Visualization Techniques for Healthcare
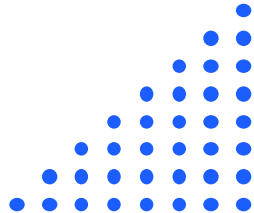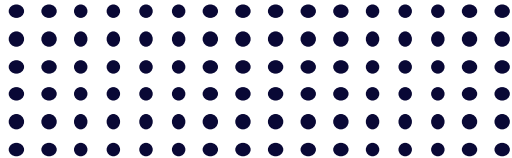
Adrian Lockwood

Introduction

Background

This research project aims to prove that healthcare tactics can improve the general welfare of African Americans. This will be performed by a study of random individuals in the State of South Carolina. Using a collection of forms from African Americans, I will use visualization techniques to analyze the data collected. This will be conducted by using visualization techniques so the results of the output are displayed properly. The type of forms used will consist of health aspects including history, knowledge, and attitude. The tools used will help provide solutions in Healthcare for African Americans.

Abstract

The integration of technology into daily life has generated great interest across various domains, including research, healthcare, and personal well-being. The information given will provide an overview of categorizing the findings of Healthcare. The purpose of this research is to find visualization methods so we can collect various health data. This is ideal for tracking health especially when dealing with a large amount of input from participants. The methods and results will determine if health literacy and data will help improve individuals' health efforts.
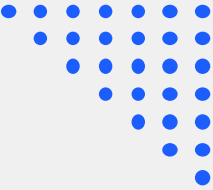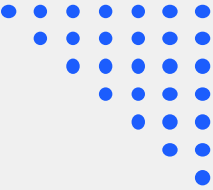
Electronic Health Records (EHR)

An electronic health record (EHR) is a digital version of a patient's paper chart. EHRs are real patient records that make information readily available and securely to authorized users. While an EHR does contain the medical and treatment histories of patients, an EHR system is built to go beyond standard clinical data collected in a provider's office and can be inclusive of a broader view of a patient's care. EHRs are a vital part of health IT and can contain a patient's medical history, diagnoses, medications, treatment plans, immunization dates, allergies, radiology images, and laboratory and test results. It's convenient since information can be shared with other health care providers and organizations.

Why are these techniques more effective?

Communication/ Comprehension

Visualizations provide a powerful means of communication, allowing complex data and insights to be explained and displayed clearly. Visual representations are more accessible and engaging than lengthy textual or numerical descriptions, making it easier to share information with diverse audiences. It also makes it easier for people to remember information and comprehend complex relationships when sharing data.
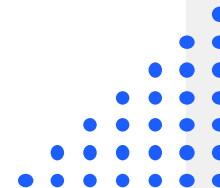
Making Decisions

When faced with large datasets, decision-makers can benefit from visualizations that point out key trends, correlations, and outliers. Visualizations can also manage decision-making by presenting information in a format that is easy to interpret and promote effective communication of information.

