Interim Project Progress

DIGITAL PROTOTYPE FOR PREOPERATIVE RISK ASSESSMENT OF ANAESTHESIA USING MACHINE LEARNING

For your project, briefly describe what is the problem you are looking at. What are the predictor variables and the response variable(s)?

Problem Statement-

Before conducting surgery and other major operative procedures, the anaesthesiologists rely on verbal data evaluation to assess whether the patient is fit for surgery or not at the moment. This is a time-consuming procedure. As discussed with one of the anaesthesiologists in AIIMS Delhi, they wish to develop an application which could take in current health parameters and determine the risk level of conducting the surgical procedure with anaesthesia.

Thus, we are developing a model that could predict patients' risk levels based on their previous background or medical history using Machine Learning. Using this model, users or patients can provide their medical history or give inputs like sugar, blood pressure, heart pulse, etc.

This model leads to results that will tell the users or patients whether they should go for anaesthesia. Whether before going for anaesthesia, there must be some treatments to be done. Directly, it would be beneficial for the Doctors to review the patient's status before surgery. Even a user or patient could also understand his or her situation and take decision accordingly.

- The predictor variables are:

1. Blood Pressure (Systolic/Diastolic) mm of Hg.
2. Blood Sugar Level (Fasting) mg/dL
3. Creatinine Level mg/dL

- The response variable is Risk level (High/Low)

What are the sources of data?

The data has been obtained from Dr. Nishkarsh Gupta Associate Professor of Onco-anaesthesia & Palliative Medicine, Dr.B.R.A.IRCH, AIIMS, Delhi, India. This data has been collected through PAC forms shared by Dr. Gupta which contains patient's health details such as blood pressure, sugar level, haemoglobin, etc. A sample form is as shown below:

एम.आर.-3 जनरल हिस्टरी
M.R.- 3 General History

डॉ० बी० आर० अम्बेडकर संस्थान रोटरी कैन्सर अस्पताल
DR. B. R. AMBEDKAR INSTITUTE ROTARY CANCER HOSPITAL
अ.भा.आ.सं., नई दिल्ली-110029 / AIIMS, New Delhi - 110029

नाम Name | उम्र Age | सर्विस Service | दिनांक Date | यू.एच.आई.डी. नं. UHID No.

प्रोफेसर इंचार्ज Professor I/C | Notes written by .....

CLINICAL NOTES

18/4/20

RPBC

Dmen. Mishra
57/M

Plan (Rx) - ① - GE Esophagus
- Diagnostic Thoracoscopy and proceed.
(TTE)

4/4/0 DM x 1 yrs - on OHA
+ Glazid M BD
+ Teneligliptin 20mg OD
Carcinoma cheek x 25 yrs Stopped 8 months back

Plan 6# CT - Paclitaxel + Carboplatin - Gr. 8/7/20.

31/10/20 INV
Hb-10.2
TLC - 12.6
PLT - 279
TBil - 0.34
OT/PT - 24/34
TProt - 6.64
Alb - 4.3
AnP - 85
Urea/Cr - 24/0.82
Na/K - 131/4.3
INR - 1.18
ECG - WNL

PFT - Restrictive pattern

PHYSICAL EXAMINATION

Temp.	Pulse	Resp.	B.P.	Weight

Adv
① Pt reasonably accepted for surgery
② NPO - 6 hrs for solids
2 hrs for clear liquids
③ W I I consent
④ D/c OHA on MOS.
⑤ Monitor blood sugar & ~~control~~ need for insulin & ketones on MOS
⑥ Encourage Incentive Spirometry & Deep Breathing Exercise.

