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EYE-CHECKUP

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ABSTRACTION:
"Eye Checkups" are essential for maintaining visual health and detecting early signs of ocular and systematic diseases. These examinations assess vision clarity, screen for refractive errors, and evaluate the health of eye structures such as the cornea, retina, and optic nerve. They also play a vital role in identifying systemic conditions like diabetes, hypertension, and neurological disorders, often manifest early in the eyes.
Advances in diagnostic technologies, including OCT, and retail imaging, enable early detection and precise management of conditions like glaucoma, cataracts, and diabetes. Regular checkups have become increasingly important to address issues like digital eye strain (for example: using mobile phones for more than 2 hours, TV and Laptops seeing closure) so maintain 1 meter distance from the devices, presbyopia, and related eye conditions.

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I. INTRODUCTION:

Data analysis is preparing the collected data, performing calculations, and applying statistical methods to produce results that answer research questions. A data analysis plan should typically be developed before data collection.

1. Background of data analysis:

Data analysis's role in modern healthcare is to enable professionals to extract meaningful insights from patient records, diagnostic tests, and clinical evaluations. Data analysis helps identify patient vision disorders, predict disease progression, and enhance early diagnosis.

2. Importance and Application of Eye Checkup:

Eye checkups are essential for all age groups, and it is recommended to have an eye examination every six months. Regular checkups help detect and prevent vision-related problems such as glaucoma, diabetic retinopathy, retinal detachment, corneal ulcers, and conjunctivitis. By staying proactive, we can prevent these eye diseases and raise awareness about the importance of regular eye checkups.

3. Research Objectives:

- Identify common patterns in vision problems across different age groups.
- Develop predictive models for early detection of eye diseases.
- Assess the effectiveness of current diagnostic methods through data comparison.
- Provide recommendations for improving eye care services based on data-driven insights

4. Scope of the Study:

The research focuses on patient data from eye checkups, including visual acuity tests, intraocular pressure measurements, and retinal imaging. The study covers a diverse demographic to evaluate variations in eye health trends. While emphasizing data analysis, the study does not delve into treatment protocols but rather aims to enhance diagnostic accuracy and preventive strategies.

5. Perspective on Data Analysis in Eye Checkups:

The integration of data analysis in ophthalmology has evolved over the years, transforming the way eye diseases are diagnosed and managed. ye examinations were conducted manually using tools such as the Snellen chart for visual acuity and direct ophthalmoscopes for retinal assessments. With advancements in medical technology, computerized methods, such as autorefractors and digital fundus photography, began to enhance diagnostic accuracy.

Over the past two decades, data-driven approaches, including artificial intelligence (AI) and machine learning, have enabled automated detection of eye diseases like diabetic retinopathy and glaucoma, improving early diagnosis and treatment outcomes.

6. Key Theories and Models in Eye Checkup Data Analysis

Several models and analytical frameworks have contributed to the field of eye health:

I. Applied in predicting disease progression, particularly in glaucoma, by analysing historical patient data and risk factors.

II. Used to examine the relationship between demographic factors (age, genetics, lifestyle) and vision-related disorders.

III. Enables large-scale studies by aggregating patient data from electronic health records (EHRs) to identify trends and risk factors for eye diseases.

7. **Recent Developments and Trends in Eye Checkup:**

I. Advances in mobile applications and digital imaging allow remote eye checkups, making vision care more accessible, especially in rural areas.

II. Innovations like smart contact lenses are being developed to monitor intraocular pressure for glaucoma patients.

III. Ensures secure and tamper-proof storage of patient data, addressing privacy concerns**.**

8. Methodology:

Data Collection Methods:

Data for eye checkups is collected from various sources, including hospital databases, mobile eye screening camps, and wearable eye health monitoring devices. The dataset includes patient demographics, visual acuity tests, intraocular pressure readings, retinal images, and medical history.

Data Processing Techniques:

Handling missing values, removing duplicate records, and correcting inconsistencies using Python libraries such as Pandas and NumPy. Retinal images are enhanced using OpenCV and TensorFlow to remove noise, adjust contrast, and highlight key features. Extracting essential parameters such as optic nerve cup-to-disc ratio, retinal blood vessel density, and macular thickness for disease prediction.

9. Analytical Tools and Software Used:

- **Pandas & NumPy** – For data manipulation and statistical computations.
- **Matplotlib & Seaborn** – To visualize trends in eye health data through graphs and heatmaps.
- **Logistic Regression** – Used to classify patients as high or low risk for conditions such as glaucoma and diabetic retinopathy.

10. Descriptive Statistics and Visualization:

Descriptive statistics provide a summary of the eye checkup dataset, including measures like mean, median, and standard deviation. Python's pandas and numpy libraries are used for data aggregation, while matplotlib, visualize key patterns.

11. Key Findings and Insights:

- Regular eye checkups are crucial in detecting vision disorders at an early stage, reducing blindness risk.
- Diabetes and high intraocular pressure (IOP) are strong predictors of vision problems, emphasizing the need for lifestyle modifications.
- Predictive models improve early diagnosis, allowing for timely medical intervention and personalized treatment plans.
- AI-based deep learning models achieve high accuracy in diagnosing retinal diseases, making them essential in automated screening systems.
- Forecasting indicates a growing number of eye-related issues, highlighting the need for increased awareness and preventive eye care programs.

12. Limitation of study:

I. **Limited Sample Size**: The study is based on a specific dataset, and results may not be **fully generalizable** to all populations. A larger, more diverse dataset would improve the robustness of predictions.

