Objective application scope

Medical innovations have become an important lever inquest of improving efficiency.

- **The main purpose is to improve the efficiency so that more patients could receive treatment more quickly without reducing the quality of care**
- **Health care system**

  -High Demand ahead

  -Social service dependency on Volunteers

-To high light the important on having user emotion be computed model and aligned with other knowledge related alignment (objectives) to have an integrated reasoning that reflect cognitive reasoning based on subjective articulated specialization (profile, personality) of the user.

-Give an outline of semantic Similarity model using alignment

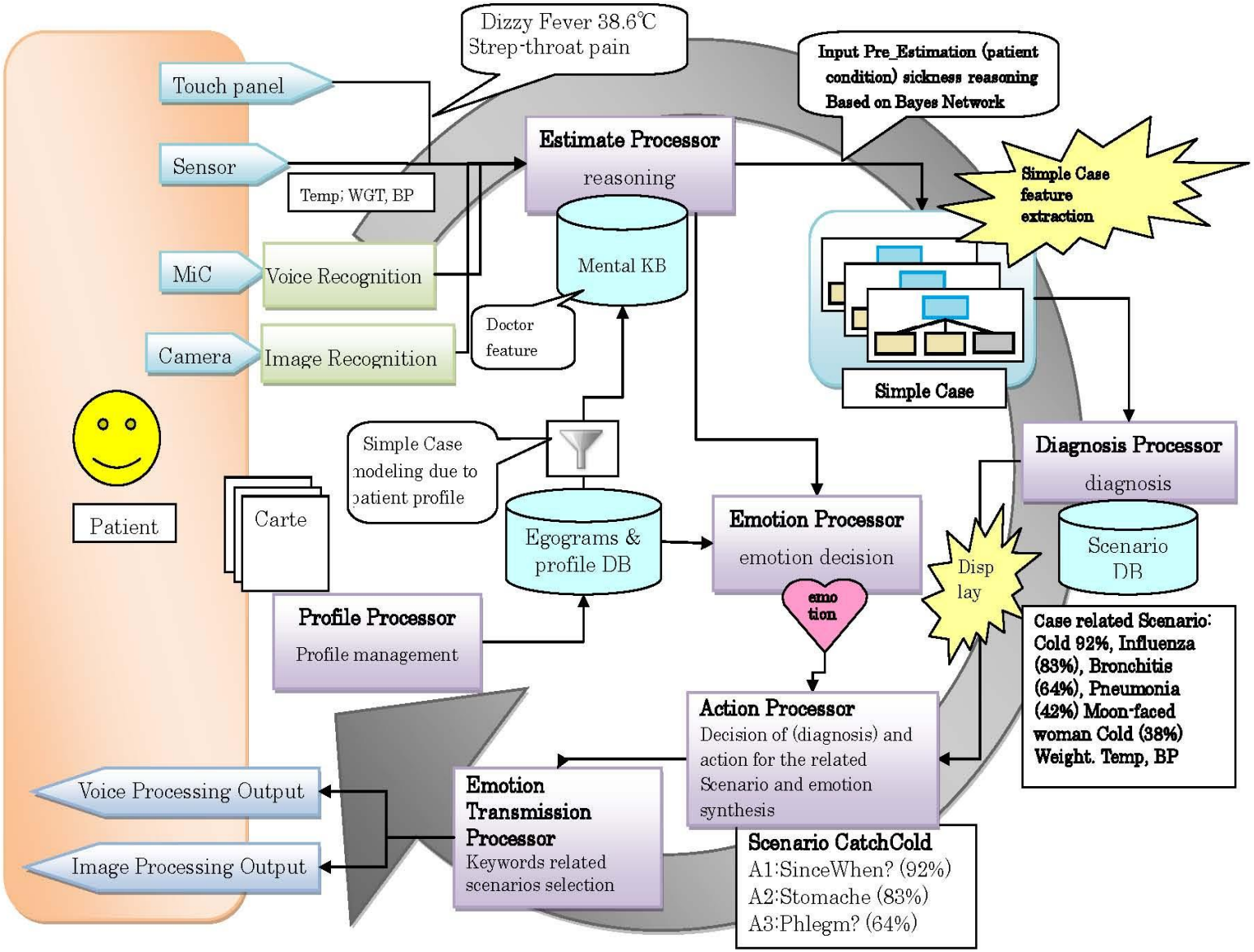
-Reflect on inference and knowledge based system state of art
On using Semantic net representation, and reasoning on Naïve Bayesian network, with a case study.

-To present an example of built system: Kenji System, and VDS as an example using above technology

-an example using project that we carried on with KDDI on mobile service based on user mental alignment

utilize **the case based reasoning** system which imitates human thinking abilities, combines with data mining methods to select eigenvectors with high importance, confirm the weight of attributes impersonally, evaluate the **similarities of the target case and the original case accurately**, and meanwhile distilling the potential rules from the selection results, thus improves the accuracy and efficiency of the decision-making of the medical diagnosis supplier selection.

Use Narrative Based reasoning to instantiate the medical guidelines. Converting the text of patient into concepts based on taken out subject of sentence and then object of the a sentence. Then define the similarity Based on similar reasoning as CBR. (this is not yet done in practice), however we have the idea!!


