**Doctors Assistant Program Continued**

New Mexico

Supercomputing Challenge

Final Report

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Team # 70

Taos High School

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**Executive Summary**

This year, the team continued a project started last year called the Doctor’s Assistant Program. The program’s goal was to provide an initial prediction of an ailment that the patient had based on symptom information gathered through natural conversation. This program would then send the data to a doctor, who could consult the symptoms and give a more accurate diagnosis if needed. The program continues to use yes and no questions to gather a collection of responses to produce a diagnosis. If the patient exhibits multiple symptoms relating to a specific ailment, the program will inform the doctor the program’s predicted ailment.

This year, the team created a functioning and expandable database attached to a UI. The purpose of the database was to increase the functionality and scope of the Doctor’s Assistant Program. These additions furthered the development of the program.

**Problem Statement**

In the medical fields, misdiagnosis is an ongoing issue especially during pandemics. Even though misdiagnosis has been an issue for years, in 2020 inaccuracy can be disastrous. The outbreak of COVID-19 has made it even more imperative that medical professionals are as precise as possible. Medical emergencies cause doctors to spread thin, decreasing precision. A few years ago, the Washington Post wrote “[m]ore than 20 percent of patients who sought a second opinion at one of the nation’s premier medical institutions had been misdiagnosed by their primary care providers, according to new research published” (Bernstein, Lenny). Now more than ever, precise diagnoses can be the difference between containing a disease or spreading it to more people, whether in a pandemic or not. The rates below represent America’s diagnosis rates in 2017 (Fig.1).]

**Method**

The team continued this project from last year, in which we addressed the problem of medical misdiagnoses by building a simple program to diagnose illnesses. This first version of the program was very limited in scope. It could diagnose only five illnesses based on a set of basic nested if/else loops. This system, while easy to write and deploy, was inefficient and inextensible. This year, to address these issues, the team completely rewrote the program by creating a diagnosis engine which ran on a server-client model. Diagnosis data was stored in a fully extensible SQL database that could be easily and efficiently updated and reorganized. The diagnosis engine was reengineered with more flexibility. Both the engine and client application were written in Python 3.8.1. The server was built using python and MySQL Community 2019 on an Ubuntu 18.04 LTS server.

The purpose of the UI was to give the program a proper interface that is user friendly and doesn’t run from the command window. The UI wasn’t nearly as important as the database. But for those interested the UI was made in the Python module Kivy. Kivy uses .kv files to define the pieces of the UI: buttons, text boxes, inputs, etc. Using these files, Kivy builds a interface for the user, connecting the user to the software for patient and doctor use.

One important element of the project was the supporting medical information and data. Information about diseases and symptoms stored within the program are sourced from the Mayo Clinic, the US National Library of Medicine, Harvard Health, The CDC and Oxford Medicine Online. Although our production of algorithms was halted, the plan remains. Our plan would have used highly coveted sanitized medical records to create algorithms. An example of our research would be our knowledge on hyperlipidemia provided by the mayo clinic, which states that hyperlipidemia “has no symptoms. A blood test is the only way to detect if you have it” (High cholesterol), 2019, July 13.

**Verifying Models**

Due to the sensitive nature of medical information, the team was unable to test their model in a clinical environment. The team made plans to search for professional assistance, but the pandemic of COVID-19 set professionals' eyes on more important matters. In limited hypothetical testing, results from the program were consistent with both publicly available anonymous medical records and anecdotal evidence.

The team started by creating a patient that experienced a scratchy throat, swollen tonsils, and difficulty swallowing. The program predicted the patient had a sore throat, likely suffering from Acute Laryngopharyngitis. The team saw this to match up three of the seven symptoms in the database “pain or a scratchy sensation in the throat, pain that worsens with swallowing or talking, difficulty swallowing, sore, swollen glands in your neck or jaw, swollen, red tonsils, white patches or pus on your tonsils, a hoarse or muffled voice” (Mayo Clinic, 2020).

The team then wished to try an entirely different ailment. The patient had a constant urge to use the bathroom, a burning sensation while urinating, and cloudy urine that had a strong smell. The database matched with four of the six symptoms of Urinary Tract Infection in males, seven in females (Harber, 2020), making UTI a likely ailment.

The team wanted to then give the program a more difficult case to diagnose. This hypothetical patient experienced a runny nose, a sore throat, and a postnasal drip. These symptoms meet similar criteria to Hay Fever, and Acute Sinusitis. The difference between these two ailments is coughing, which the patient did not experience. This means the patient shows a higher chance of Acute Sinusitis. The program detected that the patient did not experience coughing and diagnosed the patient with Acute Sinusitis.

