Early Prediction for Chronic Kidney Disease Detection: A Progressive Approach to Health Management

1 INTRODUCTION:

❖ ***OVERVIEW:***

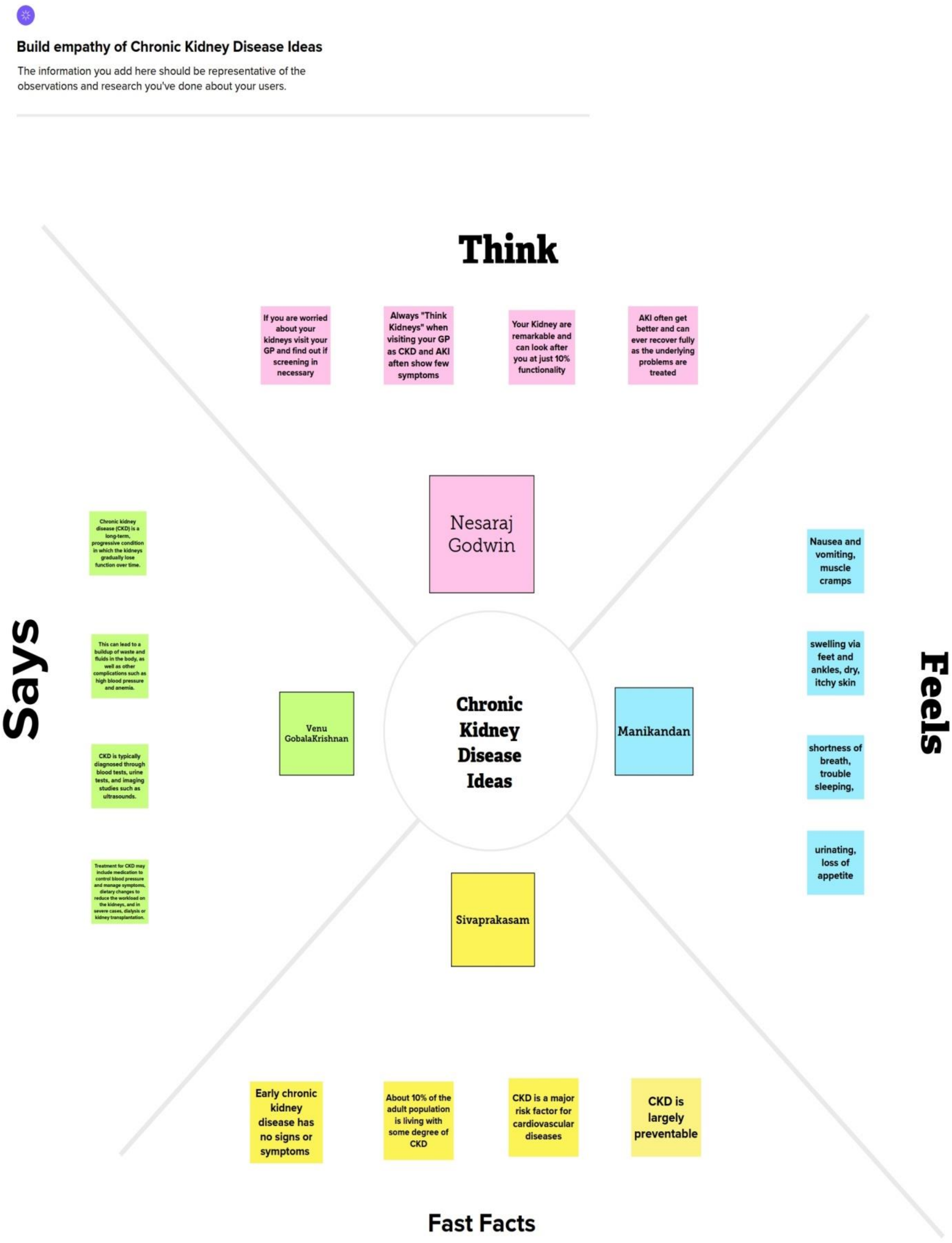
- ***Chronic kidney disease (CKD) is a long-term condition where the kidneys gradually lose their function over time. It is a significant public health issue, affecting millions of people worldwide, and if left untreated, can progress to end-stage renal disease (ESRD), requiring dialysis or kidney transplantation.***
- ***Early detection and management of CKD can significantly improve outcomes and prevent or delay the progression of the disease. Predicting the development of CKD in individuals at high risk can also help identify those who would benefit most from early intervention.***
- ***Several risk factors are associated with the development of CKD, such as hypertension, diabetes, obesity, family history, and age. Predictive models that integrate these risk factors can identify individuals at high risk of developing CKD and guide targeted screening and prevention strategies.***
- ***In this context, machine learning algorithms have shown promise in developing accurate and reliable predictive models for early CKD detection. By leveraging large datasets and advanced analytical techniques, these models can identify patterns and relationships between risk factors and disease outcomes, leading to more personalized and effective healthcare interventions.***

❖ PURPOSE:

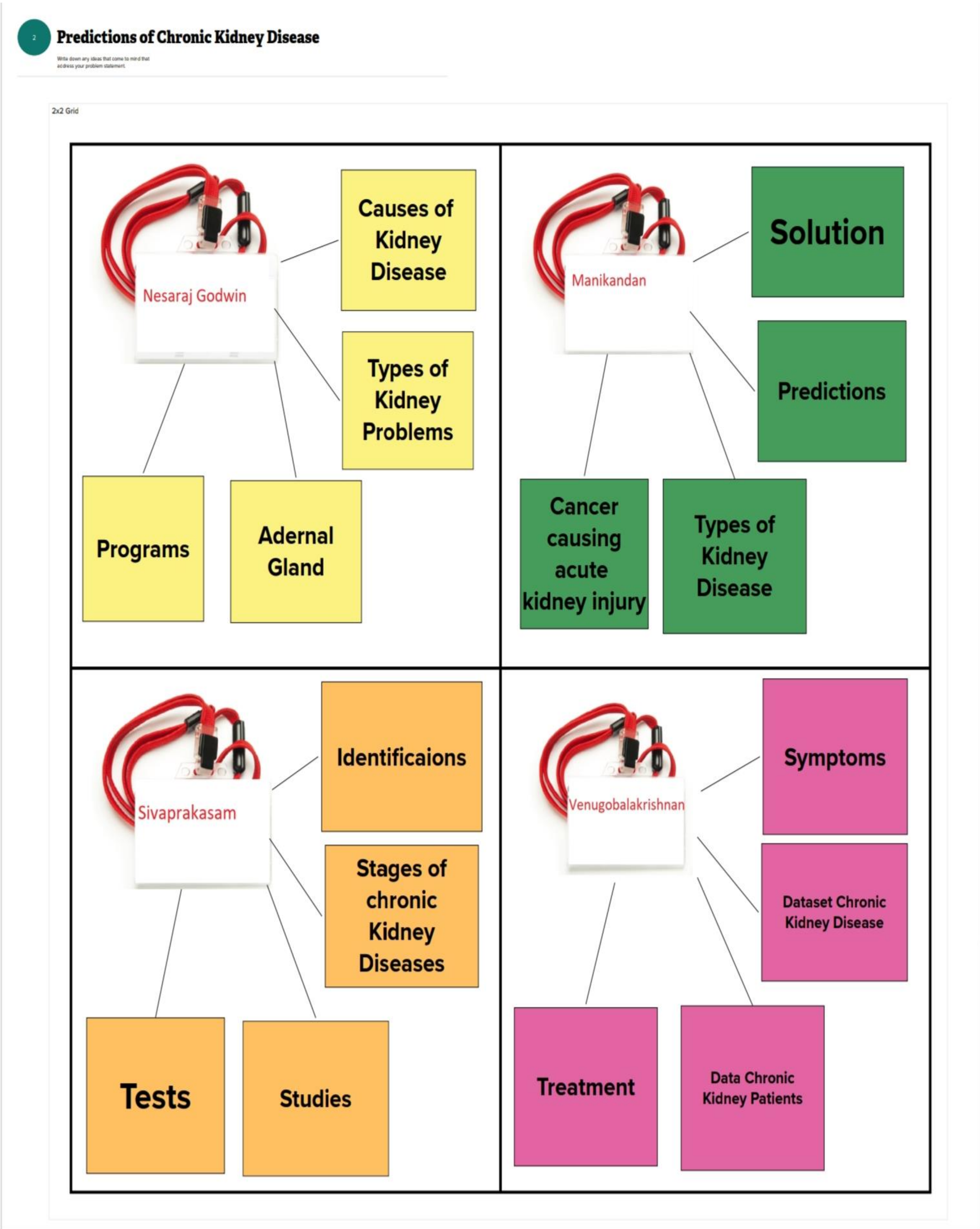
- *In the context of machine learning projects, the purpose of early kidney disease prediction is to develop accurate predictive models that can identify individuals at high risk of developing CKD. The use of machine learning algorithms can help identify patterns and relationships between risk factors and disease outcomes, leading to more personalized and effective healthcare interventions.*
- *The development of predictive models for early CKD detection using machine learning can also lead to improved healthcare resource allocation, as targeted screening and prevention strategies can be employed for high-risk individuals. This can lead to more efficient use of healthcare resources and improved patient outcomes.*
- *In addition, machine learning algorithms can help identify modifiable risk factors that contribute to the development of CKD, such as hypertension and diabetes. By addressing these risk factors early, healthcare providers can help prevent the onset of CKD in high-risk individuals, leading to better health outcomes and improved quality of life.*
- *Overall, the development of machine learning models for early kidney disease prediction has the potential to make a significant impact on public health by reducing the burden of this chronic condition.*