Dizzy Fever 38.6℃
Strep-throat pain
Input Pre_Estimation (patient condition) sickness reasoning Based on Bayes Network
Touch panel
Sensor
Temp; WGT, BP
Estimate Processor
reasoning
Simple Case feature extraction
MiC
Voice Recognition
Mental KB
Doctor feature
Camera
Image Recognition
Simple Case
Simple Case modeling due to patient profile
Diagnosis Processor
diagnosis
Patient
Carte
Egograms & profile DB
Emotion Processor
emotion decision
Disp lay
Scenario DB
emo tion
Profile Processor
Profile management
Case related Scenario: Cold 92%, Influenza (83%), Bronchitis (64%), Pneumonia (42%) Moon-faced woman Cold (38%) Weight. Temp, BP
Action Processor
Decision of (diagnosis) and action for the related Scenario and emotion synthesis
Voice Processing Output
Image Processing Output
Emotion Transmission Processor
Keywords related scenarios selection
Scenario CatchCold
A1:SinceWhen? (92%)
A2:Stomache (83%)
A3:Phlegm? (64%)

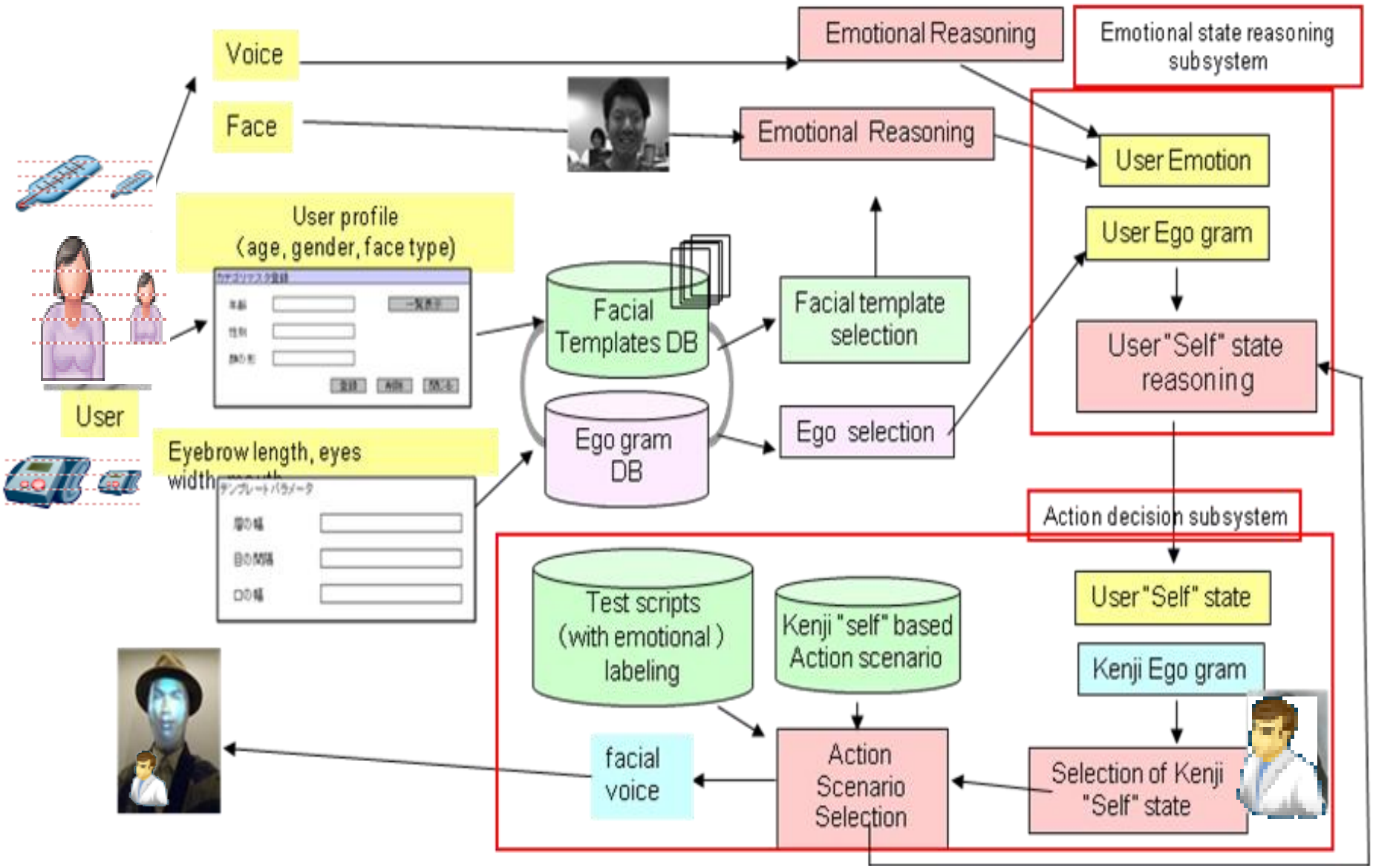


Fig. 4: The implemented system outline

Semantic similarity measurement

- How close are two entities to each other conceptually?
- Value between 0 and 1:
  - '0' => no similarity
  - '1' => both entities are equal
- Different measurement theories.
- Domain knowledge be formalized: taxonomic and non-taxonomic relationships(semantic links graphs), is-a, has-a
- Shortest path between two concepts <-Similarity: or minimum number of links. Sim(c1,c2)=2*N3/(N1+N2+2*N3)

N1,N2 #of is-a links to the least common subsumer(LCS), N3 is # of is-a from LCS to the root ontology.

Feature-based models

Common elements approach

- Two entities (stimuli) are similar if they have common features (elements).
- The more elements they share, the more similar the stimuli are.
- Problem: always possible to find endless amount of common elements depending on the view.

Contrast model

$$S(A,B) = q \cdot f \cdot (A \cap B) - a \cdot f \cdot (A - B) - b \cdot f \cdot (B - A)$$

- q, a, b … weights for common / distinctive features
- (A∩B) … number of features that A and B have in common
- (A-B) … features possessed by A but not B
- (B-A) … features possessed by B but not A

Asymmetric because a is not constrained to be equal to b nor f(A-B) to f(B-A).

- Similarity is normalized => S between 0 and 1.

$$S(a,b) = \frac{f(A \cap B)}{f(A \cap B) + \alpha * f(A - B) + \beta * f(B - A)}$$

- Mental View Ontology
  specify and reason on mental behavior of the patinet:

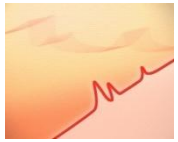
TypeFear:(Type_Age:20th, Type_Gender:male, Meta_Type_perosnality),

pain (user): stereo type {disgust (attribute), (sad (attribute)), neutral(attribute)}, patient physiological stat(ego gram).

