The Ubiquitous Nature of Data

Vetria L. Byrd, PhD

Research Talk

vlbyrd@purdue.edu
Computer Graphics Technology
Polytechnic Institute
Purdue University

Data Science Boot camp | Georgia Tech
Friday, August 9, 2019

About Me

Vetria L. Byrd, PhD

Academic Preparation

- Computer Science (PhD, MS)
- Biomedical Engineering (MSMBE)

THE UNIVERSITY OF ALABAMA AT BIRMINGHAM

Knowledge that will change your world

Visualization Initiatives

- Research Experience for Undergraduates in Collaborative Data Visualization Applications (2014/2015)

CLEMSON UNIVERSITY

Water Cooler Chat

MIDWEST BIG DATA HUB

ACCELERATING THE BIG DATA INNOVATION ECOSYSTEM

Steering Committee Member
2016 -1018

BLUE WATERS
SUSTAINED PETASCALE COMPUTING

[Visualization Webinars]

International HPC Summer School
on HPC Challenges in Computational Sciences

Toronto, Canada (2015), Ljubljana, Slovenia (2016), Boulder, CO, US (2017)

http://www.ihpcss.org/about

HPC wire

Since 1987 - Covering the Fastest Computers in the World and the People Who Run Them

July 31, 2014

Biomedical Engineering and Computer Science

Medical Imaging & Bioinformatics

(pre-Purdue)

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Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology

Volume 85, Issue 4, April 1998, Pages 473-478

Semiautomated image registration for digital subtraction radiography

Vetria Byrd BS, MSBE (Programmer) [a], Tracy Mayfield-Donahoo DMD, MS, PhD (Assistant Professor) [b], Michael S Reddy DMD, DMSc (Associate Professor and Director) [c], Marjorie K Jeffcoat DMD (James Rosen Professor of Dental Research and Chair) [d]

Show more

https://doi.org/10.1016/S1079-2104(98)90077-4

Get rights and content

Abstract

Objective. The purpose of this study was to evaluate the semiautomatic alignment and correction of affine geometric discrepancies for digital subtraction radiography.

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A MULTIRESOLUTION APPROACH TO THE DETECTION OF IMAGE DISCREPANCIES FOR IMPROVED QUALITY CONTROL OF MICROARRAY OLIGONUCLEOTIDE IMAGES

by

VETRIA LAVERNE BYRD

ANTHONY SKJELLUM, CHAIR
KENNETH SLOAN
ALAN SPRAGUE
ELLIOT LEFKOWITZ
GRIER PAGE

A DISSERTATION

Submitted to the graduate faculty of The University of Alabama at Birmingham,
in partial fulfillment of the requirements for the degree of
Doctor of Philosophy

BIRMINGHAM, ALABAMA

2010

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About Me

Vetria L. Byrd, PhD

Engagement

Broadening Participation in Visualization (BPViz Workshop)