2 Problem Definition & Design Thinking:

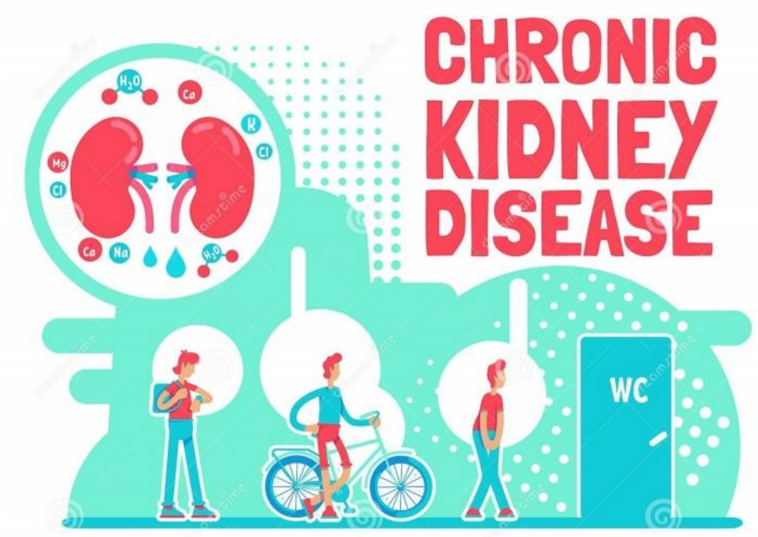
❖ EMPATHY MAP



❖ ***BRAINSTORM:***


Predictions of Chronic Kidney Disease
2x2 Grid
Nesaraj Godwin
Causes of Kidney Disease
Types of Kidney Problems
Programs
Adernal Gland
Manikandan
Solution
Predictions
Cancer causing acute kidney injury
Types of Kidney Disease
Sivaprakasam
Identificaions
Stages of chronic Kidney Diseases
Tests
Studies
Venugobalakrishnan
Symptoms
Dataset Chronic Kidney Disease
Treatment
Data Chronic Kidney Patients

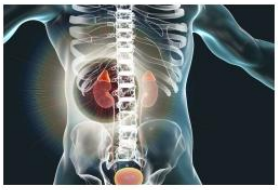
Chronic Kidney Disease

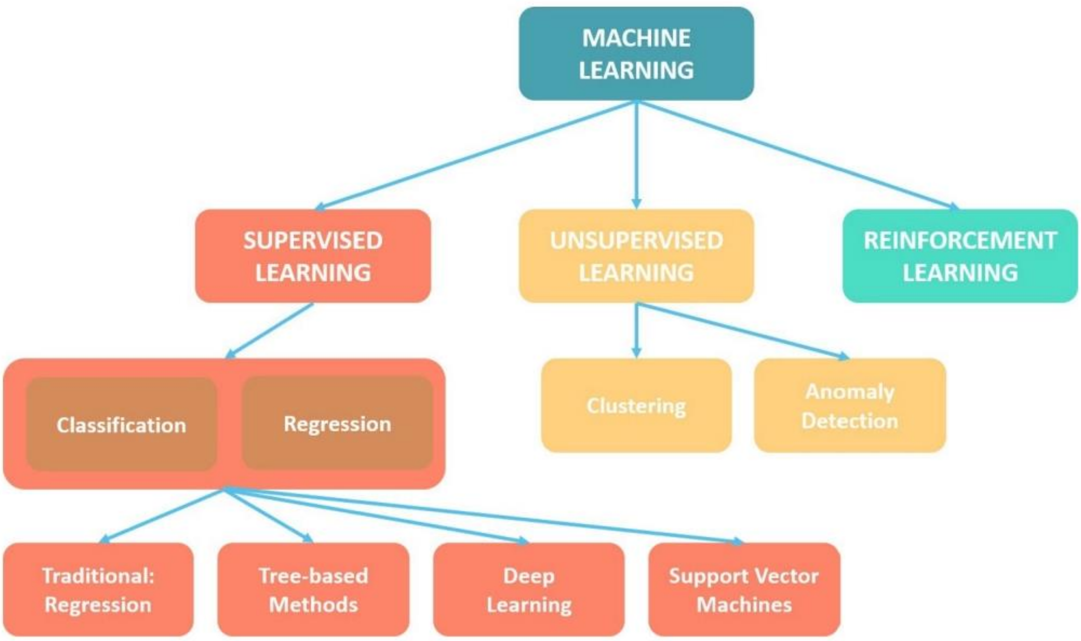


This article is about Chronic Kidney Disease, We discuss to identify the disease by Machine Learning Program

Kidney Gland

A small gland that makes steroid hormones, adrenaline, and noradrenaline. These hormones help control heart rate, blood pressure and other important body functions. There are two adrenal glands, one on top of each kidney. Also called suprarenal gland.