- Physical View Ontology

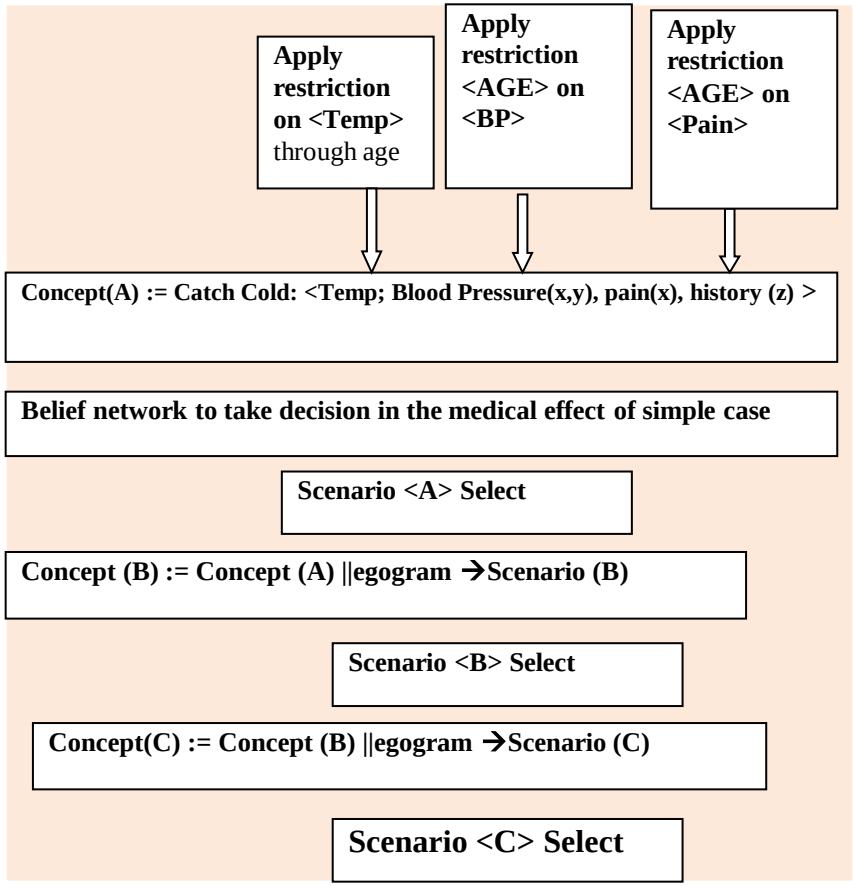
Specify the physical status of the patient,

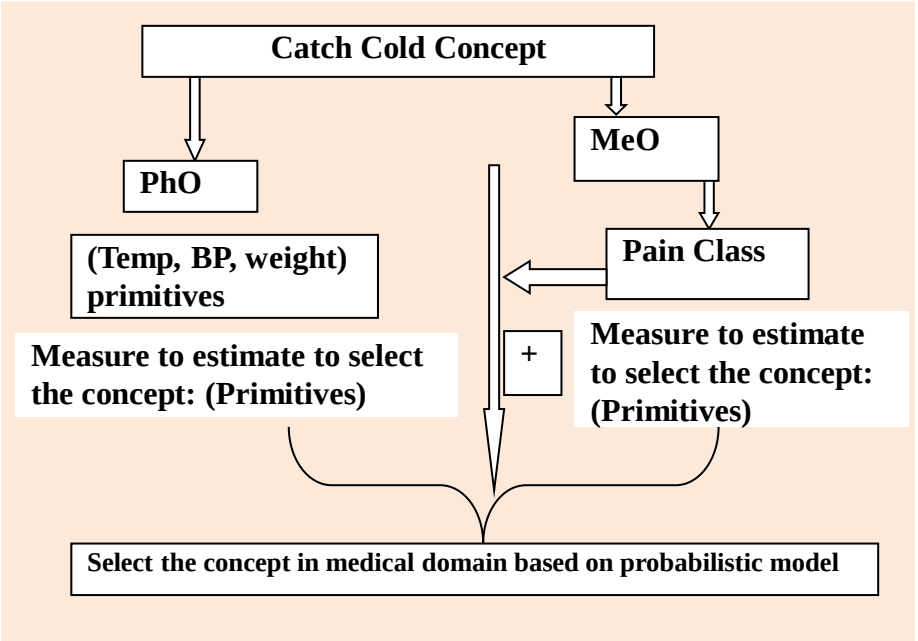
Weight(real), temperature(real), tall, blood_pressure(x,y), BMI(real), BSA(real), IBW(real), previous diagnosis data(if any).



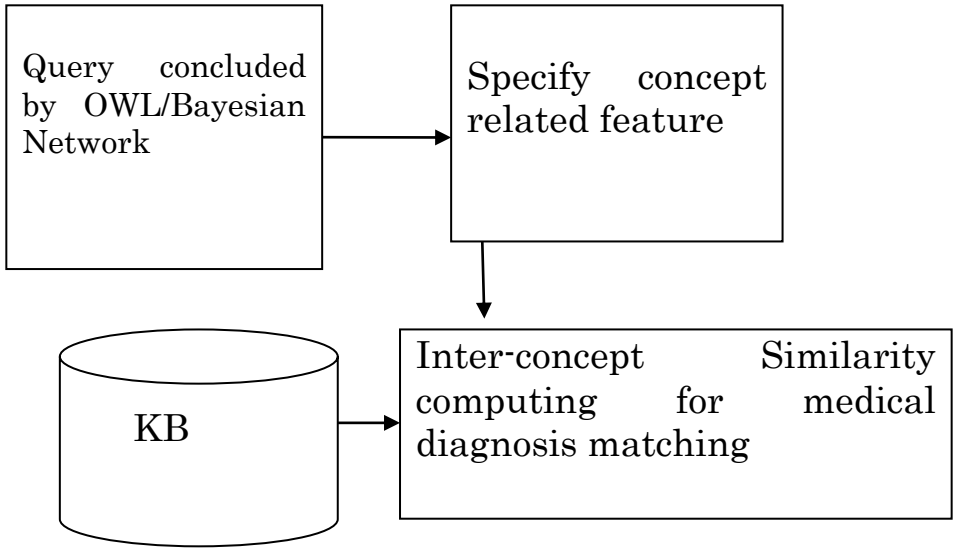
Ci= (w1i,…, wni) where *wji* describe the significance of the medical description *j* synthesizing certain medical concept *i*.

