

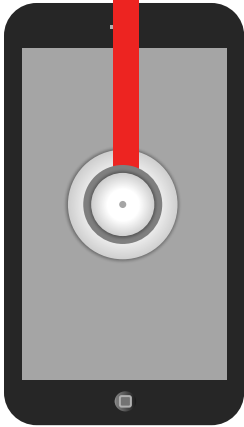


Group 18

# Healthcare Mining

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# Agenda



## 01 Introduction & Dataset Description

Covers the problem definition articulating the problem and the description of the dataset used by the team

## 02 Architecture & Algorithms

Gets a perspective of the proposed architecture of our system and the algorithms used for our project

## 03 User Interface

The team introduces you to the user interface of our website where the user searches for a query to get the desired results and more.

## 04 Evaluation

Evaluates our approach and mentions the timelines of the tasks in addition to Conclusion and Future Work

# Problem Definition and Motivation

checking your symptoms on google



## Unstructured Data

As we are aware, there are so many health forums, and platforms where we have data regarding healthcare but the question is how a user can benefit from such data? How are we using that data?



## Uncertainty from Forums

There are various platforms where users posts their queries and get responded by Doctors or other community members or by Google search but the question is how reliable are they?



## Pharmaceuticals

They can also be benefited. If they find out by performing analytics on the structured data that many patients are suffering from a specific kind of disease, they can focus efforts on a specific medicine and stock up the same at the time of an epidemic.



## Compiled Resources

Users can get all the information at one place. Instead of browsing through different forums and websites, we are providing all the relevant information compiled at one place to provide the potential results to the users.

# Dataset Description

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We used the following websites to scrape the data:



## **WebMD - Message Boards**

We used WebMD to extract the symptoms, diseases, and potential treatments. It has large number of forums posts useful for our data.



## **Mayo Clinic - Diseases and Conditions**

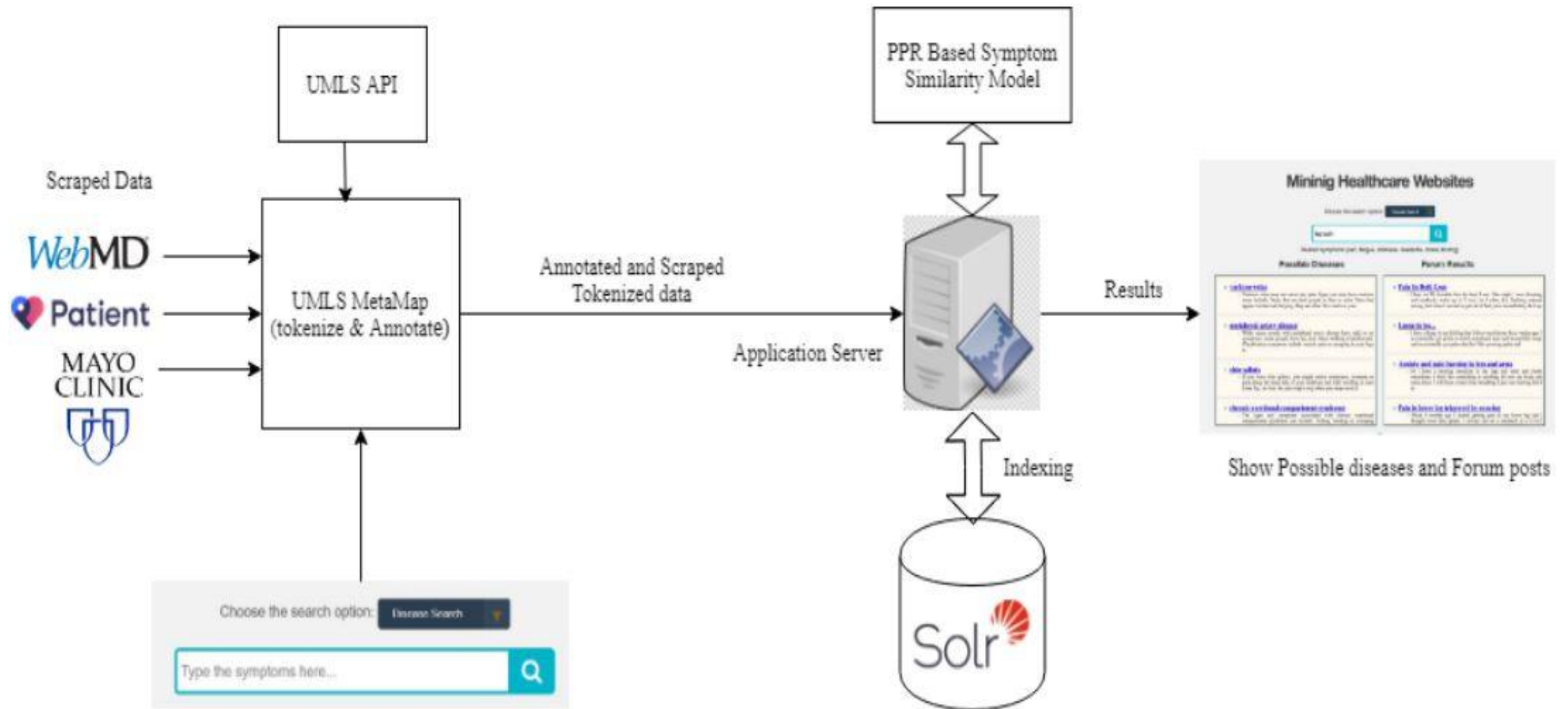
We crawled Mayo Clinic website to get the diseases and their descriptions, curated by experts and trusted all over the world.