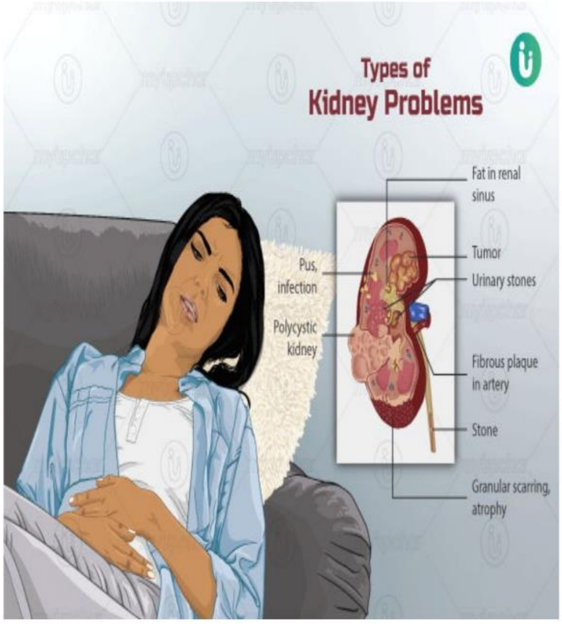


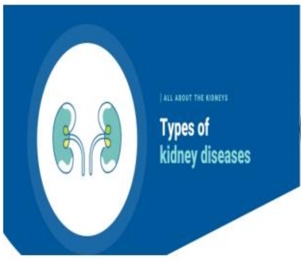
3

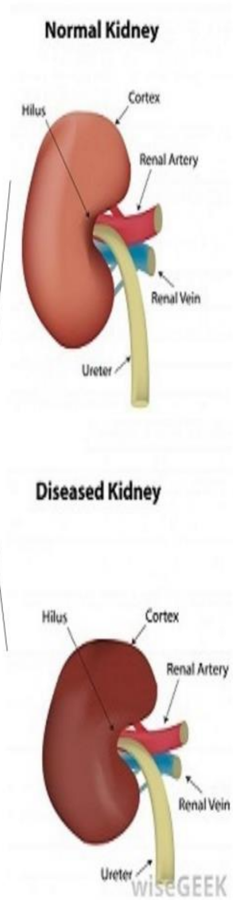
Group ideas

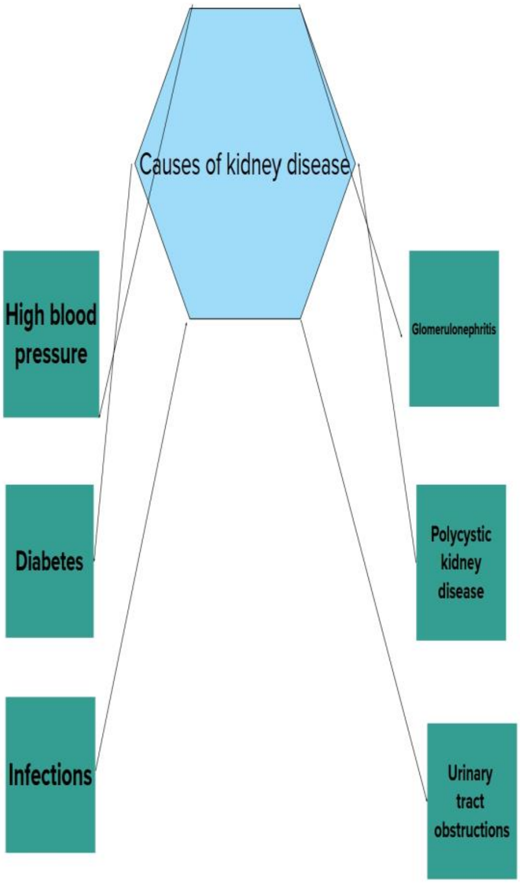
Take turns sharing your ideas while clustering similar or related notes as you go. Once all sticky notes have been grouped, give each cluster a sentence-like label. If a cluster is bigger than six sticky notes, try and see if you and break it up into smaller sub-groups.

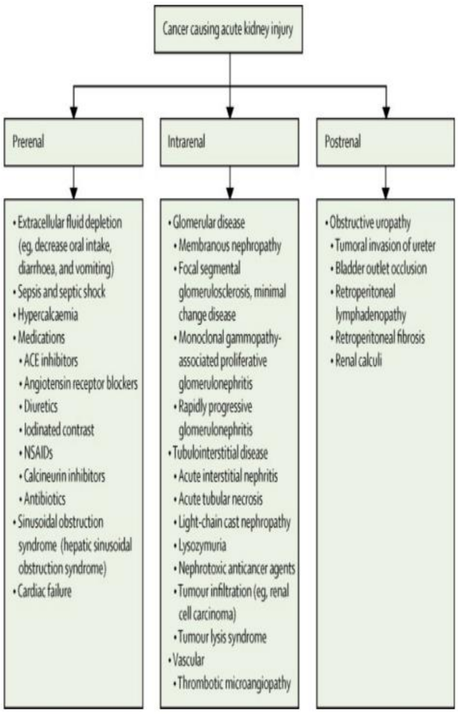
Type your paragraph...

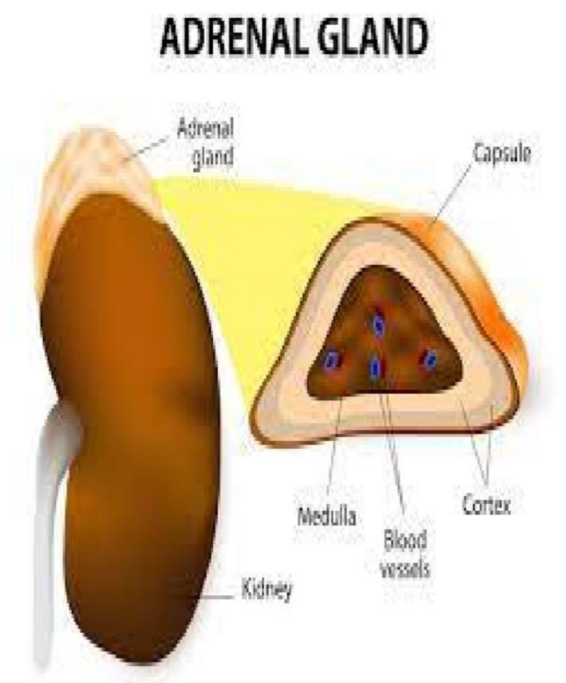


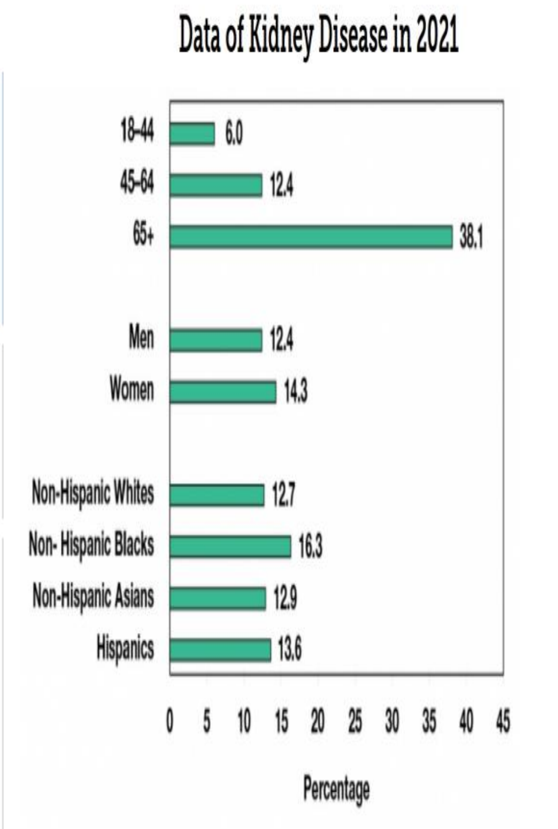






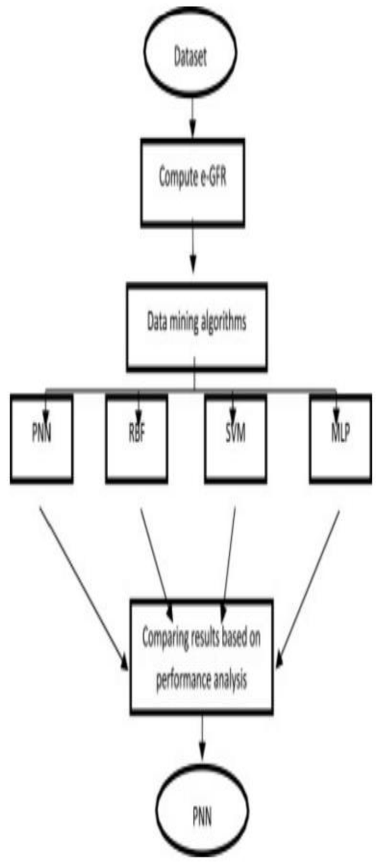






Stages of Chronic Kidney Disease

Stage of CKD	eGFR result	What it means
Stage 1	90 or higher	- Mild kidney damage - Kidneys work as well as normal
Stage 2	60-89	- Mild kidney damage - Kidneys still work well
Stage 3a	45-59	- Mild to moderate kidney damage - Kidneys don't work as well as they should
Stage 3b	30-44	- Moderate to severe damage - Kidneys don't work as well as they should
Stage 4	15-29	- Severe kidney damage - Kidneys are close to not working at all
Stage 5	less than 15	- Most severe kidney damage - Kidneys are very close to not working or have stopped working (failed)