This weight is between [0, 1].





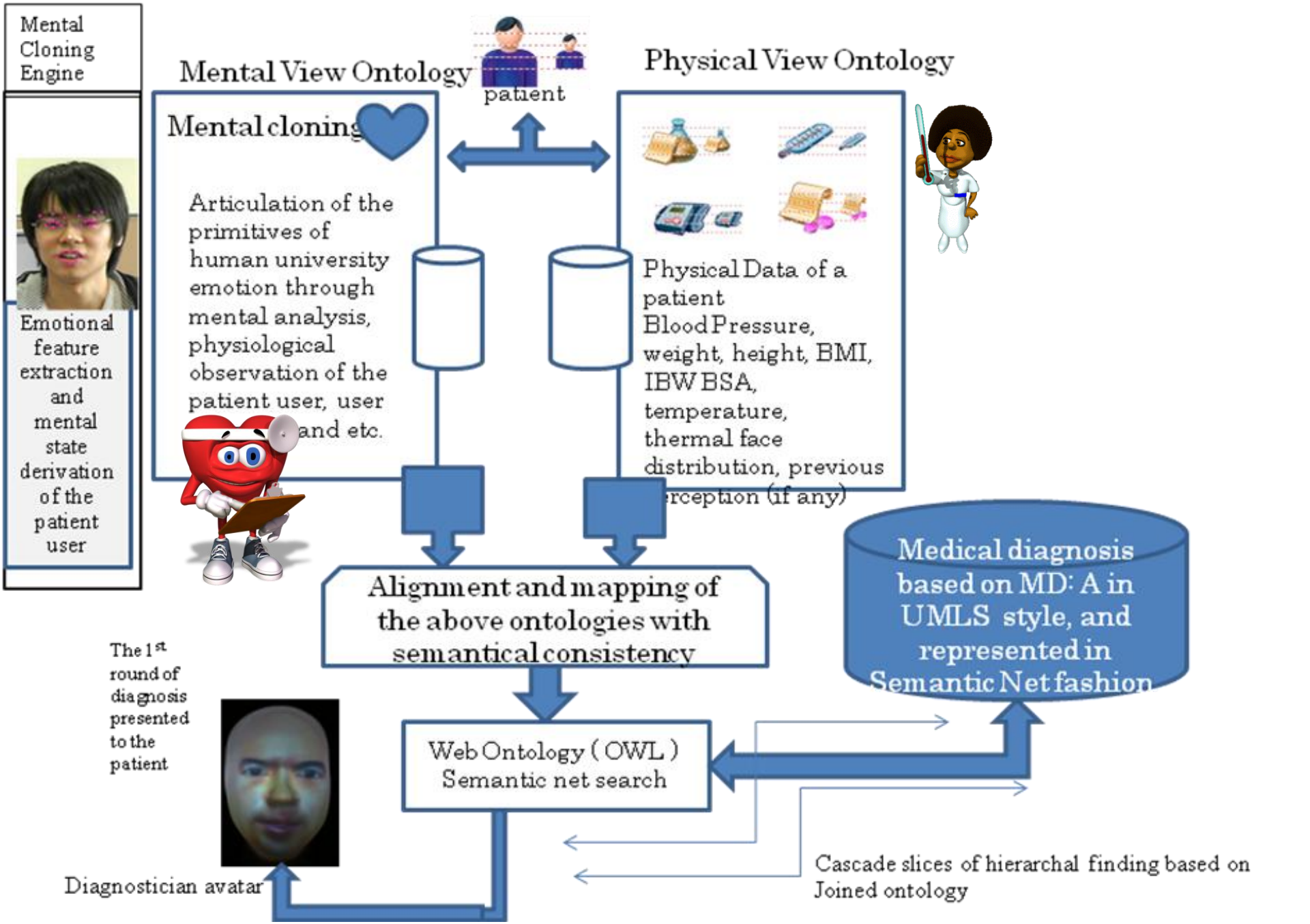
Set of concepts reflect ontology related to either physical or mental.
Set of concepts SET(C)domain = { M1SET(C)/ C1,….., MdomainSET(C)/ C1}