WNL
SRCA

DR. B.R.A. INSTITUTE ROTARY CANCER HOSPITAL
ALL INDIA INSTITUTE OF MEDICAL SCIENCES
NEW DELHI-110029
DEPARTMENT OF ANAESTHESIOLOGY

Dinesh Mishra AGE/SEX 57/M UHID NO. 10510318 DATE: 10/2/2020
DIAGNOSIS (STAGE) CaEsophagus SCC PROPOSED OPN.
CLINICAL HISTORY (BRIEF)
CVS - Breathlessness/Palpitation/Chest Pain
RS - Cought/Hemoptysis
CNS - Seizure/Headache/TIA/CVA/Neurological Deficit
Abdomen - Distension/Vomiting/Hepatitis/Renal Disease
Endocrine - DM/Thyroid Disease/Parathyroid Disease
H/O Allergy
Any other significant History HT/CAD Asthma TB

HT/CAD
Asthma
TB
4/4/0 DM - 7 yrs
Pt Tenglid 20mg 1BBF + Glazid M 1/1bf.
BBF 8/1/2020.

CURRENT / PAST MEDICATION
1. Anti HT
2. Anti Diabetic
3. Anti Thyroid
4. Bronchodilators
5. Steroids
6. Chemotherapy Drugs
7. Radiotherapy Received
8. Any Other Drugs

PAST ANAESTHETIC HISTORY
Carcinoma Cheek x 25 yrs
Stopped 9 months back

CT- 1st Cycle 8/7/2020

Weight 70 Height 165cm Pulse 72/min/Rgl BP 150/90 R.R. 16/min/Rgl BHT	General Physical Examination - Temperature - Pallor - Icterus - Cyanosis - Clubbing - Oedema - Venous Access	CVS S1S2 (+) Resp. System B/L AE cord Abdomen / CNS Soft

Airway Assessment :
Mouth Opening 3 fingers
Loose Teeth/Buck Teeth/Dentures/Edentulous/Missing Teeth
Mallampati Score II
Neck Examination : Movements (+)
Radiation Induced Changes
DIFFICULT AIRWAY ANTICIPATED YES/NO
Spine :

Receding Mandible | Subluxation
Thyromental Distance | Mentohyoid Distance | Submental Flat
Post Surgical Deformity

2

INVESTIGATIONS (Date) 4/3/20

Hb/Hct	WBC/PLATELETS	SUGAR F/PP/R	UREA/CREATININE	NA/K
9.2/28.1	5800/2.06 lakh	143	19/0.7	132/5
T PROTEINS / A : G	BILIRUBIN / D / I	SGOT / PT	ALKPO4ASE	HBsAG
7.6/1.6	0.75	18/17	74	

X RAYS (Date) 5/3/20 (AP)

ECG/ECHO/MUGA (Date)
WNL

PFT	Actual	% Predicted
FVC	.....	.....
FEV_1	.....	.....
FEV_1/FVC	.....	.....
PEFR	.....	.....

USG/CT/MRI
NOTE - 3D Recon.
- Involving ext. carotid and thyroid
- Displacement of IJV at DB

OTHERS
- Prominent LN seen (upto 1.2 cm) in Rt. Submandibular, Jugulodigastric & Jugulo-omohyoid region
- Rt. Jugulodigastric LN of 1.0 cm

RISK GROUP STATUS (ASA) _____ Reason for risk
FURTHER ORDERS AND INVESTIGATIONS

* DATE FOR SURGERY CAN BE GIVEN	SEEN BY (CAPITALS)	Review PAC (Date)
* NEEDS FURTHER INVESTIGATIONS	SIGNATURE	
ADMIT _____ DAYS PRIOR TO SURGERY	DESIGNATION	
AND INFORM SR. ANAESTHESIOLOGY	DATE	