Finding Discrepancies and Exploring New ideas

Visualization tools can quickly highlight deviations from the norm, prompting further investigation into potential issues or insights. From plots to machine learning models, these methods not only can spot abnormalities, but also gain a deeper understanding of thinking. By generating new hypotheses and insights, researchers can develop and provide new solutions to real-world problems.
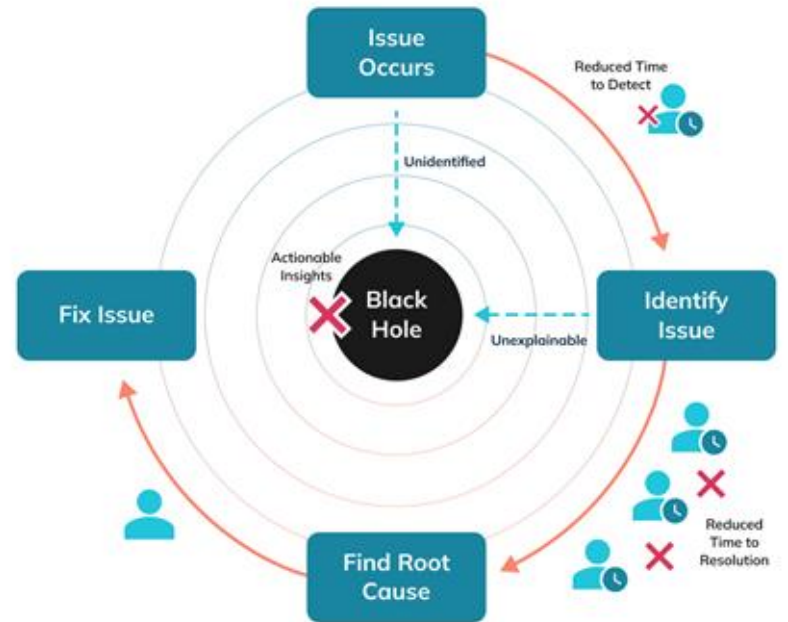
Methods
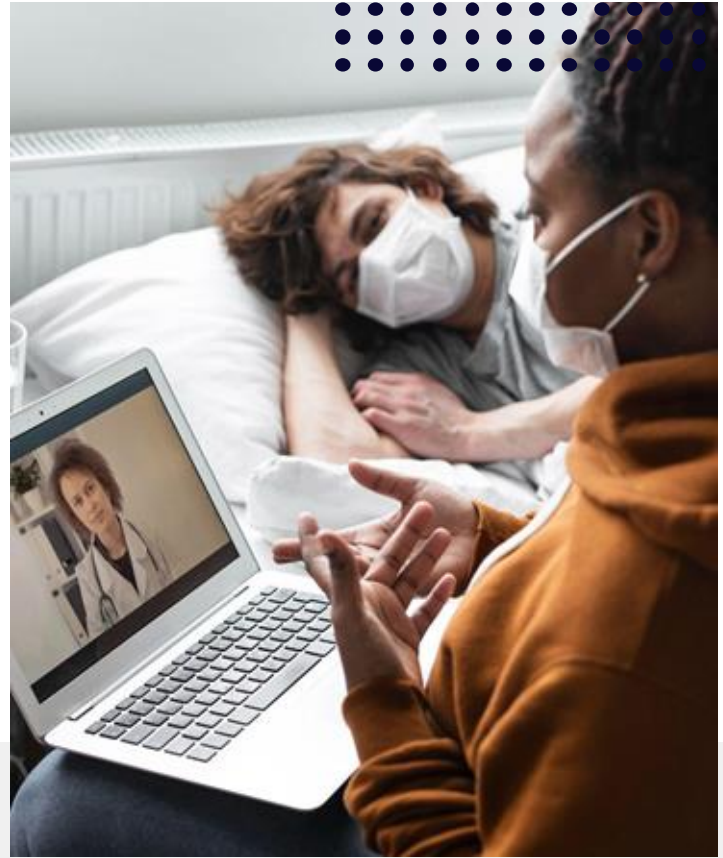
Logistic Regression

There have been a few ways of using visualization when it comes to health. One of the most common has been using Healthcare models. Healthcare models have been very helpful as far as predicting a binary outcome. This means that it could detect responses such as 'yes or no,' and 'True or False.' A method that uses a strategy like this is called Logistic regression. Logistic regression is a statistical method that uses parameters to predict the probability of an event.

Why is it great?