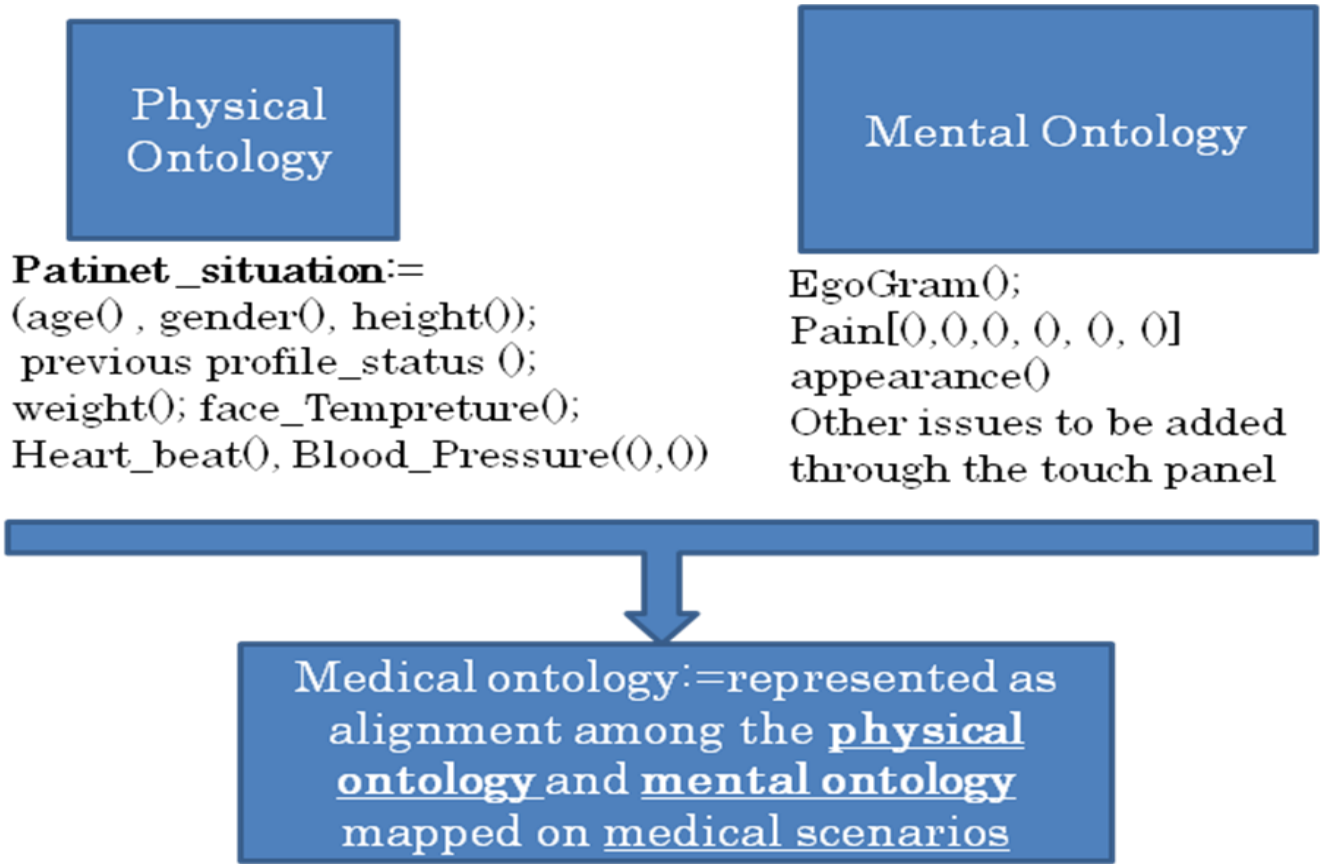


Inter_Concept Similarity computing framework

The alignment is an approach this providing such pairing or association based similarity. It is based on medical knowledge.

Hungarian methods computes the best pairing to achieve computable associated similarity.


Mental Cloning Engine
Emotional feature extraction and mental state derivation of the patient user
Mental View Ontology
patient
Physical View Ontology
Mental cloning
Articulation of the primitives of human university emotion through mental analysis, physiological observation of the patient user, user and etc.
Physical Data of a patient Blood Pressure, weight, height, BMI, IBW BSA, temperature, thermal face distribution, previous
rception (if any)
Alignment and mapping of the above ontologies with semantical consistency
Medical diagnosis based on MD: A in UMLS style, and represented in Semantic Net fashion
The 1st round of diagnosis presented to the patient
Web Ontology (OWL) Semantic net search
Diagnostician avatar
Cascade slices of hierarchal finding based on Joined ontology



the “alignment ontology” consists of axioms merging classes, individuals and properties. Uses Jena Ontology API

We develop ontologies that collected from categorized classes diagnosis: that reflected from real medical practices; classified as: Simple_Class, non-Simple_class

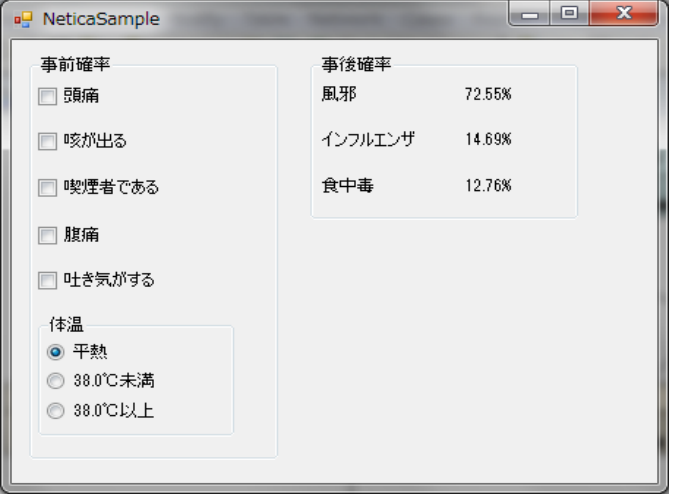
Simple Class:= defined as medical diagnosis relative scenarios that do not lead to criticize
Patient routine life-style: These are modeled by rdfs, and owl.

