieval; privacy; clinical decision support systems; data mining; metadata

Example Probabilistic Semantic Rule for Inference
Tag name is always the software and version that wrote the tag.

Association constant P(A&B)/P(A)P(B) for this data, along with Pfwd and Pbwd, allows calculation of almost all epidemiological and EBM measures such as relative risk, odds ratios and number needed to treat/harm.

Collections of these rules can form a probabilistic knowledge network. With the proposed mathematical basis, cyclic paths do not require iteration.

Advantages Of Dirac Nets Over Bayes Nets
- Bidirectional: the same net establishes probabilities of consequences and causes.
- Establishes coherence by satisfying Bayes Theorem P(A&B)/P(B)P(A); by seeing only in one direction, Bayes Nets can’t!
- Allow cyclic paths, fast without iteration.
- Allow all forms of basic logic including negation operator, predicate logic, and higher logic
- Can express the existential (“some”) and universal (“all”) cases of semantics.
- Networks are expressions in the algebra of quantum mechanics with vectors as probability distributions and operators as probability density matrices, so indeterminacy can be handled richly in classical ways.
- Use quantum mechanical algebra as metarules allows use of semantic laws like syllogisms, generating new or substitution statements, and so evolve the network with addition of new information.

Component Example Example Example Example

Delimiters 
< | >

Attributes 
male nominal categorical data can stand alone.

cardiovascular:= ‘blood pressure (mmHg) (GMT Sat Jan 19 16:36: 54 2013)’ := (systolic:=140 +/-7CI), diastolic:= 80+/-6CI)
Pfwd:=0.6 The probability of the statement in the direction as read (default=1).
Pbwd:=0.3 The probability of the statement in the direction as read in the inverse (default=1)

Internal Operators 
and, or, not Default whitespace implies and.

AND, OR, NOT Operators can be used between tags

References
1. PCAST, “Realizing the Full Potential of Health IT to Improve Healthcare for Americans: The Path Forward.”, 2010.