PRE-OP MEDICATION (DRUG) DOSE ROUTE TIME

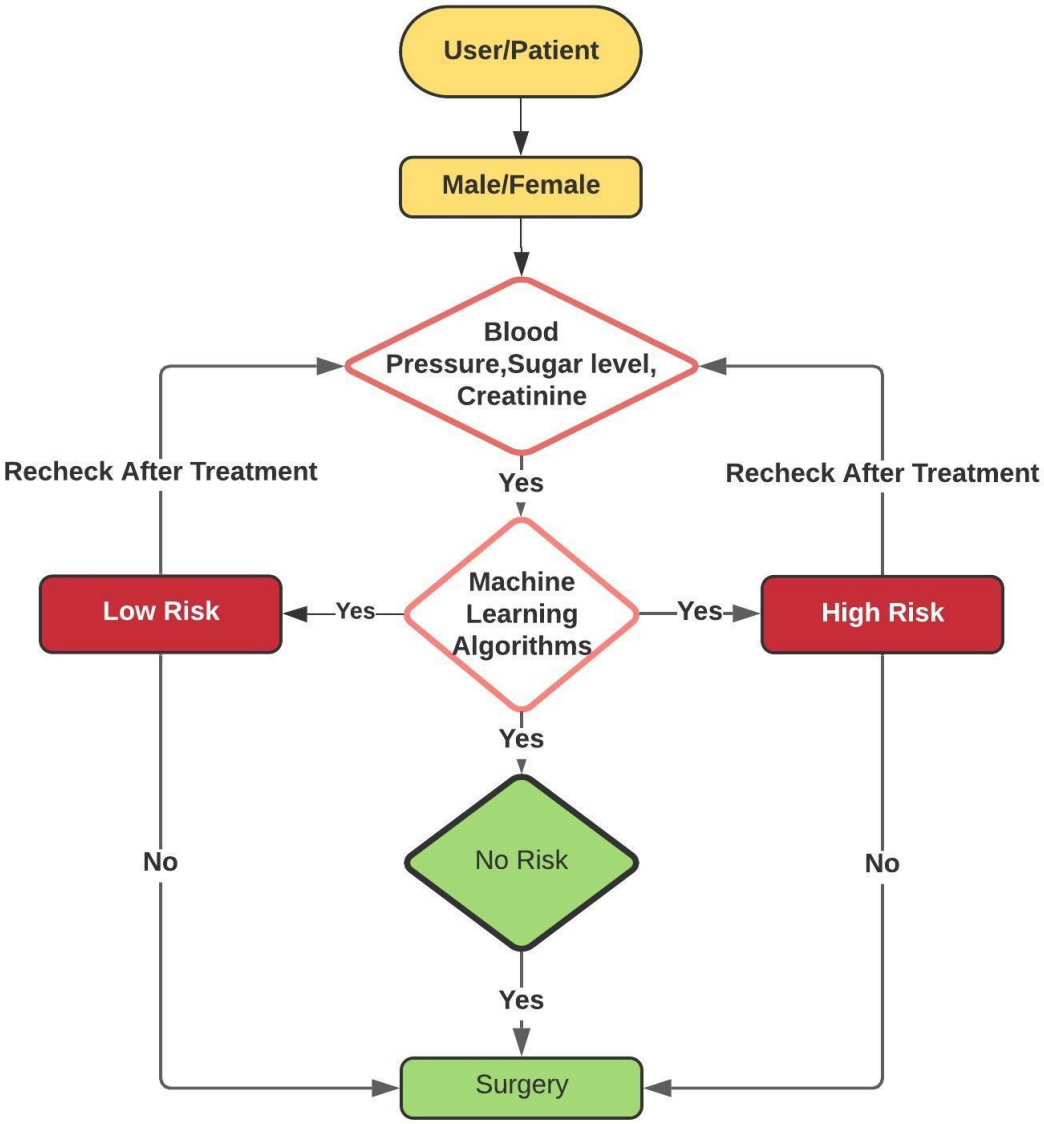
1. NPO after
2. Consent : Routine / High Risk
3. Sedative
4. Narcotic
5. Antisialogogue
6.
7.
8.
9.
10.

Investigations to be done on Morning of Surgery

ORDERED BY SIGNATURE NAME DATE / TIME

RIAC
Endocrinology opinion
Surgery
- To follow Endocrinology opinion & continue OHAs as prescribed
- T. Telmisid-M (80/500) OD
T. Pantoprazole 40mg OD.
- Hbi AE, BSR
- RBS charting at home
- Pre OPD can be given
- To be reviewed after
Adv.
- Endocrine ref. for
- RBS & fitness
- Refer ECG
- RIAC

Please share the rough schema of your project data.



Please perform the first cut analysis using data collection, data pre-processing and data visualization and share insights for your project.