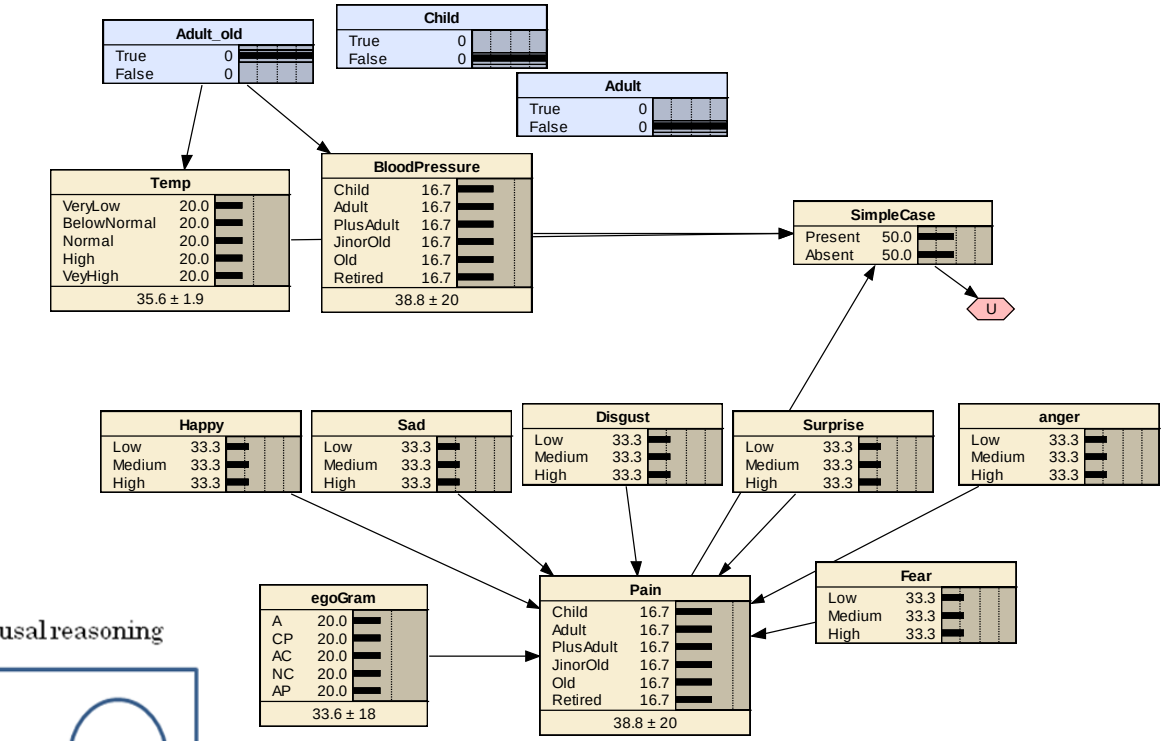
Simple Case: Catch Cold: = reconciliation of two Super Class:
Physical, Super Class: Mental SuperClass

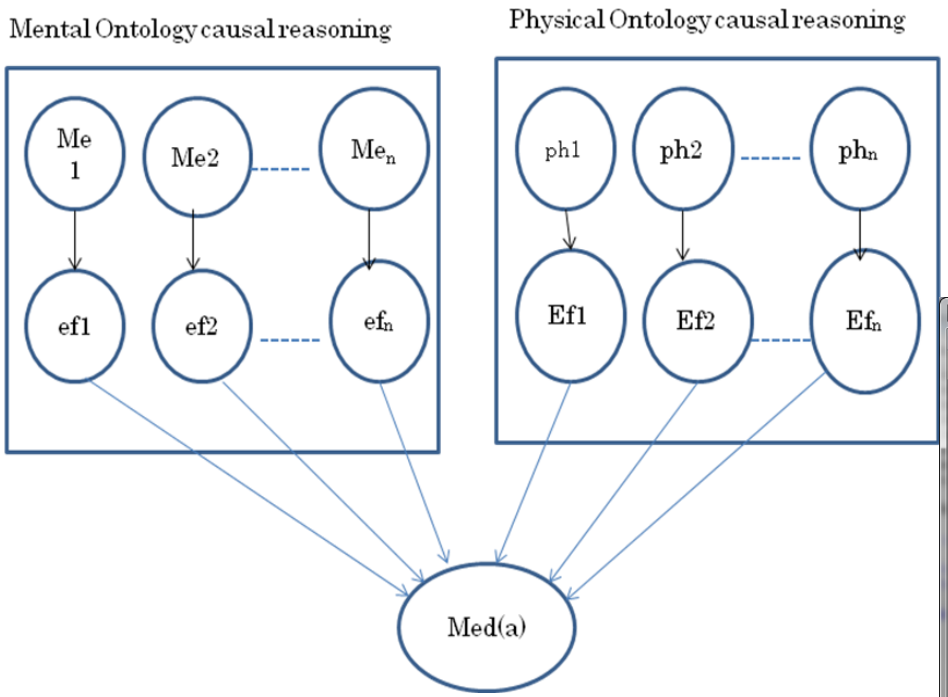
Eg: Simple cases analysis: Catch Cold: Physical Property: mild Type Fever, Mental Property: Tired:=(diguestState(50%), SadState(30%), depressedState(20%))

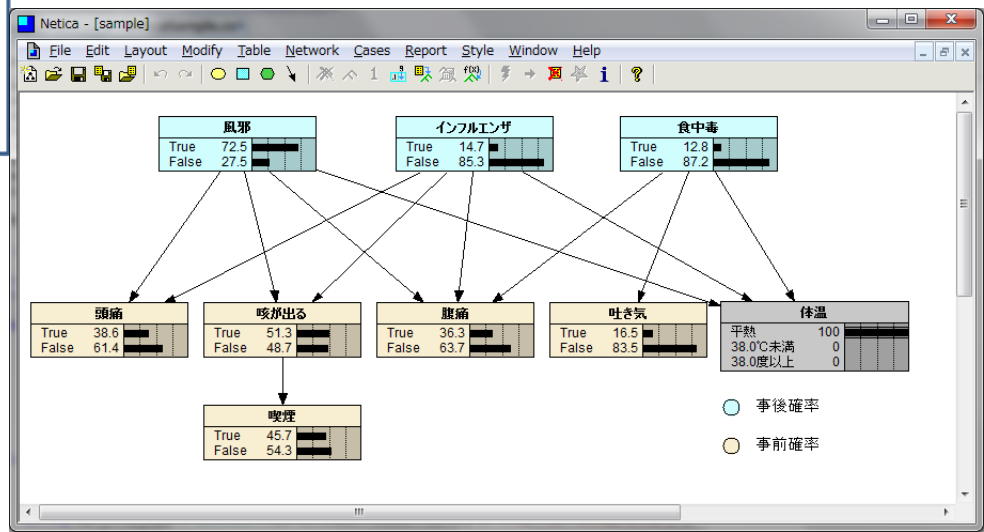
These states decision related values are fuzzy values and inferred from data set reflected
to emotional recognition.