This method is based on independent variables (like patient data) to predict things like risk assessment, early diagnosis, treatment planning, and clinical mortality. Logistic Regression is a great visualization method that has been improving greatly in the Healthcare Industry. While this method is more statistical, it can provide great aspects for visualization. The first being determining probability which can help users understand how the predicted probabilities change as input variables vary. Another is also looking at the effects of interactions. With this, researcher can understand how the relationship between the predictors and the outcome changes when certain conditions are met to determine which models are the best to use.
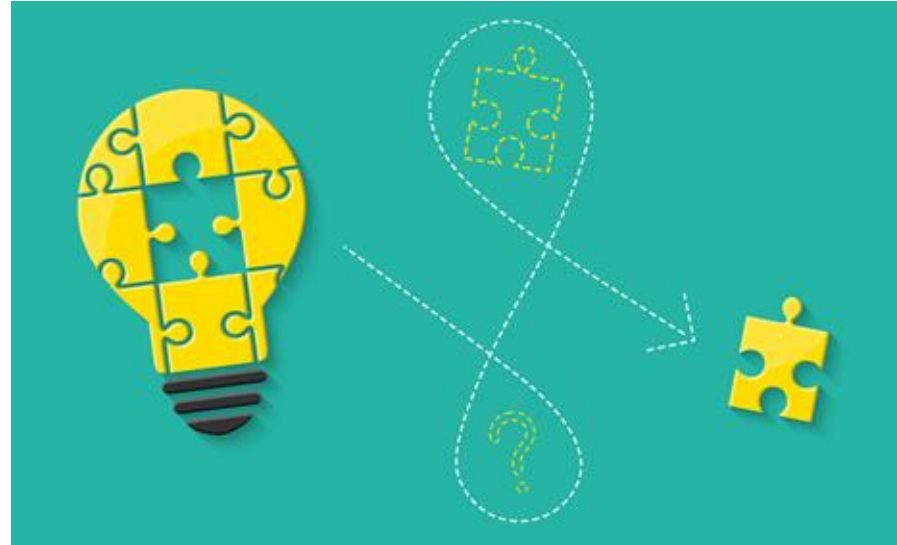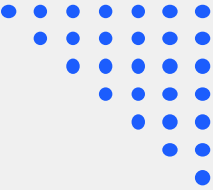
Regression Tree

A regression tree is a type of decision tree used in statistics and machine learning when predicting a certain outcome. It is a tree-like structure where each node represents a decision or condition based on a specific feature, and each leaf node represents a predicted numerical value. It's great for visualization as you can quickly identify which features play a significant role in predicting the target variable, making it easier to focus on important factors in your analysis.

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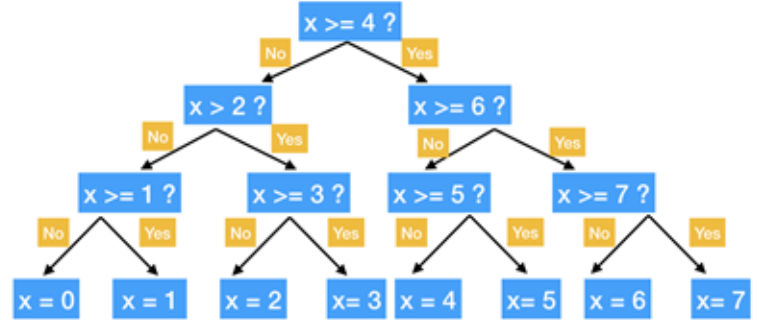
Innovative Tactics Report

There have also been way that show that there have been methods implemented for a different approach to visualization. In West (2015), a study was conducted to evaluate innovative approaches to knowledge discovery using visualization techniques reported between 1996 and 2013. This was done by using an electronic literature search for comprehensive findings on health tactics. The study concentrated on records from a single patient and the representation of complex data connected to a single patient.

UCI ML repository

UCI ML repository is a collection of databases and datasets used to learn machine algorithms. These datasets are very helpful for Data scientists, machine learning practitioners, and researchers as they can use the repository to develop and test new algorithms, models, and data analysis techniques on a variety of datasets.. Not only does it interpret results but it can also determine how they can get those results. It's notable for its website due to it providing a user-friendly interface for browsing, searching, and downloading datasets

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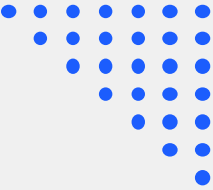
Popularity

Accessibility

The UCI repository stands out from other dataset collections as it available to the general public at no cost making it a popular platform for teachers, researchers, and scientists. It also offers a variety of open-source applications for several purposes like research projects and machine analysis reports.