- Importing datasets from .csv format in the form of a table..

```
table= readtable("Anaesthesia.csv","PreserveVariableNames",true);
table
```

table = 8×14 table

	Name	Age	Sex	Blood Pressure	Hb/Hct	WBC/plateletes	Sugar F/PP/R	Urea/Creatinine	NA/K/CA
1	'Sushil Cho…	55	'Male'	'130/60'	'11.5/356'	'12910/324'	NaN	'17/0.5'	'139/3.3/1.3'
2	'Mantorini B…	42	'Male'	'119/72'	'10.2/321'	'19990/310'	NaN	'19/0.9'	'143/4/8.5'
3	'Pinki'	40	'Female'	'118/83'	'11.9'	'6.920/274'	NaN	'23/0.5'	'140/'
4	'Kesh Raj'	13	'Male'	''	'13.2/39.1'	'5.9/219'	NaN	''	''
5	'Payal'	17	'Female'	'119/90'	'14/43'	'5800/1.81'	NaN	'21/0.69'	'141/'
6	'Indrajeet K…	NaN	'Male'	'130/80'	'14.4/36.17'	'4.24/1.12'	89	'19.3/0.50'	'140/'
7	'Gayatri'	64	'Female'	'177/112'	'11.4'	'4570/1.53'	NaN	'14/0.74'	'138/'
8	'Sunita'	23	'Female'	'112/78'	'9.6/31.3'	'9.28/314'	116	'31.5/0.59'	'136.7/4.9/9.3

```
summary(table);
```

```
Variables:

    Name: 8×1 cell array of character vectors

    Age: 8×1 double

        Values:

            Min             13
            Median          40
            Max             64
            NumMissing      1

    Sex: 8×1 cell array of character vectors
```

```
table2 = removevars(table,{'HBsAG/HIV','Sugar F/PP/R'});
table2
```

table2 = 8×12 table

	Name	Age	Sex	Blood Pressure	Hb/Hct	WBC/plateletes	Urea/Creatinine	NA/K/CA	T Proteins /A/G
1	'Sushil Cho…	55	'Male'	'130/60'	'11.5/356'	'12910/324'	'17/0.5'	'139/3.3/1.3'	''
2	'Mantorini B…	42	'Male'	'119/72'	'10.2/321'	'19990/310'	'19/0.9'	'143/4/8.5'	'6.8/3.7'
3	'Pinki'	40	'Female'	'118/83'	'11.9'	'6.920/274'	'23/0.5'	'140/'	'6.8/4.3/1.66'
4	'Kesh Raj'	13	'Male'	''	'13.2/39.1'	'5.9/219'	''	''	''
5	'Payal'	17	'Female'	'119/90'	'14/43'	'5800/1.81'	'21/0.69'	'141/'	'7.5/4.9'
6	'Indrajeet K…	NaN	'Male'	'130/80'	'14.4/36.17'	'4.24/1.12'	'19.3/0.50'	'140/'	'7.08/1.85'
7	'Gayatri'	64	'Female'	'177/112'	'11.4'	'4570/1.53'	'14/0.74'	'138/'	'7.6/4.4'
8	'Sunita'	23	'Female'	'112/78'	'9.6/31.3'	'9.28/314'	'31.5/0.59'	'136.7/4.9/9.3'	'7.1/3.9/3.2'

- We attempted to find missing data by taking mean of the available data under that particular variable.

```
mean_age=round(nanmean(table2{:,'Age'}),0);
mean_alkap=round(nanmean(table2{:,'ALKP04ASE'}),0);
table2=fillmissing(table2,"constant",mean_age,'DataVariables',{'Age'});
table2=fillmissing(table2,"constant",mean_alkap,'DataVariables',{'ALKP04ASE'});
missing=(ismissing(table2{:,'Blood Pressure'})==1);
missing
```

missing = 8×1 logical array

```
   0
   0
   0
   1
   0
   0
   0
   0
```

```
for k=1:size((missing),1)
    if missing(k,1)==1
        table2(k,:)=[];
    end
end
table2
```