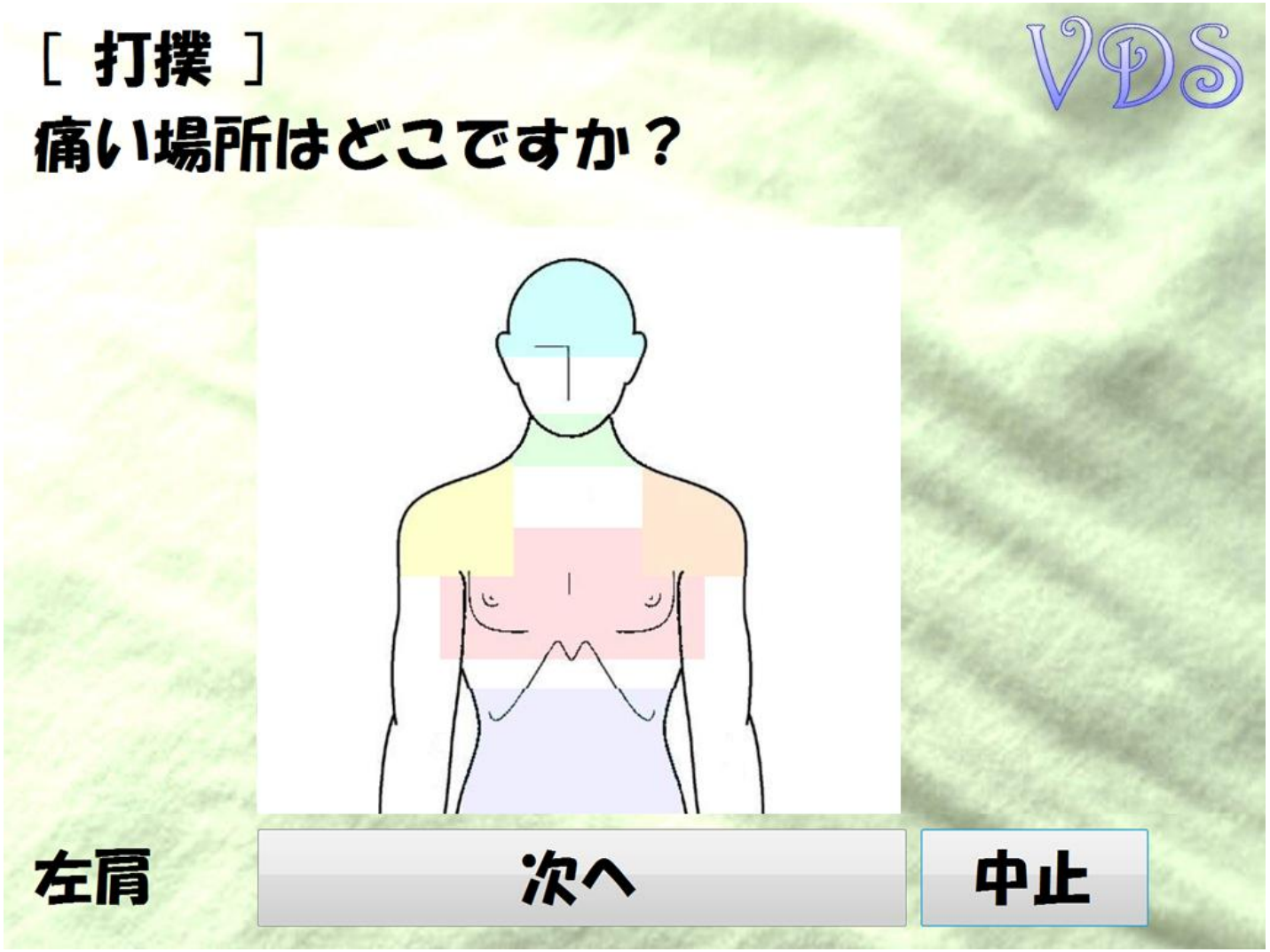
Computational intelligence related approach is by using correlation matrix, Specifying the alignment as positive and negative in relation to the medical knowledge articulated on threshold values submitted by medical doctors These threshold values are relative to nominated MD.


NeticaSample
事前確率
頭痛
咳が出る
喫煙者である
腹痛
吐き気がする
体温
平熱
38.0℃未満
38.0℃以上
事後確率
風邪 72.55%
インフルエンザ 14.69%
食中毒 12.76%


Adult_old
True 0
False 0
Child
True 0
False 0
Adult
True 0
False 0
Temp
VeryLow 20.0
BelowNormal 20.0
Normal 20.0
High 20.0
VeyHigh 20.0
35.6 ± 1.9
BloodPressure
Child 16.7
Adult 16.7
PlusAdult 16.7
JinorOld 16.7
Old 16.7
Retired 16.7
38.8 ± 20
SimpleCase
Present 50.0
Absent 50.0
U
Happy
Low 33.3
Medium 33.3
High 33.3
Sad
Low 33.3
Medium 33.3
High 33.3
Disgust
Low 33.3
Medium 33.3
High 33.3
Surprise
Low 33.3
Medium 33.3
High 33.3
anger
Low 33.3
Medium 33.3
High 33.3
egoGram
A 20.0
CP 20.0
AC 20.0
NC 20.0
AP 20.0
33.6 ± 18
Pain
Child 16.7
Adult 16.7
PlusAdult 16.7
JinorOld 16.7
Old 16.7
Retired 16.7
38.8 ± 20
Fear
Low 33.3
Medium 33.3
High 33.3


