

Medical expert system for early stage of chronic kidney disease (CKD)

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12-13 November 2016, Penang International Science Fair
SPICE Arena, Penang Malaysia

Medical Expert System for Early stage of Chronic Kidney Disease (CKD)

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Background of Work

- ▶ Raw data is meaningless: require techniques to extract information from it
 - Data: records facts
 - Information: presents patterns underlying the data
- ▶ Example: Medical report records numerous of raw data

Background of Work

- ▶ Machine learning (ML) is the subfield of computer science that gives computers the ability to learn without being explicitly programmed [1].
- ▶ It explores the study and construction of algorithms that can learn from and make predictions on data [2], e.g. algorithms overcome following strictly static program instructions by making data-driven predictions or decisions, through building a model from sample inputs.

[1] Phil Simon: Too Big to Ignore: The Business Case for Big Data. Wiley. 89, 2013.

[2] Ron Kohavi, Foster Provost: Glossary of terms. Machine Learning, 30, 271–274, 1998.

Background of Work

- ▶ ML evolved from the study of pattern recognition and computational learning theory in artificial intelligence.
- ▶ It is sometimes conflated with data mining, where the latter subfield focuses more on exploratory data analysis and is known as unsupervised learning**.

** Unsupervised learning is the machine learning task of inferring a function to describe hidden structure from unlabeled data. Since the examples given to the learner are unlabeled, there is no error or reward signal to evaluate a potential solution – this distinguishes unsupervised learning from supervised learning and reinforcement learning.

Background of Work


- ▶ In artificial intelligence context, an Expert System (ES) is a computer system that emulates the decision-making ability of a human expert.
- ▶ ESs are designed to solve complex problems by reasoning about knowledge, represented primarily as if-then rules rather than through conventional procedural code.

Medical Expert System (MES) – Early stage of Chronic Kidney Disease (CKD)

A Machine Learning-based System by School of Science and Technology (SST), Wawasan Open University (WOU) : Version 1.1.0.20161013

Please enter required information: -

Age (numerical in years):	55
Blood Pressure (numerical in mm/Hg):	190
Specific Gravity:	<input type="text"/>
Albumin:	<input type="text"/>
Sugar:	4
Red Blood Cells:	<input type="text"/>
Pus Cell:	<input type="text"/>
Pus Cell Clumps:	<input type="text"/>
Bacteria	present
Blood Glucose (numerical in mgs/dl):	<input type="text"/>
Blood Urea (numerical in mgs/dl):	<input type="text"/>
Serum Creatinine (numerical in mgs/dl):	<input type="text"/>
Sodium (numerical in mEq/L):	<input type="text"/>
Potassium (numerical in mEq/L):	<input type="text"/>
Hemoglobin (numerical in gms):	<input type="text"/>
Packed Cell Volume (numerical):	<input type="text"/>
White Blood Cell Count (numerical):	<input type="text"/>
Red Blood Cell Count (numerical):	<input type="text"/>
Hypertension:	<input type="text"/>
Diabetes Mellitus:	yes
Coronary Artery Disease:	yes
Appetite:	poor
Pedal Edema:	yes
Anemia	no




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Medical Expert System for
Early stage of Chronic Kidney Disease
(CKD) Diagnosis

It analyzes the located historical data, and produces an inferred function which can be used for mapping your inputs from screen.

Your prediction result: -



System messages: -

```

=== 10-fold Cross-validation in data analysing ===
Correctly Classified Instances 397 99.25 %
Incorrectly Classified Instances 3 0.75 %
Kappa statistic 0.984
Mean absolute error 0.0223
Root mean squared error 0.0799
Relative absolute error 4.7596 %
Root relative squared error 16.5087 %
Total Number of Instances 400

Thu Oct 13 14:32:44 SGT 2016
Received inputs: [55, 190, ?, ?, 4, ?, ?, present, ?, ?, ?, ?, ?, ?, ?,
yes, yes, poor, yes, no, ?]
                    
```

CKD depicts conditions that damage kidneys and decrease their ability to keep our health by doing the jobs listed [1].

[1] <https://www.kidney.org/kidneydisease/aboutckd>

Medical Expert System (MES)

- ▶ MES Research Context (Scope of Study):
 - CKD described by many known and unknown facts (also named as *features* in the context of ML)
- ▶ Research Problem:
 - Selection of known facts that cause CKD
- ▶ Research Data:
 - Many laboratory results and test outcomes
- ▶ Research Outcomes:
 - Prediction based on selected *features* from user

Medical Expert System (MES)

- ▶ MES learned from a set of historical data (obtained from a hospital), and able to make prediction based on user inputs on the screen.
- ▶ It emulates the decision-making ability of an medical expert in hospital in the absence of any medical representative.

Medical Expert System (MES)

- ▶ All data entries are optional. ML algorithm will handle those blank inputs as the missing data in prediction process
- ▶ Data fields show samples of laboratory results and test outcomes from a medical report
- ▶ Predict Input: Click on the button after completing data entries
- ▶ Update Knowledge: Click on the button after altering historical data for the system
- ▶ System Messages: It show the output of the said data predicting and knowledge updating processes

Medical Expert System (MES)

- On the screenshot, 99.25% shows the three (3) correctness of Machine Learning updating its knowledge based on the given historical data.

Note that only 3 out of 400 records were wrongly predicted in the testing environment.