## **Patient Info**

We crawled the Patient.info website, having active community forums that are extensively dedicated to healthcare related discussions (including symptoms and diseases).

# Proposed Architecture



# Proposed Algorithm

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## PPR Based Symptom Similarity Model

- ❖ Extracted symptoms from extracted patient.info forums using UMLS Metamap
- ❖ Created a symptom-symptom similarity matrix from the list of co-occurring symptoms
- ❖ Constructed a personalized pagerank graph using the above matrix with an 85% likelihood threshold(from the research paper introducing PPR)
- ❖ The server loads the graph from a pickle file(to reduce overhead) and returns a list of similar symptoms that occur together frequently as a cautionary message

## SOLR INDEXING for DRUGS, DISEASES, FORUMS

- ❖ Annotated extracted forums and drug reviews using UMLS Metamap
- ❖ Extracted symptoms and diseases for further use
- ❖ Indexed the data into Solr

# User Interface (Disease Search)

## Mininig Healthcare Websites

Choose the search option:

Disease Search



shortness of breath wheezing



Related Symptoms: pain, fatigue, coughing, dizziness, illness (finding)

### Possible Diseases

- [carcinoid-syndrome](#)

- The signs and symptoms of carcinoid syndrome depend on which chemicals the carcinoid tumor secretes into your bloodstream. The most common signs and symptoms include: Skin flushing. The skin on your ...
- Symptoms: Flushing, **Dyspnea**, Diarrhea, **Wheezing**, Abdominal Cramps, Respiratory distress

- [childhood-asthma](#)

- Common childhood asthma signs and symptoms include: Frequent coughing that worsens when your child has a viral infection, occurs while your child is asleep or is triggered by exercise or cold air A w...
- Symptoms: **Wheezing**, Coughing, **Dyspnea**, Fatigue, Difficulty sleeping, Sleep disturbances

- [bronchiolitis](#)

- For the first few days, the signs and symptoms of bronchiolitis are similar to those of a cold: Runny nose Stuffy nose Cough Slight fever (not always present) After this, there may be a week or more ...
- Symptoms: Coughing, **Wheezing**, **Dyspnea**, slight fever, Respiratory distress, Rhinorrhea

### Forum Results

- [Juice down the wrong pipe. Suffocating sensation. Wheezing sound.](#)

- I recently choked on watermelon juice (while eating and laughing simultaneously). I choked really bad. Ever since, I've been having a slight difficulty breathing (it feels as though something is stuck...
- Symptoms: **Wheezing**, **Dyspnea**, Coughing, Respiratory distress

- [Is this Athma??](#)

- Its a bit of a story, if anyone has had something slimier I would love to hear about it. I hope there is a light at the end of this tunnel. At the end of December I caught a nasty Bronchitis cold, it ...
- Symptoms: Coughing, **Dyspnea**, **Wheezing**, Catch - Finding of sensory dimension of pain

- [Asthma or not? Doctors aren't sure](#)

- Things that point to asthma: - Short of breath - Tight chest - Night gasping - Had eczema and hayfever growing up. - Ventolin relieves symptoms immediately. Things that say it is not asthma: - Prev...
- Symptoms: Coughing, **Dyspnea**, **Wheezing**, Symptoms, Gasping for breath, Chest tightness