table2 = 7×12 table

	Name	Age	Sex	Blood Pressure	Hb/Hct	WBC/plateletes	Urea/Creatinine	NA/K/CA	T Proteins /A/G
1	'Sushil Cho…	55	'Male'	'130/60'	'11.5/356'	'12910/324'	'17/0.5'	'139/3.3/1.3'	''
2	'Mantorini B…	42	'Male'	'119/72'	'10.2/321'	'19990/310'	'19/0.9'	'143/4/8.5'	'6.8/3.7'
3	'Pinki'	40	'Female'	'118/83'	'11.9'	'6.920/274'	'23/0.5'	'140/'	'6.8/4.3/1.66'
4	'Payal'	17	'Female'	'119/90'	'14/43'	'5800/1.81'	'21/0.69'	'141/'	'7.5/4.9'
5	'Indrajeet K…	36	'Male'	'130/80'	'14.4/36.17'	'4.24/1.12'	'19.3/0.50'	'140/'	'7.08/1.85'
6	'Gayatri'	64	'Female'	'177/112'	'11.4'	'4570/1.53'	'14/0.74'	'138/'	'7.6/4.4'
7	'Sunita'	23	'Female'	'112/78'	'9.6/31.3'	'9.28/314'	'31.5/0.59'	'136.7/4.9/9.3'	'7.1/3.9/3.2'

```
bloodPressure=table2{:,"Blood Pressure"};
bloodPressure2=split(bloodPressure(:,1),'/');
bloodPressure2
```

bloodPressure2 = 7×2 cell

```
'130'    '60'
'119'    '72'
'118'    '83'
'119'    '90'
'130'    '80'
'177'    '112'
'112'    '78'
```

```
systole=str2double(bloodPressure2(:,1));
diastole=str2double(bloodPressure2(:,2));
table2.("Systolic Pressure")=systole;
table2.("Diastolic Pressure")=diastole;
table2
```

table2 = 7×14 table

	Name	Age	Sex	Blood Pressure	Hb/Hct	WBC/plateletes	Urea/Creatinine	NA/K/CA	T Proteins /A/G
1	'Sushil Cho…	55	'Male'	'130/60'	'11.5/356'	'12910/324'	'17/0.5'	'139/3.3/1.3'	''
2	'Mantorini B…	42	'Male'	'119/72'	'10.2/321'	'19990/310'	'19/0.9'	'143/4/8.5'	'6.8/3.7'
3	'Pinki'	40	'Female'	'118/83'	'11.9'	'6.920/274'	'23/0.5'	'140/'	'6.8/4.3/1.66'
4	'Payal'	17	'Female'	'119/90'	'14/43'	'5800/1.81'	'21/0.69'	'141/'	'7.5/4.9'
5	'Indrajeet K…	36	'Male'	'130/80'	'14.4/36.17'	'4.24/1.12'	'19.3/0.50'	'140/'	'7.08/1.85'
6	'Gayatri'	64	'Female'	'177/112'	'11.4'	'4570/1.53'	'14/0.74'	'138/'	'7.6/4.4'
7	'Sunita'	23	'Female'	'112/78'	'9.6/31.3'	'9.28/314'	'31.5/0.59'	'136.7/4.9/9.3'	'7.1/3.9/3.2'

➢ Using available data to perform data visualization

```
f=@introdelim;
g=@seperatecol;
fm=@fillmean;
table2=f(table2,{'SGOT/PT','Hb/Hct','NA/K/CA','T Proteins /A/G','Biliburin/D/l'}.');
table2
```

table2 = 7×14 table

	Name	Age	Sex	Blood Pressure	Hb/Hct	WBC/plateletes	Urea/Creatinine	NA/K/CA	T Proteins /A/G
1	'Sushil Cho…	55	'Male'	'130/60'	'11.5/356'	'12910/324'	'17/0.5'	'139/3.3/1.3'	'/'
2	'Mantorini B…	42	'Male'	'119/72'	'10.2/321'	'19990/310'	'19/0.9'	'143/4/8.5'	'6.8/3.7/'
3	'Pinki'	40	'Female'	'118/83'	'11.9/'	'6.920/274'	'23/0.5'	'140/'	'6.8/4.3/1.66'
4	'Payal'	17	'Female'	'119/90'	'14/43'	'5800/1.81'	'21/0.69'	'141/'	'7.5/4.9/'
5	'Indrajeet K…	36	'Male'	'130/80'	'14.4/36.17'	'4.24/1.12'	'19.3/0.50'	'140/'	'7.08/1.85/'
6	'Gayatri'	64	'Female'	'177/112'	'11.4/'	'4570/1.53'	'14/0.74'	'138/'	'7.6/4.4/'
7	'Sunita'	23	'Female'	'112/78'	'9.6/31.3'	'9.28/314'	'31.5/0.59'	'136.7/4.9/9.3'	'7.1/3.9/3.2'

```
table2=g(table2,{'Hb/Hct','WBC/plateletes','Urea/Creatinine','NA/K/CA','SGOT/PT','T Proteins /A/G','Biliburin/D/l'}.');
table2
```