Mental Ontology causal reasoning
Physical Ontology causal reasoning
Me 1
Me2
Me_n
ef1
ef2
ef_n
ph1
ph2
ph_n
Ef1
Ef2
Ef_n
Med(a)


Netica - [sample]
File Edit Layout Modify Table Network Cases Report Style Window Help
風邪
True 72.5
False 27.5
インフルエンザ
True 14.7
False 85.3
食中毒
True 12.8
False 87.2
頭痛
True 38.6
False 61.4
咳が出る
True 51.3
False 48.7
腹痛
True 36.3
False 63.7
吐き気
True 16.5
False 83.5
体温
平熱 100
38.0℃未満 0
38.0度以上 0
喫煙
True 45.7
False 54.3
事後確率
事前確率



A touch panel that patient can specify pain location and value as high, Med, low

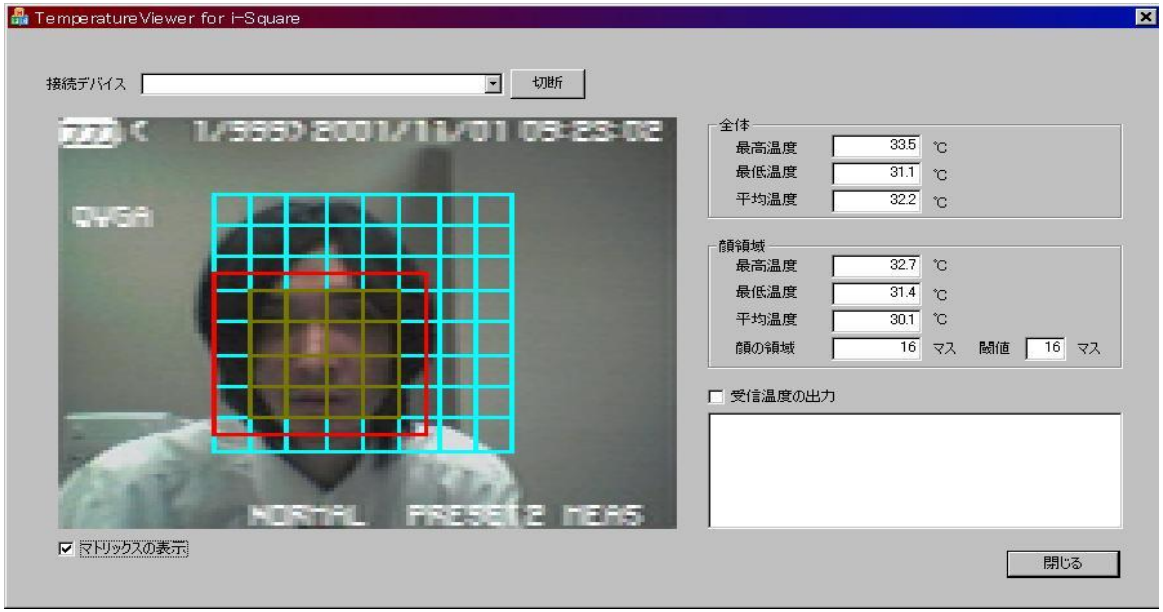







NO SIGNAL


SCOPE
バーチャル・ドクター・システム研究開発
岩手県立大学ソフトウェア情報学部藤田研
問診を開始します。開始と書かれている
部分をタッチしてください。
開始



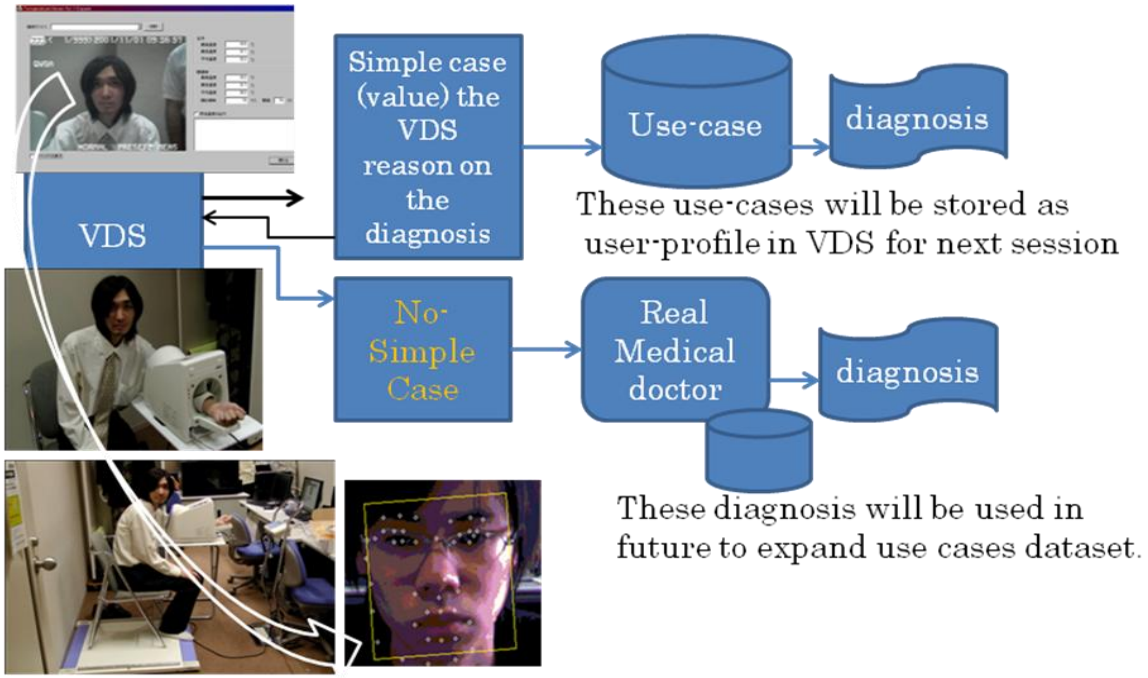


Figure 10: The physical ontology and VDS related simple case