# User Interface (Drug Search)

## Mininig Healthcare Websites

Choose the search option:

Drug Search



asthma



### Drug Results

- [Accolate](#)
  - ([Check user reviews](#))
- [Advair HFA Aerosol with Adapter](#)
  - ([Check user reviews](#))
- [Advair Diskus Blister, With Inhalation Device](#)
  - ([Check user reviews](#))
- [albuterol sulfate Vial for Nebulizer Beta-Adrenergic Agents Short-Acting \(Inhaled\)](#)
  - ([Check user reviews](#))
- [albuterol sulfate Tablet, Extended Release 12 hr](#)
  - ([Check user reviews](#))



# Evaluation & Metric

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- Randomly sampled 20 diseases and searched as per their symptoms
- in the next few slides we show a few results
- The results are verified manually by us, and the evaluation file can be found in github repo:
  - link: [https://github.com/hemantcs/SWMSpring20/blob/master/EVALUATIONS/healthcare\\_mining\\_evaluation\\_results.txt](https://github.com/hemantcs/SWMSpring20/blob/master/EVALUATIONS/healthcare_mining_evaluation_results.txt)
- Accuracy was around 65% for the number of symptoms checked

# Sample Result 1

Input text: i am a 40 year old man, i am suffering from shortness of breath, wheezing, pain

## Mininig Healthcare Websites

Choose the search option: Disease Search

Q

Related Symptoms: fatigue, dizziness, coughing, headache, illness (finding)

### Possible Diseases

- [exercise-induced-asthma](#)
  - Signs and symptoms of exercise-induced bronchoconstriction may begin during or soon after exercise. These symptoms may last for 60 minutes or longer if left untreated. The signs and symptoms may incl...
  - Symptoms: **Dyspnea**, **Pain**, Coughing, **Wheezing**, Fatigue, exercise induced, Chest tightness
- [heart-failure](#)
  - Heart failure Open pop-up dialog box Close Heart failure Heart failure Heart failure occurs when your heart muscle doesn't pump blood as well as it should. When your heart doesn't pump enough blood t...
  - Symptoms: **Dyspnea**, Edema, Chest Pain, Coughing, **Wheezing**, Nausea, Cyanosis, Fatigue, Persistent cough, Weakness
- [asthma](#)
  - Asthma symptoms vary from person to person. You may have infrequent asthma attacks, have symptoms only at certain times — such as when exercising — or have symptoms all the time. Asthma

### Forum Results

- [Am I being ridiculous?](#)
  - I've been anemic for about 10 months, but my doctor has only recently noticed that it is classified as "severe" anemia. The only reason this was discovered was because I've been to the ER due to feeli...
  - Symptoms: Dizziness, Vertigo, Chest Pain, **Dyspnea**, **Wheezing**, Chest tightness, Exhaustion, Respiratory distress, Symptoms
- [Is this Athma??](#)
  - Its a bit of a story, if anyone has had something slimier I would love to hear about it. I hope there is a light at the end of this tunnel. At the end of December I caught a nasty Bronchitis cold, it ...
  - Symptoms: Coughing, **Dyspnea**, **Wheezing**, Catch - Finding of sensory dimension of pain
- [Please help I might have heart failure](#)
  - My symptoms started with a cough and itchy throat and runny nose but now I feel fatigue that comes and goes and this keeps going for a month now also I have no appetite sometimes but that



# Sample Result 2

Input text: earache dizziness vertigo

## Mininig Healthcare Websites

Choose the search option: Disease Search

earache dizziness vertigo



Related Symptoms: pain, fatigue, headache, dizziness, tired

### Possible Diseases

- [earwax-blockage](#)
  - Signs and symptoms of earwax blockage may include: Earache Feeling of fullness in the affected ear Ringing or noises in the ear (tinnitus) Decreased hearing in the affected ear Dizziness Cough...
  - Symptoms: Earache, Dizziness, Vertigo, Coughing
- [airplane-ear](#)
  - Airplane ear can occur in one or both ears. Common signs and symptoms include: Moderate discomfort or pain in your ear Feeling of fullness or stuffiness in your ear Muffled hearing or slight to moder...
  - Symptoms: Vertigo, Earache, Aural pressure, Discomfort
- [ruptured-eardrum](#)
  - Signs and symptoms of a ruptured eardrum may include: Ear pain that may subside quickly Mucuslike, pus-filled or bloody drainage from your ear Hearing loss Ringing in your ear (tinnitus) Spinning sen...
  - Symptoms: Vertigo, Earache, Nausea, Vomiting, Pain of ear structure