table2 = 7×31 table

	Name	Age	Sex	Blood Pressure	Hb/Hct	WBC/plateletes	Urea/Creatinine	NA/K/CA	T Proteins /A/G
1	'Sushil Cho…	55	'Male'	'130/60'	'11.5/356'	'12910/324'	'17/0.5'	'139/3.3/1.3'	'/'
2	'Mantorini B…	42	'Male'	'119/72'	'10.2/321'	'19990/310'	'19/0.9'	'143/4/8.5'	'6.8/3.7/'
3	'Pinki'	40	'Female'	'118/83'	'11.9/'	'6.920/274'	'23/0.5'	'140/'	'6.8/4.3/1.66'
4	'Payal'	17	'Female'	'119/90'	'14/43'	'5800/1.81'	'21/0.69'	'141/'	'7.5/4.9/'
5	'Indrajeet K…	36	'Male'	'130/80'	'14.4/36.17'	'4.24/1.12'	'19.3/0.50'	'140/'	'7.08/1.85/'
6	'Gayatri'	64	'Female'	'177/112'	'11.4/'	'4570/1.53'	'14/0.74'	'138/'	'7.6/4.4/'
7	'Sunita'	23	'Female'	'112/78'	'9.6/31.3'	'9.28/314'	'31.5/0.59'	'136.7/4.9/9.3'	'7.1/3.9/3.2'

```
table2=removevars(table2,{'Blood Pressure','Hb/Hct','WBC/plateletes','Urea/Creatinine','NA/K/CA','SGOT/PT','T Proteins /A/G','Biliburin/D/
table2=removevars(table2,{'K','CA','G'});
table2
```

table2 = 7×20 table

	Name	Age	Sex	ALKP04ASE	Systolic Pressure	Diastolic Pressure	Hb	Hct	WBC	p
1	'Sushil Cho...	55	'Male'	144	130	60	11.5000	356.0000	12910	
2	'Mantorini B...	42	'Male'	124	119	72	10.2000	321.0000	19990	
3	'Pinki'	40	'Female'	48	118	83	11.9000	NaN	6.9200	
4	'Payal'	17	'Female'	64	119	90	14.0000	43.0000	5800	
5	'Indrajeet K...	36	'Male'	93	130	80	14.4000	36.1700	4.2400	
6	'Gayatri'	64	'Female'	75	177	112	11.4000	NaN	4570	
7	'Sunita'	23	'Female'	458	112	78	9.6000	31.3000	9.2800	

```
table2=fm(table2,{'Hb','Hct','WBC','Urea','NA','SGOT','D','l','A','T Proteins ','PT'}.');
table2
```

table2 = 7×20 table

	Name	Age	Sex	ALKP04ASE	Systolic Pressure	Diastolic Pressure	Hb	Hct	WBC	p
1	'Sushil Cho...	55	'Male'	144	130	60	11.5000	356.0000	12910	
2	'Mantorini B...	42	'Male'	124	119	72	10.2000	321.0000	19990	
3	'Pinki'	40	'Female'	48	118	83	11.9000	157.4900	6.9200	
4	'Payal'	17	'Female'	64	119	90	14.0000	43.0000	5800	
5	'Indrajeet K...	36	'Male'	93	130	80	14.4000	36.1700	4.2400	
6	'Gayatri'	64	'Female'	75	177	112	11.4000	157.4900	4570	
7	'Sunita'	23	'Female'	458	112	78	9.6000	31.3000	9.2800	

```
table2=sortrows(table2,'Age')
```