Chronic Kidney Disease (CKD)

Early Identification and Intervention in Primary Care

Step 1 — Identify individuals at risk

Main clinical risk factors for CKD:
- Hypertension
- Diabetes
- CVD
- Family history of CKD

Consider other factors:
- Systemic disease affecting the kidneys (e.g. SLE)
- Obesity
- Genetic risk factors (e.g. ADPKD)
- Environmental exposures to nephrotoxins
- Demographics – older age, race/ethnicity
- History of AKI

Step 2 — Test high-risk adults to detect CKD (not population-wide)

Evaluate kidney function – eGFR
- eGFR calculated based on serum creatinine and/or cystatin C

AND

Evaluate kidney damage – albuminuria
- **UACR or dipstick*** (if UACR is unavailable)

If UACR $\geq$30 mg/g (>3 mg/mmol) **OR** eGFR <60 mL/min/1.73 m^2

Re-test in 3 months

If UACR <30 mg/g (<3 mg/mmol) **AND** eGFR >60 mL/min/1.73 m^2

Step 3 — Diagnose CKD

If low eGFR or high UACR are present for $\geq$3 months, diagnose CKD

Re-test at least once a year[†]

Step 4 — Stratify and treat (also see Table 1)

Risk categories for CKD progression, morbidity, and mortality; monitoring frequency (number of check-ups per year in parentheses); and nephrology consultation[‡]

eGFR categories (mL/min/1.73 m^2) Description and range	Albuminuria categories: A1 <30 mg/g <3 mg/mmol	A2 30–299 mg/g 3–29 mg/mmol	A3 $\geq$300 mg/g $\geq$30 mg/mmol
$\geq$90 G1	Monitor (1)	Treat (1)	Treat & consult (3)
60–89 G2	Monitor (1)	Treat (1)	Treat & consult (3)
45–59 G3a	Treat (1)	Treat (2)	Treat & consult (3)
30–44 G3b	Treat (2)	Treat & consult (3)	Treat & consult (3)
15–29 G4	Treat & consult (3)	Treat & consult (3)	Treat & consult (4+)
<15 G5	Treat & consult (4+)	Treat & consult (4+)	Treat & consult (4+)

Low risk: Stable disease OR NO CKD in absence of other markers of kidney damage.[†] Requires measurements once a year or earlier in case of new symptoms / risk factors.

Moderately increased risk: Requires measurements at least once a year

High risk: Requires measurements at least twice a year

Very high risk: Treat in agreement with a nephrologist. Requires measurements at least three times a year. Requires the closest monitoring at least four times a year (every 1–3 months)

Adapted from de Boer et al. 2022[1]

Step 5 — Nephrology consultation

Take action based on the risk categories for CKD progression, morbidity, and mortality, and monitoring frequency (see above).

Primary care practitioners should consult with a nephrologist while initiating treatment; some patients may be under the direct care of a nephrologist if indicated (see Table 3).

Symptoms of Chronic Kidney Disease

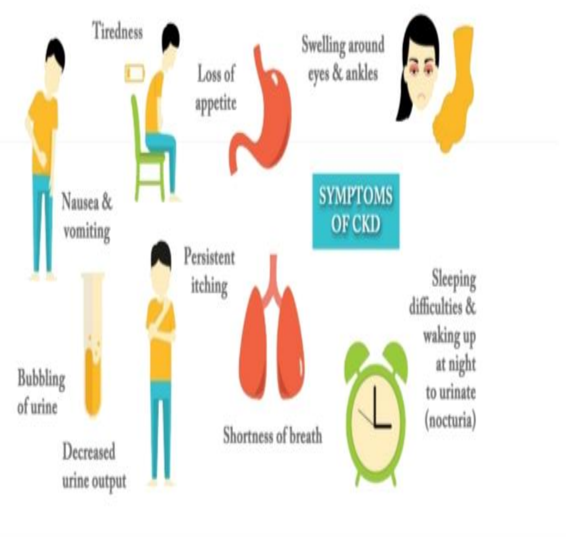


Table 1. Treat to slow CKD progression, reduce mortality risk, and manage comorbidities

Lifestyle modification	
Smoking cessation; regular exercise; well-balanced diet (avoid excessive protein intake and processed food, limit sodium intake <2 g/day)	
Medical treatment	
Treat diabetes, hypertension, and CVD: Optimise blood pressure and glycemic control	Ensure guideline-directed medical treatment to slow down CKD progression and reduce CVD risk: maximally tolerated doses of **ACEIs/ARBs, SGLT2 inhibitors, nonsteroidal MRAs** with proven benefits in renal and cardiovascular outcome trials for T2D; also consider **lipid-lowering therapy (statins)** and/or **antiplatelet therapy** (for patients with CKD at risk of atherosclerotic events)
Considerations	
Adjust dosing of medications based on eGFR; exercise caution when prescribing analgesics, antimicrobials, hypoglycemics, chemotherapeutics, or anticoagulants; avoid nephrotoxins (e.g. NSAIDs) and some contrast media	

Table 2. Monitor for CKD progression and comorbidities

CKD progression and comorbidities	What to monitor
CKD monitoring	eGFR, UACR, urinalysis (urine sediment)
CVD and dyslipidemia	Blood pressure, cardiovascular risk stratification, lipid status
Diabetes	Blood glucose, HbA1c

Identify CKD complications: anemia, mineral and bone disorders, metabolic acidosis, etc.

Table 3. Additional considerations for nephrology consultation

- Unexplained, progressive decline in eGFR $\geq$5 mL/min/1.73 m^2 over 12 months or sudden decline in eGFR over days to weeks
- Unexplained significant albuminuria/proteinuria or hematuria
- Persistent hyperkalemia, resistant hypertension (defined as uncontrolled hypertension on three antihypertensive agents, including a diuretic), recurring kidney stones, or hereditary kidney diseases (e.g. ADPKD)
- Other complications identified (anemia, mineral and bone disorders, metabolic acidosis, etc.)

Consultation with a nephrologist can be for identifying other treatable causes or for developing a treatment plan. Although some patients may be maintained further in nephrology care, most will return to primary care.