Quality of Information

The datasets on the repository is very informative and accurate. It details information about data sources, features, attributes, and any data preprocessing that may have been applied. It also entails domains, including classification, regression, and clustering which are important in experimentation and data analysis.

UCI

Machine Learning Repository
Center for Machine Learning and Intelligent Systems

Adult Data Set
Download: Data Folder, Data Set Description
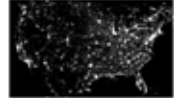
Abstract: Predict whether income exceeds $50K/yr based on census data. Also known as "Census Income" dataset.

| Data Set Characteristics:	Multivariate	Number of Instances:	48842	Area:	Social
Attribute Characteristics:	Categorical, Integer	Number of Attributes:	14	Date Donated	1996-05-01
Associated Tasks:	Classification	Missing Values?	Yes	Number of Web Hits:	1868994

Source:

Donor:

Ronny Kohavi and Barry Becker
Data Mining and Visualization
Silicon Graphics.
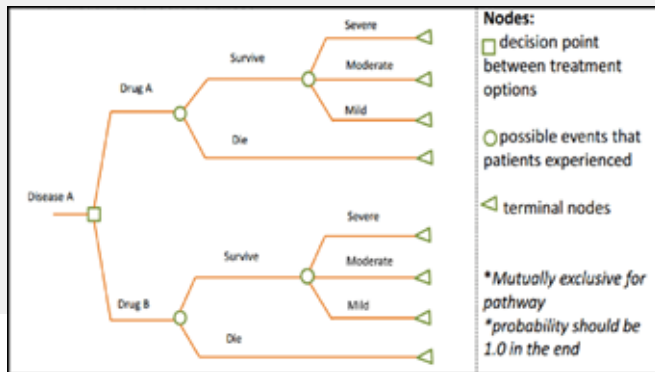e-mail: ronnyk '@' live.com for questions.

Results
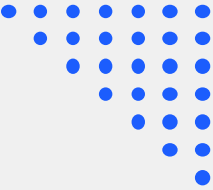
MEPS Dataset

Serving as a valuable resource for researchers, policymakers, and healthcare professionals, The Medical Expenditure Panel Survey (MEPS) is a data tool beneficial in healthcare. It collects information like Demographics, insurance coverage, and health outcomes. By using this dataset, researchers can identify disparities in healthcare access and spending across different demographic groups and can be used for educational purposes and to effectively communicate healthcare-related information.

Select by year and/or data file type

Year: All available years

Data file types to include in search (check all that apply). Click information icon for file details. Click link for full list of file types in category.

☐ Search all data files
☐ Household Component Full-Year files
Expenditure and utilization data for the calendar year from several rounds of data collection.
☐ Full-Year Consolidated Data files
☐ Full-Year Population Characteristics files
☐ Full-Year Medical Organizations Survey files
☐ Medical Conditions files
☐ Risk Adjustment Scores files
☐ Employment Variables file
☐ Jobs files
☐ Food Security file
☐ Person Round Plan files
☐ Longitudinal Data files
☐ Preventive Care Self-Administered Questionnaire file (2014)
☐ Supplemental Variables files (1996-2000)
☐ Health Insurance Plan Abstraction file (1996)
☐ Long Term Care file (1998)
☐ Household Component Event files
Data for the calendar year on unique household-reported medical events.
☐ Prescribed Medicines files
☐ Dental Visits files
☐ Other Medical Expenses files
☐ Hospital Inpatient Stays files
☐ Emergency Room Visits files
☐ Outpatient Visits files
☐ Office-Based Medical Provider Visits files
☐ Home Health files

Source:

The Regression Tree

The Regression Tree has been proven to be both an effective statistical method with great results. It was revealed in Sushmita (2015) that the average healthcare cost of just one person is $50,000. The demographics also showed that 9.08% of that comes from females while 23.09% are male. The remaining 67.83% are unspecified. While MEPS had a broader view of medical events, the data collected was categorized by beneficiaries. The main method of this was to use a Regression Tree by establishing an independent variable between the events and the cost of each one.