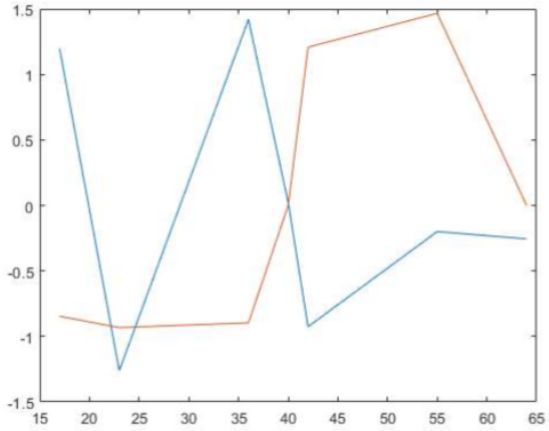
table2 = 7×20 table

	Name	Age	Sex	ALKP04ASE	Systolic Pressure	Diastolic Pressure	Hb	Hct	WBC	p
1	'Payal'	17	'Female'	64	119	90	14.0000	43.0000	5800	
2	'Sunita'	23	'Female'	458	112	78	9.6000	31.3000	9.2800	
3	'Indrajeet K...	36	'Male'	93	130	80	14.4000	36.1700	4.2400	
4	'Pinki'	40	'Female'	48	118	83	11.9000	157.4900	6.9200	
5	'Mantorini B...	42	'Male'	124	119	72	10.2000	321.0000	19990	
6	'Sushil Cho...	55	'Male'	144	130	60	11.5000	356.0000	12910	
7	'Gayatri'	64	'Female'	75	177	112	11.4000	157.4900	4570	

```
plot(table2.Age,(table2.Hb-nanmean(table2.Hb))/nanstd(table2.Hb));

hold on
plot(table2.Age,(table2.Hct-nanmean(table2.Hct))/nanstd(table2.Hct));
plot(table2.Age,(table2.WBC-nanmean(table2.WBC))/nanstd(table2.WBC));
plot(table2.Age,(table2.plateletes-nanmean(table2.plateletes))/nanstd(table2.plateletes));

hold off
```




```
function[table]=introdelim(table,col1)
col1={'WBC/plateletes'
      'Hb/Hct'}
for m=1:size(col1,1) %size=n X 1
col=col1{m,1}; % col='WBC/plateletes'
col2=table{:,col};
mx=countmaxdelim(table,col);
for k=1:size(col2,1)
```

```
        num=length(strfind(col2{k,1},'/'));
        count=mx-num;
        for j=1:count
            table.(col){k,1}=append(table.(col){k,1},'/');
        end
end
end
end

function[mx]=countmaxdelim(table,col)
    col2=table{:,col};
    count=zeros(size(col2));
    for k=1:size(col2,1)
        count(k,1)=length(strfind(col2{k,1},'/'));
    end
    mx=max(count(:)); %max([1 2])
end

function[table]=seperatecol(table,col1)
    for m=1:size(col1,1)
        col=col1{m,1};
        col3=split(col,'/'); %{"Hb/Hct"}='Hb' 'Hct'
        col2=table{:,col};
        col4=split(col2(:,1),"/"); %col2={'120/30'     %col3
                                    '140/50'}
        for k=1:size(col3,1)
            table.(col3{k,1})=round(str2double(col4(:,k)),2);
        end
    end
end

function[table]=fillmean(table,col1)
    for m=1:size(col1,1)
    mean=round(nanmean(table{:,col1{m,1}}),2);
    table=fillmissing(table,"constant",mean,'DataVariables',{col1{m,1}});
    end
end
```

This program was written in the month of November when we had limited datasets. We have now collected a total of 100 datasets. The data preprocessing & visualization part is complete and we have headed towards building a digital prototype.

For our project purpose, we have been suggested to use only these three predictor variables due to limited reliable data availability. However, it is anticipated that the current program can be made comprehensive at a later stage to include more variables for prediction depending upon the availability of data with Dr. Nishkarsh Gupta.