3 RESULT:

❖ OVERVIEW:

<table>
<tr><th>OBJECT NAME</th><th>FIELDS IN THE OBJECT</th></tr>
<tr><td>PREDICTION</td><td>
<table>
<tr><th>FIELD LABEL</th><th>DATA TYPES</th></tr>
<tr><td>Age</td><td>Numeric</td></tr>
<tr><td>Gender</td><td>Categorical(Binary:Male/Female)</td></tr>
<tr><td>Body Mass Index(BMI)</td><td>Numeric</td></tr>
<tr><td>Blood Pressure</td><td>Numeric</td></tr>
<tr><td>Serum Creatinine</td><td>Numeric</td></tr>
<tr><td>Blood Glucose</td><td>Numeric</td></tr>
<tr><td>Albumin</td><td>Numeric</td></tr>
<tr><td>Hemoglobin</td><td>Numeric</td></tr>
<tr><td>Smoking Status</td><td>Categorical(Binary:Yes/No)</td></tr>
<tr><td>Family History</td><td>Categorical(Binary:Yes/No)</td></tr>
</table>
</td></tr>
<tr><td>SVM</td><td>
<table>
<tr><th>FIELD LABEL</th><th>DATA TYPES</th></tr>
<tr><td>Support Vectors</td><td>List of Numeric values</td></tr>
<tr><td>Kernal Function</td><td>Categorical(e.g linear,
Polynomial, radial basis function)</td></tr>
</table>
</td></tr>
</table>

❖ ACTIVITY & SCREENSHOT:

Read the Dataset

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Run Code

In [1]:
```
import pandas as pd
import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt
```

In [2]:
```
pd.pandas.set_option('display.max_columns', None)
```

In [3]:
```
dataset = pd.read_csv("kidney_disease.csv")
dataset.head()
```

Out[3]:

	id	age	bp	sg	al	su	rbc	pc	pcc	ba	bgr	bu	sc	sod	pot	hemo	pcv	wc	rc	htn	dm	cad	appet	pe	ane
0	0	48.0	80.0	1.020	1.0	0.0	NaN	normal	notpresent	notpresent	121.0	36.0	1.2	NaN	NaN	15.4	44	7800	5.2	yes	yes	no	good	no	no
1	1	7.0	50.0	1.020	4.0	0.0	NaN	normal	notpresent	notpresent	NaN	18.0	0.8	NaN	NaN	11.3	38	6000	NaN	no	no	no	good	no	no
2	2	62.0	80.0	1.010	2.0	3.0	normal	normal	notpresent	notpresent	423.0	53.0	1.8	NaN	NaN	9.6	31	7500	NaN	no	yes	no	poor	no	yes
3	3	48.0	70.0	1.005	4.0	0.0	normal	abnormal	present	notpresent	117.0	56.0	3.8	111.0	2.5	11.2	32	6700	3.9	yes	no	no	poor	yes	yes
4	4	51.0	80.0	1.010	2.0	0.0	normal	normal	notpresent	notpresent	106.0	26.0	1.4	NaN	NaN	11.6	35	7300	4.6	no	no	no	good	no	no

Handling Missing Values

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Run Code

In [6]:
```
dataset.isnull().sum()
```

Out[6]:
```
age                 9
bp                 12
sg                 47
al                 46
su                 49
rbc               152
pc                 65
pcc                 4
ba                  4
bgr                44
bu                 19
sc                 17
sod                87
pot                88
hemo               52
pcv                70
wc                105
rc                130
htn                 2
dm                  2
cad                 2
appet               1
pe                  1
ane                 1
classification      0
dtype: int64
```

DESCRIPTIVE STATISTICAL ANALYSIS:

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In [39]:
```
dataset.describe()
```

Out[39]:

	age	bp	sg	al	su	rbc	pc	pcc	ba	bgr	bu	sc	
count	391.000000	388.000000	353.000000	354.000000	351.000000	248.000000	335.000000	396.000000	396.000000	356.000000	381.000000	383.000000	313.00
mean	51.483376	76.469072	1.017408	1.016949	0.450142	0.189516	0.226866	0.106061	0.055556	148.036517	57.425722	3.072454	137.52
std	17.169714	13.683637	0.005717	1.352679	1.099191	0.392711	0.419431	0.308305	0.229351	79.281714	50.503006	5.741126	10.40
min	2.000000	50.000000	1.005000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	22.000000	1.500000	0.400000	4.50
25%	42.000000	70.000000	1.010000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	99.000000	27.000000	0.900000	135.00
50%	55.000000	80.000000	1.020000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	121.000000	42.000000	1.300000	138.00
75%	64.500000	80.000000	1.020000	2.000000	0.000000	0.000000	0.000000	0.000000	0.000000	163.000000	66.000000	2.800000	142.00
max	90.000000	180.000000	1.025000	5.000000	5.000000	1.000000	1.000000	1.000000	1.000000	490.000000	391.000000	76.000000	163.00

FINDING CORRELATION BETWEEN THE INDEPENDENT COLUMNS:

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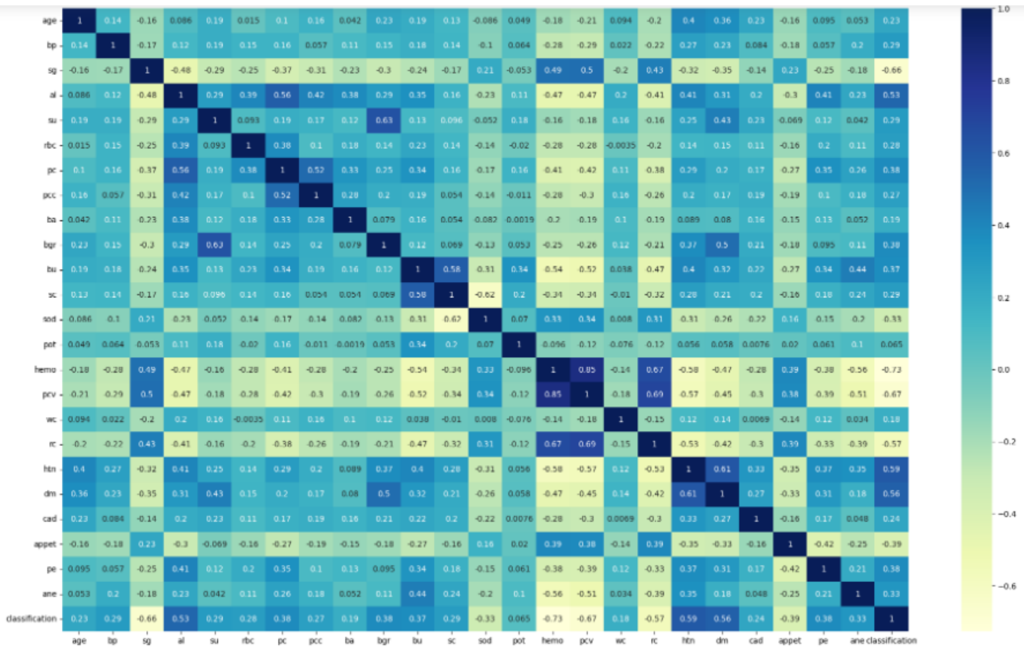
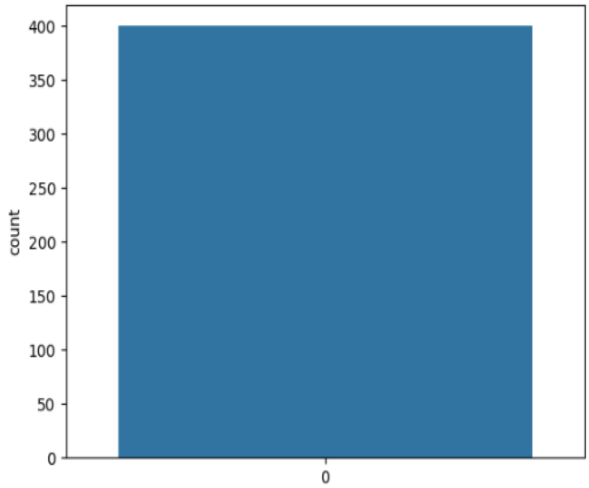
In [45]:
```
plt.figure(figsize=(24,14))
sns.heatmap(dataset.corr(), annot=True, cmap='YlGnBu')
plt.show()
```



```
In [48]: sns.countplot(dataset['classification'])
Out[48]: <Axes: ylabel='count'>
```



SPLITTING THE DATA INTO TRAIN AND TEST:

```
In [56]: from sklearn.model_selection import train_test_split
         X_train,X_test,y_train,y_test = train_test_split(X,y, test_size=0.3, random_state=33)

In [57]: print(X_train.shape)
         print(X_test.shape)

(280, 8)
(120, 8)
```