### Forum Results

- [What should be my next step?](#)
  - About a year ago I was having pain inside my inner left ear. Thinking nothing of it, I went to work and figured it was just an ear infection. About an hour into work the pain shot down into my neck an...
  - Symptoms: Pain, Dizziness, Vertigo, Earache
- [ear trouble after using cotton swab](#)
  - About a week ago I used a cotton swab to clean my ears...(I now know this is a very bad idea and will never do it again) Unfortunately the swab wasn't completely on the stick and I felt a stab in my l...
  - Symptoms: Earache, Dizziness, ear popping
- [Ear Infection. Off Balance. Ciproflaxcin. Hole in ear as well](#)
  - Male. 30 years. Non smoker 1 month quit. No drugs or alch. 180 lbs. 5'9 inches. Los angeles CA Prior to may 17th. I had some ear pain. Slight clear smelly drainage. Small sharp pains off and on I



# Sample Result 3

Input text: kidney problem

## Mininig Healthcare Websites

Choose the search option: Disease Search

kidney problem



Related Symptoms: pain, fatigue, nausea, illness (finding), dizziness

### Possible Diseases

- [fetal-alcohol-syndrome](#)
  - The severity of fetal alcohol syndrome symptoms varies, with some children experiencing them to a far greater degree than others. Signs and symptoms of fetal alcohol syndrome may include any mix of p...
  - Symptoms: [Kidney problem](#), Forgetful, Feeling jittery
- [noonan-syndrome](#)
  - Signs and symptoms of Noonan syndrome vary greatly among individuals and may be mild to severe. Characteristics may be related to the specific gene containing the mutation. Facial features Facial app...
  - Symptoms: Edema, HEART PROBLEM, [Kidney problem](#), Rhinorrhea
- [mgus](#)
  - People with monoclonal gammopathy generally don't experience signs or symptoms. Some people may experience a rash or nerve problems, such as numbness or tingling. MGUS is usually detected by chance w

### Forum Results

- [Kidney Problems](#)
  - I have been referred to a specialist after a blood test. Diabetic for 27 years. Microalbumin should, I believe, be within range between 0.00 and 30.00 mg/l. Mine is 457 ! I understand that this indica...
  - Symptoms: [Kidney problem](#)
- [Possible Kidney Disease?](#)
  - So I went for a physical about a month ago and my blood work came back that my creatinine levels were a 1.22 which is only slightly over the highest normal level. My kidney function was only about 65%...
  - Symptoms: [Kidney problem](#)
- [Kidney issues](#)
  - Im asking for a friend she was beat up and punched in the stomach and kidneys and she is in alot of kidney pain and is peeing blood need any suggestions on this matter...
  - Symptoms: Renal pain, [Kidney problem](#)

# Conclusions & Future Work

## Step 1: User provides their Symptoms

Users have mentioned their symptoms. They want the first hand response to their illness.



Our Search Engine



## Step 2: Here are the results

We would display the diseases as the result of the search engine.

Q Shortness of breath

### Possible Diseases

[Asthma](#)  
Asthma is a condition in which your airways narrow and swell and produce extra mucus...

[Heart Failure](#)  
Heart failure, sometimes known as congestive heart failure, occurs when your heart muscle doesn't pump...

[Heart Arrhythmia](#)  
Heart rhythm problems (heart arrhythmias) occur when the electrical impulses that...

### Related Forums

[Shortness of breath](#)  
I am 6 months along, and experiencing a slight shortness of breath, it last for...

[Palpitations and short...](#)  
31 y/o female, 7 months postpartum, 3rd child, SOB with normal pulse, Pulse oximetry...

[weakness, fatigue & sh...](#)  
6 months pregnant and having a few shortness of breath that last for about 1/2 hr or...