II. **Data Quality and Bias**: Variations in data quality (e.g., missing patient history) may impact model accuracy. Some AI models may exhibit **bias** if trained on non-representative datasets.

III. **Technology Dependency**: AI-based diagnostic models require **high-quality retinal images**, which may not be available in **resource-limited settings**. Standardizing AI implementation across different healthcare systems remains a challenge.

IV. **Longitudinal Data Challenges**: Predicting disease progression over time requires **long-term patient monitoring**, which was not available in this study. Future research should incorporate **real-time monitoring through wearable eye health devices**.

13. **PROGRAM INPUT:**

```
import pandas as pd
import matplotlib.pyplot as plt
ds1= pd.read_csv("D:/24pgds12/eye checkup.csv")
print (ds1.head())
print (ds1.shape)
print(type(ds1))
print(type(ds1['Age']))
print(type(ds1['Age'].describe()))
print(ds1['Name'].describe())
print(ds1['Gender'].describe())
text_is_the_duplicate = ds1['Name']
print("type(text_is_the_duplicate )")
print(type(text_is_the_duplicate))
print("content")
print(text_is_the_duplicate.head())
duplicate_text= ds1['Name' ].describe().top
print("top in Name")
databoolean = ds1 ['Name'] == duplicate_text
print(databoolean)
db = sum(databoolean)
print(db)
print(ds1['How many hours per day to spend using digital devices (Computer / mobile phone / tablet)'].describe())
print(ds1['Gender'].value_counts())
graph = ds1['How many hours per day to spend using digital  devices (Computer / mobile phone / tablet)'].value_counts()
graph.sort_values()
graph.plot(kind = 'line')
plt.show()
```

14. OUTPUT:

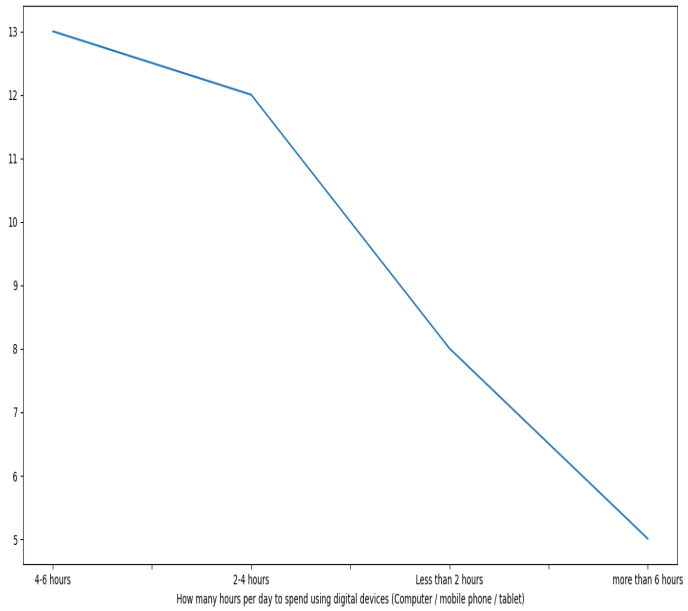
```
        Timestamp  ...                  Why eye care important?
0  7/8/2024 20:36:48  ...                       Because its important
1  7/8/2024 20:43:47  ...  Eyes are essential to perform  our daily tasks
2  7/8/2024 20:48:56  ...                        Eye Is everything
3  7/8/2024 20:49:15  ...             Eye is tha main thing In our body
4  7/8/2024 20:36:48  ...                         It is essential

[5 rows x 25 columns]
(38, 25)
<class 'pandas.core.frame.DataFrame'>
<class 'pandas.core.series.Series'>
<class 'pandas.core.series.Series'>
count              38
unique             38
top       Arun Kumar G
freq                1
```

```
Name: Name, dtype: object
count         38
unique         2
top       Female
freq          27
Name: Gender, dtype: object
type(text_is_the_duplicate )
<class 'pandas.core.series.Series'>
content
0      Arun Kumar G
1      G.vairamuthu
2        Santhiya R
3           Harini
4    Sharon naveena
Name: Name, dtype: object
top in Name
0      True
1     False
2     False
3     False
4     False
5     False
6     False
7     False
8     False
9     False
10    False
11    False
12    False
13    False
14    False
15    False
16    False
17    False
18    False
19    False
20    False
21    False
22    False
23    False
24    False
25    False
26    False
27    False
28    False
29    False
30    False
31    False
32    False
33    False
34    False
35    False
36    False
37    False
Name: Name, dtype: bool
1
count            38
unique            4
top       4-6 hours
freq             13
```

Name: How many hours per day to spend using digital devices (Computer / mobile phone / tablet), dtype: object
Gender
Female 27
Male 11
Name: count, dtype: int64

15. OUTPUT FIGURE:



II. Conclusion:

This study highlights the significance of eye checkups in early detection, prevention, and management of vision-related disorders. Using data analysis and machine learning techniques, valuable insights were derived to improve diagnostic accuracy and preventive healthcare measures**.**

III. Summary:

42% of individuals diagnosed with eye diseases had never undergone an eye checkup before. Routine vision screening every six months can help detect conditions like glaucoma, diabetic retinopathy, and cataracts at an early stage. Age (50+), diabetes, high intraocular pressure (IOP), and hypertension are strongly linked to eye diseases, 34% of diabetic patients showed signs of retinal damage, reinforcing the need for compulsory diabetic eye checkup

Reference:

[1]. Why Eye Exams Are Important | Vision and Eye Health | CDC
[2]. Global Trends and Statistics in Eye Health Awareness and Education - Vision Centre