RANDOM FOREST MODEL :

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```
In [58]: from sklearn.metrics import accuracy_score, confusion_matrix, classification_report
```

```
In [59]: from sklearn.ensemble import RandomForestClassifier
         RandomForest = RandomForestClassifier()
         RandomForest = RandomForest.fit(X_train,y_train)

         y_pred = RandomForest.predict(X_test)

         print('Accuracy:', accuracy_score(y_test,y_pred))
         print(confusion_matrix(y_test,y_pred))
         print(classification_report(y_test,y_pred))
```

```
Accuracy: 0.975
[[55  3]
 [ 0 62]]
              precision    recall  f1-score   support

           0       1.00      0.95      0.97        58
           1       0.95      1.00      0.98        62

    accuracy                           0.97       120
   macro avg       0.98      0.97      0.97       120
weighted avg       0.98      0.97      0.97       120
```

DECISION TREE MODEL :

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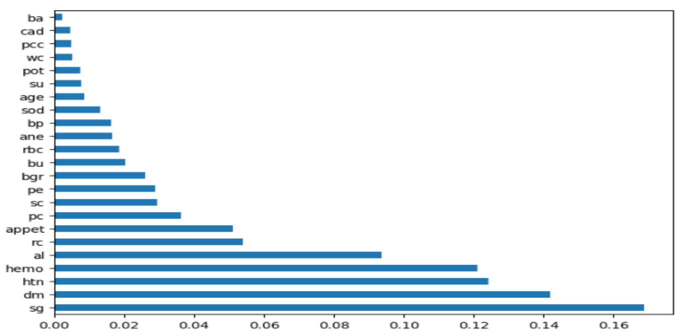
```
In [51]: from sklearn.ensemble import ExtraTreesClassifier
         import matplotlib.pyplot as plt
         model=ExtraTreesClassifier()
         model.fit(X,y)

         plt.figure(figsize=(8,6))
         ranked_features=pd.Series(model.feature_importances_,index=X.columns)
         ranked_features.nlargest(24).plot(kind='barh')
         plt.show()
```



CLASSIFICATION :

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Run Code

In [92]:

```python
from sklearn.ensemble import AdaBoostClassifier
AdaBoost = AdaBoostClassifier()
AdaBoost = AdaBoost.fit(X_train,y_train)

y_pred = AdaBoost.predict(X_test)

print('Accuracy:', accuracy_score(y_test,y_pred))
print(confusion_matrix(y_test,y_pred))
print(classification_report(y_test,y_pred))
```

```
Accuracy: 1.0
[[58  0]
 [ 0 62]]
              precision    recall  f1-score   support

           0       1.00      1.00      1.00        58
           1       1.00      1.00      1.00        62

    accuracy                           1.00       120
   macro avg       1.00      1.00      1.00       120
weighted avg       1.00      1.00      1.00       120
```

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Run Code

```
weighted avg       1.00      1.00      1.00       120
```

In [93]:

```python
from sklearn.ensemble import GradientBoostingClassifier
GradientBoost = GradientBoostingClassifier()
GradientBoost = GradientBoost.fit(X_train,y_train)

y_pred = GradientBoost.predict(X_test)

print('Accuracy:', accuracy_score(y_test,y_pred))
print(confusion_matrix(y_test,y_pred))
print(classification_report(y_test,y_pred))
```

```
Accuracy: 0.975
[[55  3]
 [ 0 62]]
              precision    recall  f1-score   support

           0       1.00      0.95      0.97        58
           1       0.95      1.00      0.98        62

    accuracy                           0.97       120
   macro avg       0.98      0.97      0.97       120
weighted avg       0.98      0.97      0.97       120
```

MODEL DEPLOYMENT

Integrate with Wen Framework

1. Building HTML Pages
2. Building server side script
3. Run the web application

BUILDING HTML PAGES

- app.py
- index.html
- result.html

app.py

```python
from flask import Flask, render_template, request
import numpy as np
import pickle


app = Flask(__name__)
model = pickle.load(open('Kidney.pkl', 'rb'))

@app.route('/',methods=['GET'])
def Home():
    return render_template('index.html')

@app.route("/predict", methods=['POST'])
def predict():
    if request.method == 'POST':
        sg = float(request.form['sg'])
        htn = float(request.form['htn'])
        hemo = float(request.form['hemo'])
        dm = float(request.form['dm'])
        al = float(request.form['al'])
        appet = float(request.form['appet'])
        rc = float(request.form['rc'])
        pc = float(request.form['pc'])

        values = np.array([[sg, htn, hemo, dm, al, appet, rc, pc]])
        prediction = model.predict(values)

        return render_template('result.html', prediction=prediction)


if __name__ == "__main__":
    app.run(debug=True)
```

...ease-Prediction-Project-main (1)\Chronic-Kidney-Disease-Prediction-Project-main\templates\index.html

app.py × index.html × result.html ×

```html
<!DOCTYPE html>
<html lang="en">

<head>
    <meta charset="UTF-8">
    <title>Chronic Kidney Disease Model</title>

</head>
<body>
    <div style="color:black;" class="container">
        <h2 class='container-heading'><span class="heading_font">Chronic Kidney Disease Prediction
    </div>

    <div style="color:black;" class="ml-container">
        <form action="{{ url_for('predict') }}" method="POST">
            <br>
            <br>
            <h3>Specific Gravity</h3>
            <input id="first" name="sg" placeholder="Ex: (1.005,1.010,1.015,1.020,1.025)" required
            <br>
            <h3>Hyper Tension</h3>
            <input id="second" name="htn" placeholder="Yes = 1, No=0" required="required">
            <br>
            <h3>Hemoglobin</h3>
            <input id="third" name="hemo" placeholder="in gms" required="required">
            <br>
            <h3>Diabetes Mellitus</h3>
            <input id="fourth" name="dm" placeholder="Yes = 1, No=0" required="required">
            <br>
            <h3>Albumin</h3>
            <input id="fifth" name="al" placeholder="(0,1,2,3,4,5)" required="required">
            <br>
            <h3>Appetite</h3>
            <input id="sixth" name="appet" placeholder="Good = 1, Poor = 0" required="required">
            <br>
```

```html
            <h3>Red Blood Cell Count</h3>
            <input id="seventh" name="rc" placeholder="in Millions/cmm" required="required">
            <h3>Pus Cell</h3>
            <input id="eight" name="pc" placeholder="Normal = 0, Abnormal = 1" required="required"
            <br>
            <br>
            <br>
            <button id="sub" type="submit ">Submit</button>
            <br>
            <br>
            <br>
            <br>
        </form>
    </div>




<style>

/* Background Image */
body
{
background-image:url("https://raw.githubusercontent.com/SagarDhandare/Chronic-Kidney-Disease-Predi
height: 100%;

/* Center and scale the image nicely */
background-position: center;
background-repeat: no-repeat;
background-size: 100% 100%;