## Step 3: Relevance Feedback

More information implies more knowledge about the user and increases the accuracy of the results

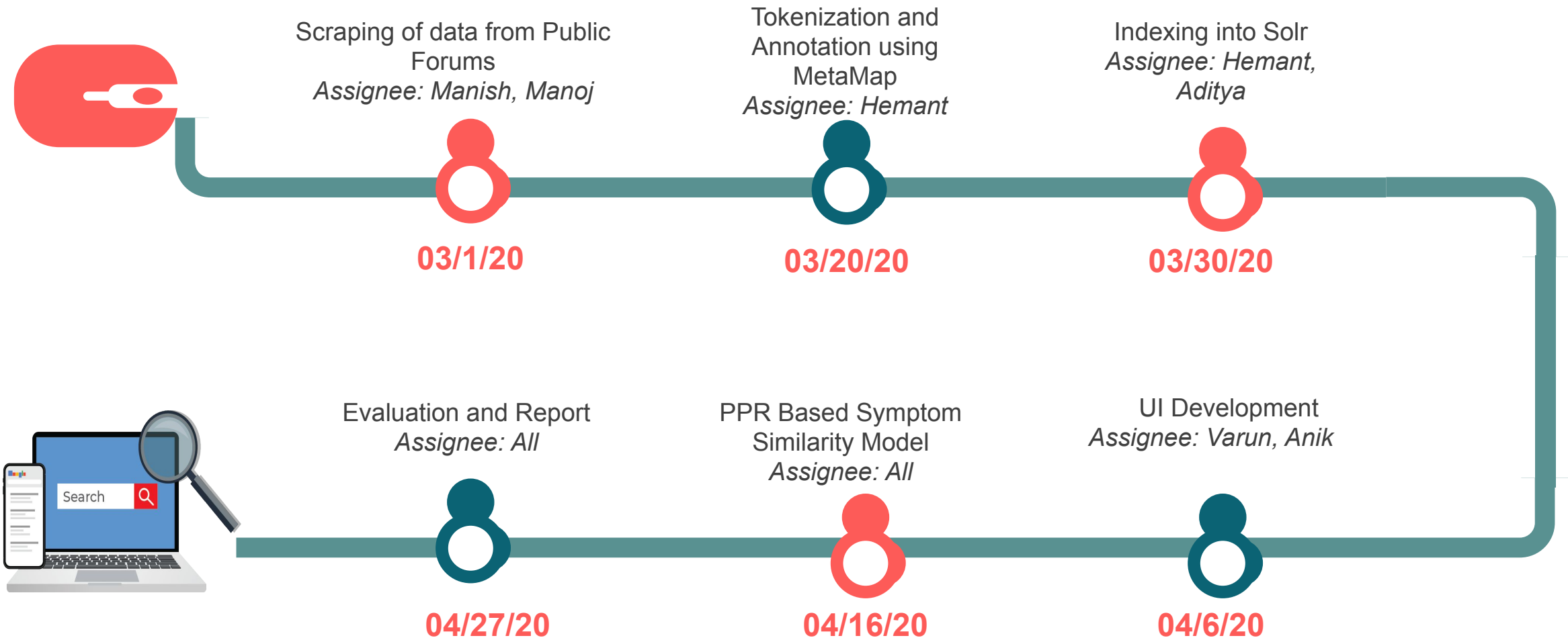


## Step 4: User Satisfaction

Once user provides more information, the results that user receives is specific and based on higher accuracy.



# Timeline & Division of Work



# References

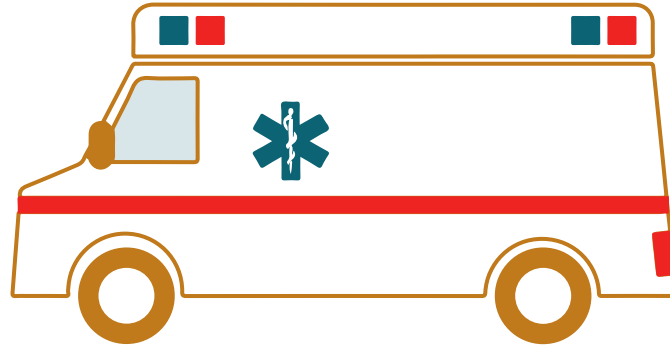
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2. Better Patient Outcomes through mining of Biomedical Big Data, Clemens Suter-Crazzolara. (2018). Front, ICT Article, <https://doi.org/10.3389/fict.2018.00030>
3. Jinhyuk Lee, Wonjin Yoon, Sungdong Kim, Donghyeon Kim, Sunkyu Kim, Chan Ho So, Jaewoo Kang, BioBERT: a pre-trained biomedical language representation model for biomedical text mining, *Bioinformatics*, Volume 36, Issue 4, 15 February 2020
4. Clinical Text Mining: Secondary Use of Electronic Patient Records[Chapter 7-8] By Hercules Dalianis

Github Project Repository:

<https://github.com/hemantcs/SWMSpring20>





Thank You!

Any Questions?