BPViz 2014

BPViz 2016

BPViz 2018

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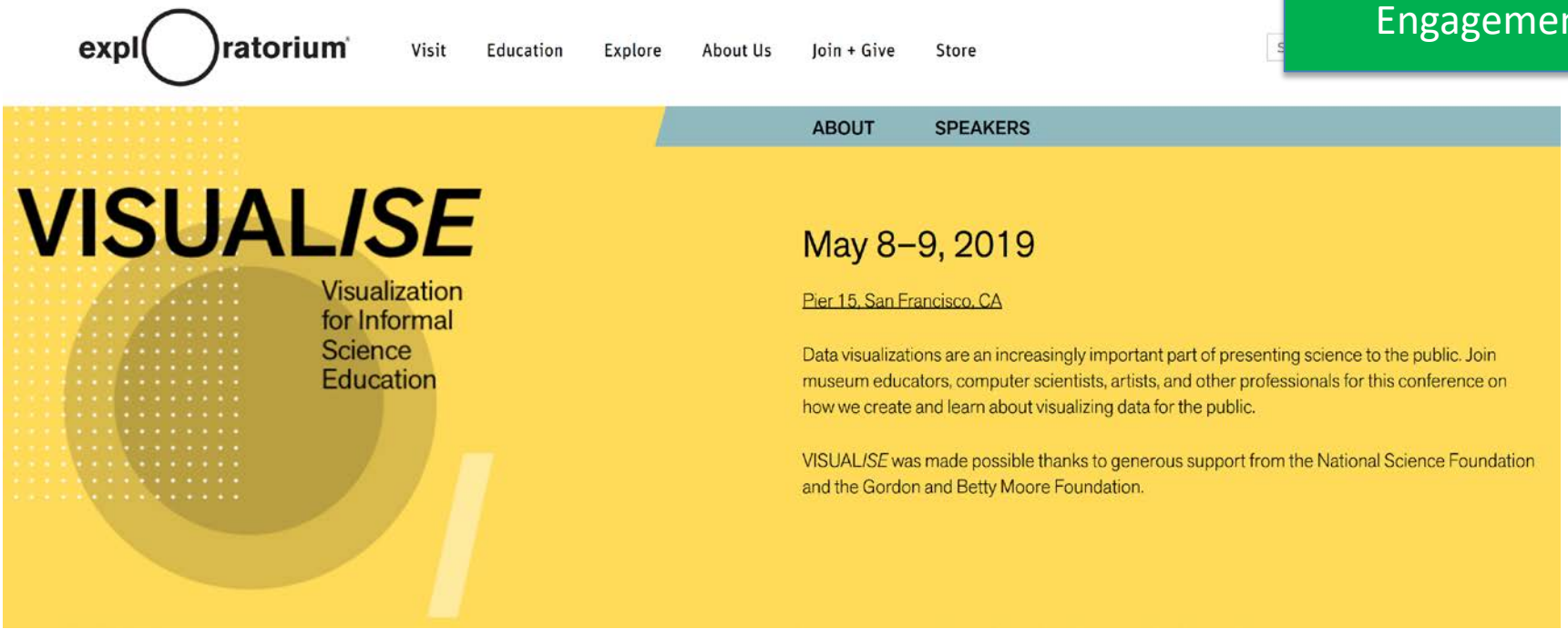
Agent for "Insight"

About Me

Vetria L. Byrd, PhD

Engagement



Advisory Board Member

PURDUE POLYTECHNIC

Agent for "Insight"

About Me

Vetria L. Byrd, PhD

Engagement

Broadening Participation in Visualization

Critical Data Viz Workshop: An introduction to the ethics and practice of data visualization

Monday, May 20, 2019 - Friday, May 24, 2019

Purdue University

Center for Science of Information
NSF Science and Technology Center

PURDUE UNIVERSITY Discovery Park

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Agent for "Insight"

About Me

Vetria L. Byrd, PhD

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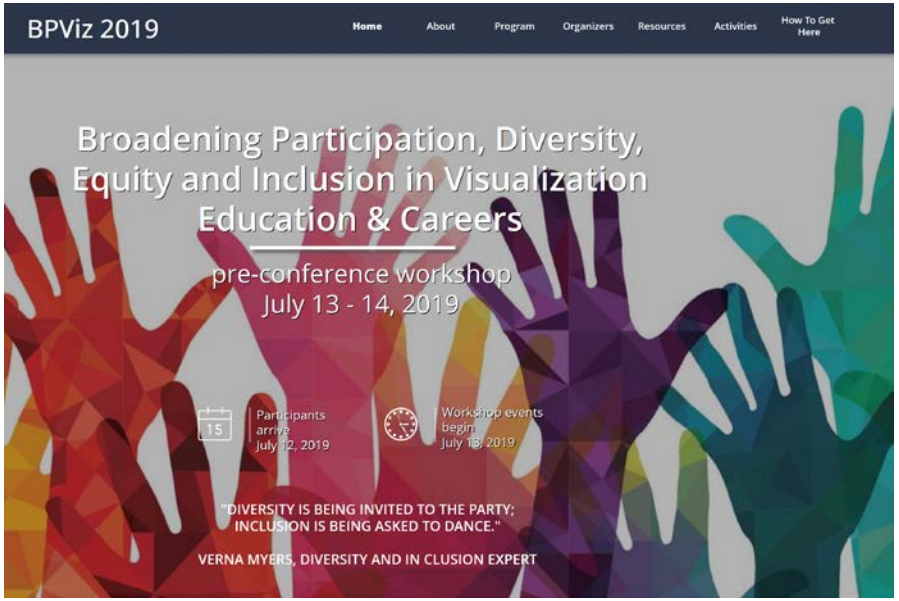
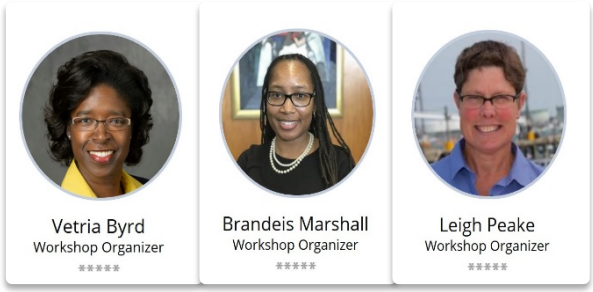
Broadening Participation in Visualization (BPViz Workshop)