}

/* Color */
body{
```

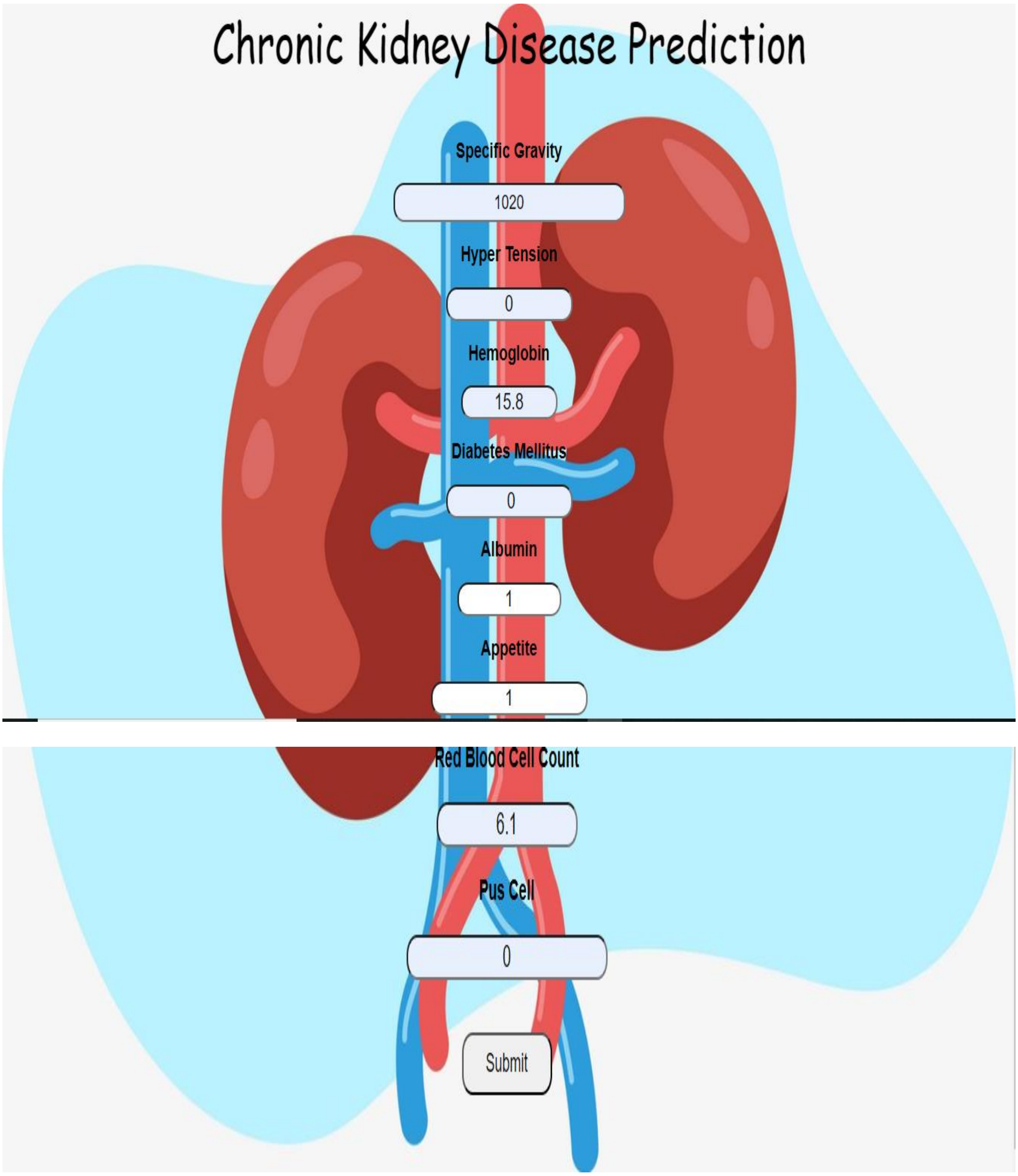
```css
    font-family: Arial, Helvetica,sans-serif;
    text-align: center;
    margin: 0;
    padding: 0;
    width: 100%;
    height: 100%;
    display: flex;
    flex-direction: column;
}


/* Heading Font */
.container-heading{
    margin: 0;
}

.heading_font{
    color: #black;
    font-family: 'Pacifico', cursive;
    font-size: 50px;
    font-weight: normal;
}



/* Box */
        #first {
            border-radius: 14px;
            height: 30px;
            width: 300px;
            font-size: 18px;
            text-align: center;
        }

        #second {
```

```
            border-radius: 14px;
            height: 25px;
            width: 160px;
            font-size: 20px;
            text-align: center;
        }

        #third {
            border-radius: 14px;
            height: 25px;
            width: 120px;
            font-size: 20px;
            text-align: center;
        }

        #fourth {
            border-radius: 14px;
            height: 25px;
            width: 160px;
            font-size: 20px;
            text-align: center;
        }

        #fifth {
            border-radius: 14px;
            height: 25px;
            width: 130px;
            font-size: 20px;
            text-align: center;
        }

        #sixth {
            border-radius: 14px;
            height: 25px;
            width: 200px;
```

app.py × index.html × result.html ×

```
            font-size: 20px;
            text-align: center;
        }

        #seventh {
            border-radius: 14px;
            height: 25px;
            width: 180px;
            font-size: 20px;
            text-align: center;
        }

        #eight {
            border-radius: 14px;
            height: 25px;
            width: 260px;
            font-size: 20px;
            text-align: center;
        }


/* Submit Button */
#sub {
            width: 120px;
            height: 43px;
            text-align: center;
            border-radius: 14px;
            font-size: 18px;
        }




<link rel="stylesheet" href="https://cdnjs.cloudflare.com/ajax/libs/font-awesome/4.7.0/css/font-aw
```

```
</style>


</body>

</html>
```


Chronic Kidney Disease Prediction
Specific Gravity
1020
Hyper Tension
0
Hemoglobin
15.8
Diabetes Mellitus
0
Albumin
1
Appetite
1
Red Blood Cell Count
6.1
Pus Cell
0
Submit

…ase-Prediction-Project-main (1)\Chronic-Kidney-Disease-Prediction-Project-main\templates\result.html

index.html × result.html ×

```html
<!DOCTYPE html>
<html lang="en">

<head>
    <meta charset="UTF-8">
    <meta name="viewport" content="width=device-width, initial-scale=1.0">
    <title>Chronic Kidney Disease Result</title>
</head>

<body>

    <div style="color:black;" class="container">
        <form action="{{ url_for('predict')}}" method="post">
            <h2 class='container-heading'><span class="heading_font">Chronic Kidney Disease Predict

            <br><br><br><br>

            <!-- Result -->
            <div style="color:black;" class="results">
                {% if prediction==1 %}
                    <h1><span class='danger'>Oops! 😟<br><br>You have CHRONIC KIDNEY DISEASE.<br><br>Pl
                    <br><br><br><br><br><br>
                    <img class="gif" src="{{ url_for('static', filename='no.gif')}}" alt="STROKE Image"
                {% elif prediction==0 %}
                    <h1><span class='safe'>🎉 Congratulation! 🎉<br><br>You DON'T have Chronic Kidney
                    <img class="gif1" src="{{ url_for('static', filename='yes2.webp')}}" alt="Not STROK
                {% endif %}
            </div>
            </form>

    </div>
    <div>
            <br><br> <br><br><br><br><br><br><br><br>
    </div>

<style>

/* Background Image */
body
{
background-image:url("https://raw.githubusercontent.com/SagarDhandare/Chronic-Kidney-Disease-Predic
height: 100%;

/* Center and scale the image nicely */
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body{
    font-family: Arial, Helvetica,sans-serif;
    text-align: center;
    margin: 0;
    padding: 0;
    width: 100%;
    height: 100%;
    display: flex;
    flex-direction: column;
}


/* Heading Font */
.container-heading{
    margin: 0;
}

.heading_font{
    color: #black;
    font-family: 'Pacifico', cursive;
    font-size: 50px;
    font-weight: normal;
}



<link rel="stylesheet" href="https://cdnjs.cloudflare.com/ajax/libs/font-awesome/4.7.0/css/font-awe

