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

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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
  - ◦ <u>Data</u>: records facts
  - ◦ <u>Information</u>: 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.

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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.

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

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 know 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.

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Medical Expert System (MES)

- All data entries are <u>optional</u>. 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

- <u>Predict Input</u>: Click on the button after completing data entries

- <u>Update Knowledge</u>: Click on the button after altering historical data for the system

- <u>System Messages</u>: 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.

Data input
From users

MES

Predicted results

Knowledge
updating
Process data

From past
Medical data

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