**Results**

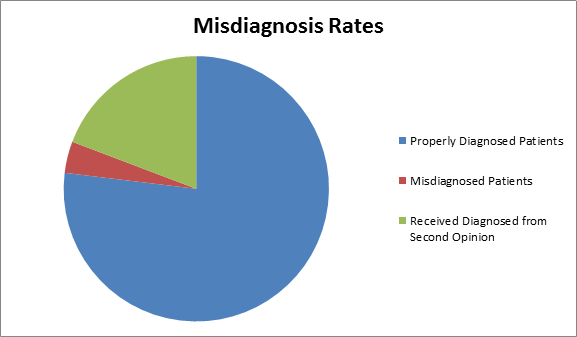
The program can take in basic inputs and can diagnose a patient as an output. However, this is not the full function of the program. Due to the outbreak of COVID 19, the program’s development was stunted. The system provided information that were consistent with expectations while maintaining acceptable stability within a limited testing environment. The program got rewritten and updated to work with GitHub but wasn’t finished due to the pandemic.

**Conclusions**

The new version of the Doctor’s Assistant Program allows for a much broader scope of diagnosing through a constant expansion of the database. This addition allows the program to be applied to multiple fields of medicine like epidemiology and the treating of physical injuries. By expanding to different medicinal fields, the program could have a positive impact on misdiagnosis rates in multifarious fields of medicine. With the new addition the Doctor’s Assistant Program has come much closer to affecting the overall misdiagnosis rate.

**Software, References, Tables, and Other Products**

Fig. 1-2 – The 2017 misdiagnosis rates

Fig 1.

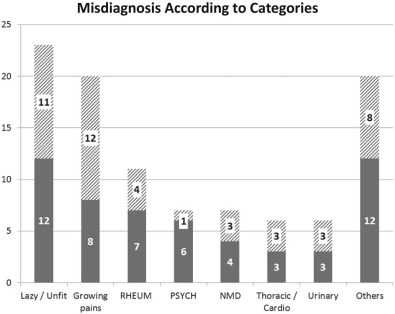
Fig 2.

Fig. 3 – SQl Server

Fig 3.

Fig. 4 – The UI

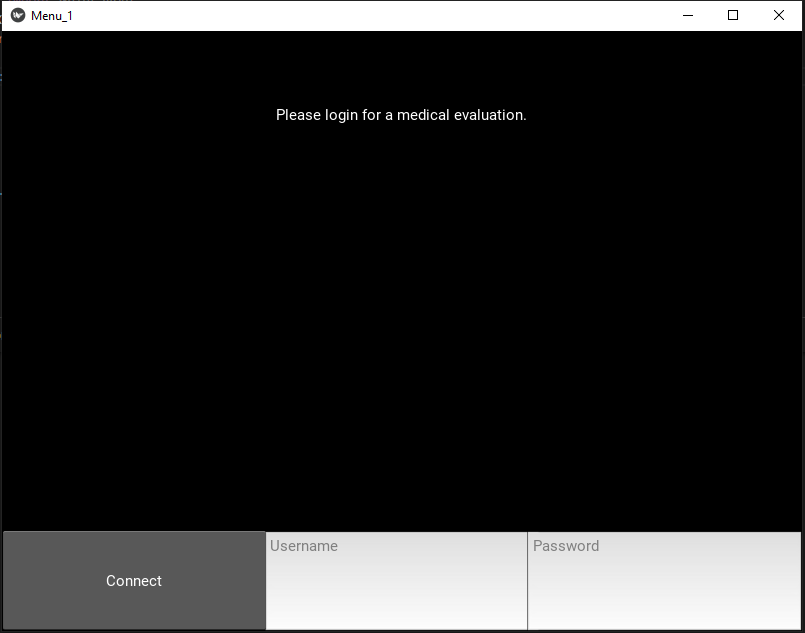
Fig 4.

Fig.5-6 – The end user client

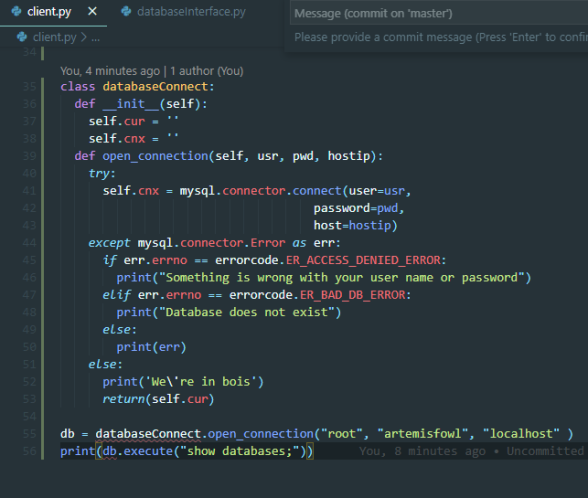
Fig 5.

Fig 6.

**Most Significant Achievement**

The most significant achievement is currently holding the team together during the COVID-19 pandemic. It became difficult to communicate effectively, so the team went to great measures to keep priorities straight. An allegorical representation of our experience would be repairing a submarine with scotch tape. This allowed for the team to work on specific parts of the program and report from a distance, also maintaining social distancing. The team continued to keep up to date on the program, allowing us to stay on track.

**Acknowledgments**

The team would like to thank their teacher Tracy Galligan for encouraging them to persevere through this confusing time. Especially during the COVID-19 outbreak, the team gained some much-needed guidance. The team thanks her for the effort she put in to organizing everyone’s participation and focuses for this year.

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