LifeLines 2

LifeLines is an application that visualizes categorical data from EHRs. It does this by using an operation called Align, Rank, and Filter (ARF) to collect patient data. This is different from standard visualization tactics as it is categorized by each feature so nothing gets misconstrued and can be compared easily. The project aims to help people find patterns in a group of records, so they can come up with solutions and figure out why things happen in a certain population.

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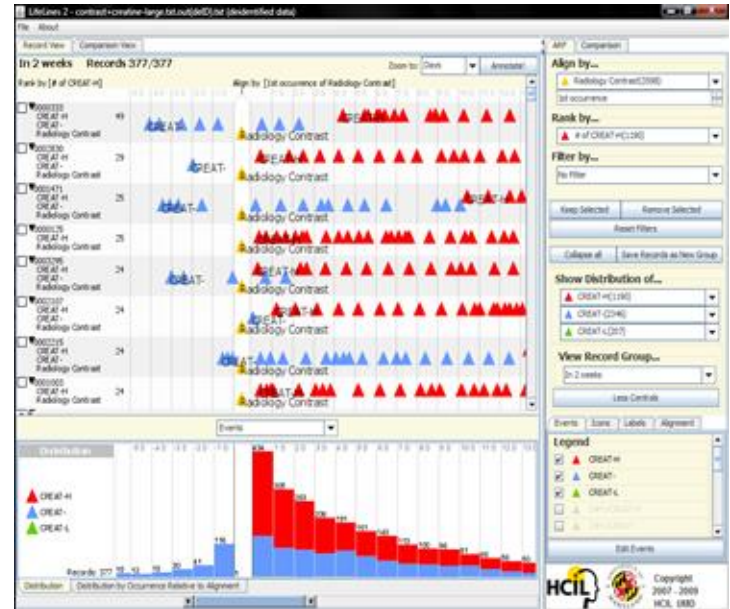
VISITORS

VISITORS (Visualization of Time-Oriented Records) is an application similar to LifeLines 2, but with a unique feature. It takes previous health record applications to create new ones, especially when dealing with time-based data. During its operation, it was discovered to be effective in the analysis of patient Electronic Health Records (EHRs). The findings indicated that the system is suitable for exploring long-term data for quality or clinical outcomes. These results were not obtained through traditional graphs but by identifying patterns and uncovering different values within a specific timeframe.

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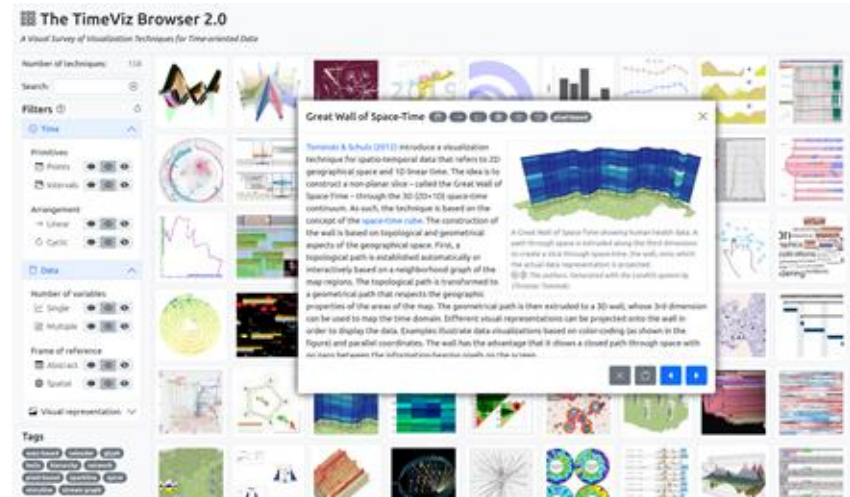
Discussions
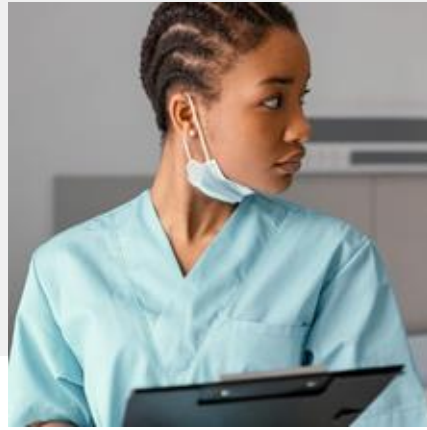
The Usage of A.I