</style>


</body>

</html>
```

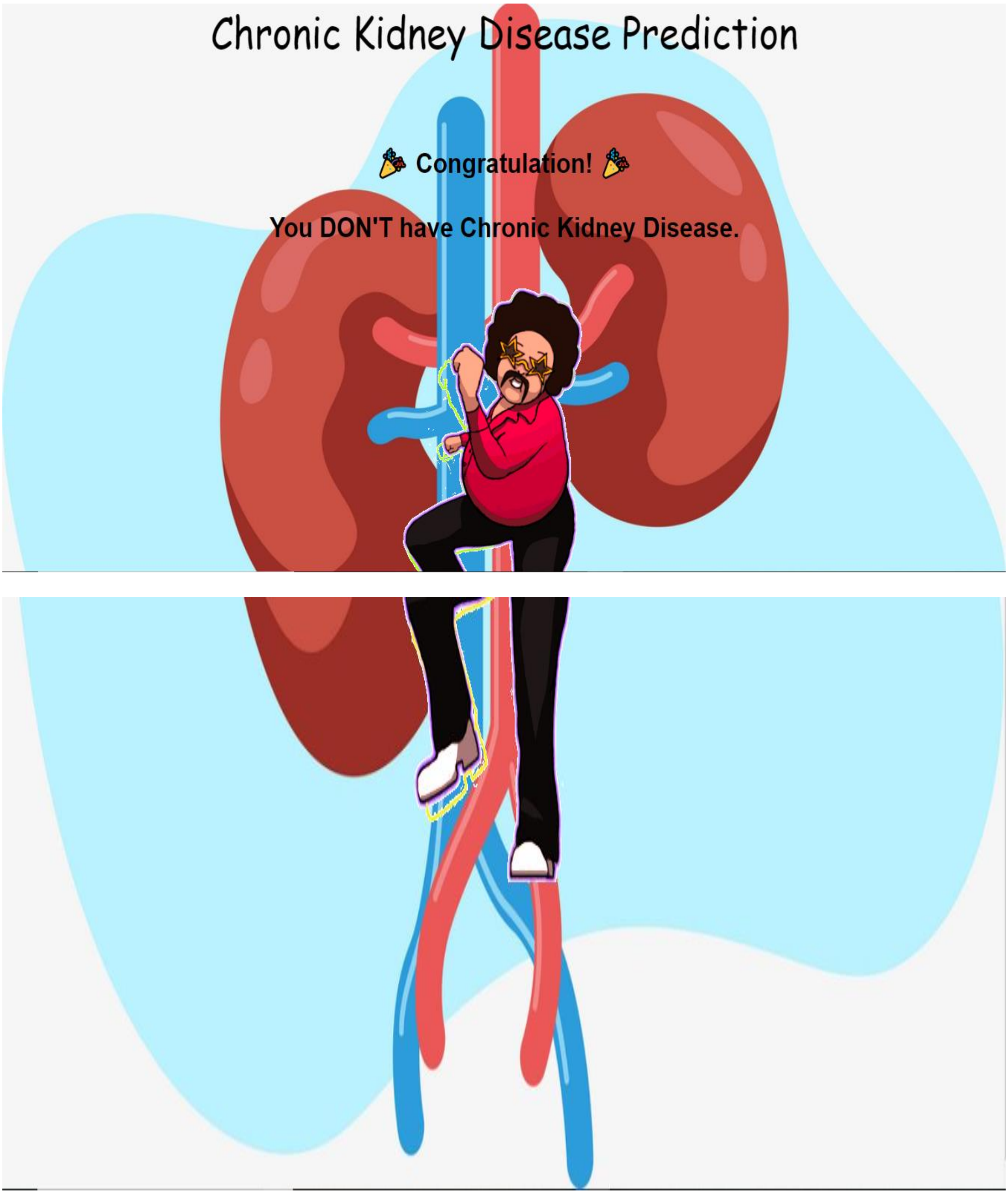
Chronic Kidney Disease Prediction
🎉 Congratulation! 🎉
You DON'T have Chronic Kidney Disease.

4 TRAILHEAD PROFILE PUBLIC URL:

Team Lead- https://trailblazer.me/id/mastergodwin

Team Member 1- https://trailblazer.me/id/mkandanv1

Team Member 2- https://trailblazer.me/id/sprakasam6

Team Member 3-. https://trailblazer.me/id/vgobalakrishnan

5 ADVANTAGES AND DISADVANTAGES:

❖ ADVANTAGES:

- ***Early detection: Machine learning models can predict the likelihood of developing CKD based on a set of patient characteristics, such as age, sex, medical history, and laboratory test results. Early detection can lead to early intervention and management, which can help slow or halt the progression of the disease.***

- ***Improved accuracy: Machine learning algorithms are designed to analyze vast amounts of data and identify patterns that may not be apparent to human observers. This can improve the accuracy of CKD diagnosis and reduce the risk of misdiagnosis.***

- ***Personalized treatment: Machine learning models can be used to identify the most effective treatment options for individual patients based on their specific characteristics.***

This can lead to more personalized and effective treatment plans.

- ***Cost-effective: Machine learning algorithms can process large amounts of data quickly and efficiently, reducing the time and cost of traditional diagnostic methods.***

❖ ***DISADVANTAGES:***

- ***Data quality: Machine learning models require high-quality data to make accurate predictions. Poor quality data can result in inaccurate predictions and unreliable outcomes.***
- ***Bias: Machine learning algorithms may be biased towards certain groups of patients, leading to unfair or discriminatory outcomes. It is essential to ensure that the data used to train the algorithm is diverse and representative of the population being studied.***
- ***Interpretability: Machine learning models can be difficult to interpret, making it challenging to understand how they arrive at their predictions. This can be a concern for clinicians who may need to explain the reasoning behind the algorithm's predictions to patients.***
- ***Privacy concerns: Machine learning models require large amounts of patient data to train and test the algorithm. There are concerns about how this data is collected, stored, and used, and there is a need to ensure that patient privacy is protected.***

6 APPLICATIONS:

- ***Logistic Regression: Logistic regression is a statistical model used to analyze the relationship between a dependent***

variable and one or more independent variables. In CKD prediction, it can be used to identify the risk factors for the disease.

- ***Decision Trees: Decision trees are a type of machine learning algorithm that can be used for classification and regression analysis. They are useful in identifying the most important risk factors for CKD and predicting the likelihood of the disease.***

- ***Random Forests: Random forests are an ensemble learning method that uses multiple decision trees to improve the accuracy of predictions. They are used in CKD prediction to identify the most significant risk factors and their interactions with other variables.***

- ***Support Vector Machines (SVM): SVM is a machine learning algorithm that can be used for classification and regression analysis. It is useful in predicting the likelihood of CKD based on patient data and identifying the most important risk factors for the disease.***

- ***Neural Networks: Neural networks are a type of machine learning algorithm that uses artificial intelligence to learn from data. They are useful in CKD prediction as they can identify complex relationships between various patient factors and predict the likelihood of the disease.***

7 CONCULSION:

Neural Networks: Neural networks are a type of machine learning algorithm that uses artificial intelligence to learn from data. They are useful in CKD prediction as they can identify complex relationships between various patient factors and predict the likelihood of the disease.

8 FEATURE SCOPE:

- ***Demographic data: Age, gender, race, and ethnicity can all be considered as potential risk factors for CKD***
- ***Medical history: Previous diagnoses of hypertension, diabetes, cardiovascular disease, and other chronic conditions are commonly considered as risk factors for CKD.***
- ***Laboratory test results: Measures of kidney function, such as serum creatinine and estimated glomerular filtration rate (eGFR), as well as electrolyte levels and other blood chemistry values, can provide insight into the patient's kidney health. Clinical examination data: Blood pressure, body mass index (BMI), and other physical measurements can provide additional information about a patient's overall health status.***
- ***Medication history: Some medications can cause or exacerbate kidney damage, so medication history can also be considered as a risk factor for CKD.***
- ***Environmental factors: Exposure to environmental toxins such as lead, cadmium, and arsenic can increase the risk of CKD, so environmental factors may also be considered.***