Artificial Intelligence has made society much easier and simpler for people to use and understand. It has been especially important to the Industry of Healthcare. While Humans have tried for centuries to figure out things like medicine, practices,laws, and procedures, AI has come in to figure out potential problems hard to solve. With that, it has provided a sense of accuracy, security, and trust to these medical practitioners. After, the results will be able to determine how effective Explainable AI is to human society in healthcare.

Technology and Public Health

Technology has impacted the lives of humans and their health. These technologies have been innovated for the welfare and simplicity of humans. These Healthcare innovations include Robotic surgeries which minimize risks and pain while increasing the accuracy and practicality of the procedure. Telemedicine has increased and improved in the last 3 years due to the COVID-19 pandemic. Devices like Smart Inhalers track how much dosage is needed on a person suffering from asthma. Research shows that Smart Inhalers are known to use less medicine than traditional inhalers.

How to protect Data?

Confidentiality is a major concern when collecting personal information. A common solution researchers use is Differential Privacy. This is where a company can get data from a user with a dataset without knowing about the individual personally. Many industries use this method of protecting the patients' confidentiality including tech and healthcare. After receiving data, someone called a data custodian usually collects the data and gives what is called "private answers" to the person requesting. Therefore the data can be analyzed without revealing any sensitive information.
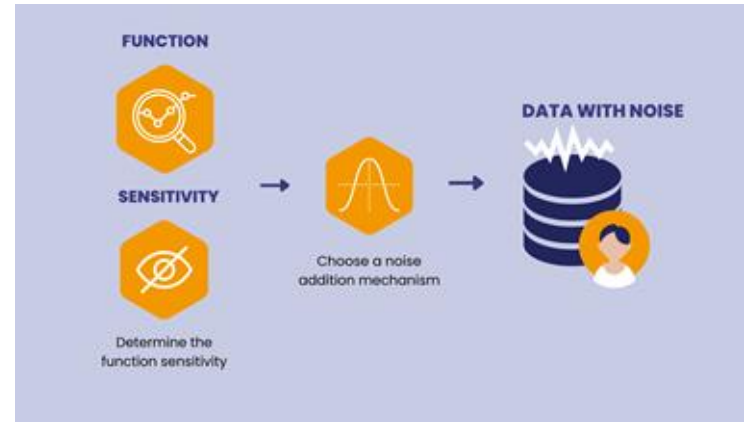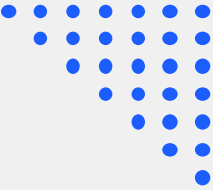

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Conclusion
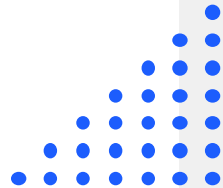
Purpose

The methods and solutions presented here offers a detailed view of the variety of healthcare tactics by using visualization. From datasets to machine models, to visual graphs, these tools have changed dramatically in careers like healthcare, education, and research. The objective of this these tactics to gather valuable health data, to promote health efforts amongst African Americans. These techniques have showcased how they can provide better solutions to improve outreach for the people who lack the proper resources.

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