BPViz 2019
Pre-conference Workshop
University of New England
Portland, Maine
July 13 – 14, 2019

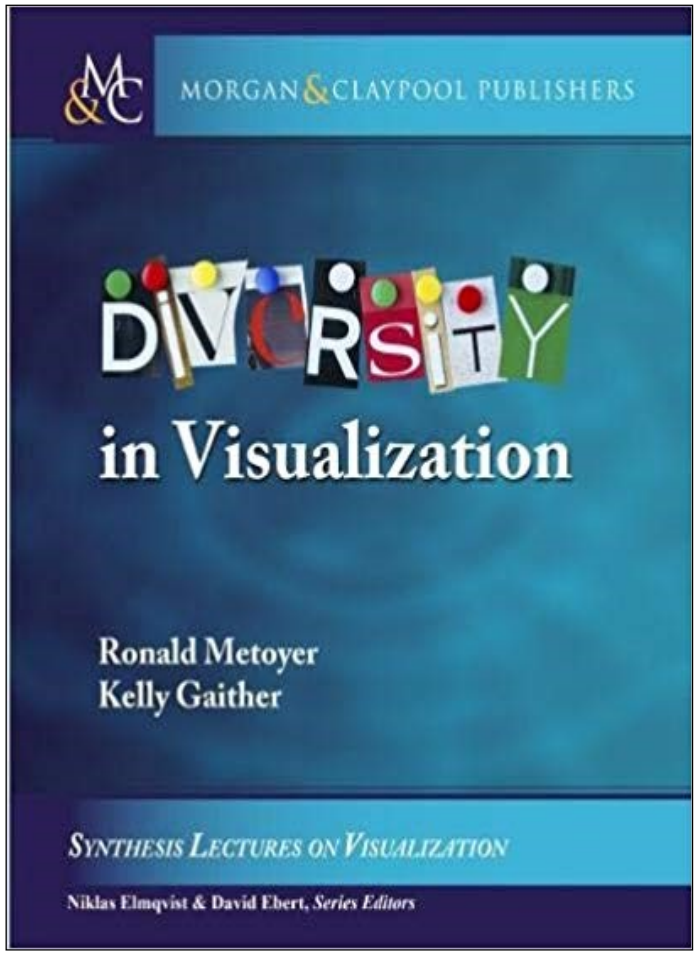


Purdue University

Spelman College

Gulf of Maine Research Institute

Agents for "Insight"



Metoyer, R., & Gaither, K. (2019). **Diversity in visualization (Synthesis lectures on visualization** ; Number 9). Morgan & Claypool.

Chapter 5: Community On ramping by Vetria Byrd and Kelly Gaither

About Me

Vetria L. Byrd, PhD

Teaching

Since joining Purdue

New Data Visualization Major for Undergraduates

Courses Taught/Teach

- Undergraduate
  - CGT 270 Data Visualization (for majors)
  - CGT 101 Foundations of Computer Graphics Technology
  - CGT 118 Fundamentals of Imaging Technology
- Graduate Courses
  - CGT 501 Graduate Seminar
  - CGT 575 Data Visualization Tools and Applications
  - CNIT 5700 Certification Course for Rolls Royce

https://polytechnic.purdue.edu/degrees/data-visualization

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Agent for "Insight"

Data Mine Data Visualization Living Learning Community

Teaching

- Inaugural cohort this fall
- Goal: 800 students by 2020
- Requirement: Must be an undergraduate

Will incorporate Python Libraries showcased this week into the fall 2019 courses.

Faculty Fellow for the Data Visualization Cohort

Fall 2019

- CGT 270 for Non-Majors
- CGT 290 Topics in Data Visualization

Spring 2020

- Advanced Data Visualization
- Programming for Data Visualization

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The Ubiquitous Nature of Data

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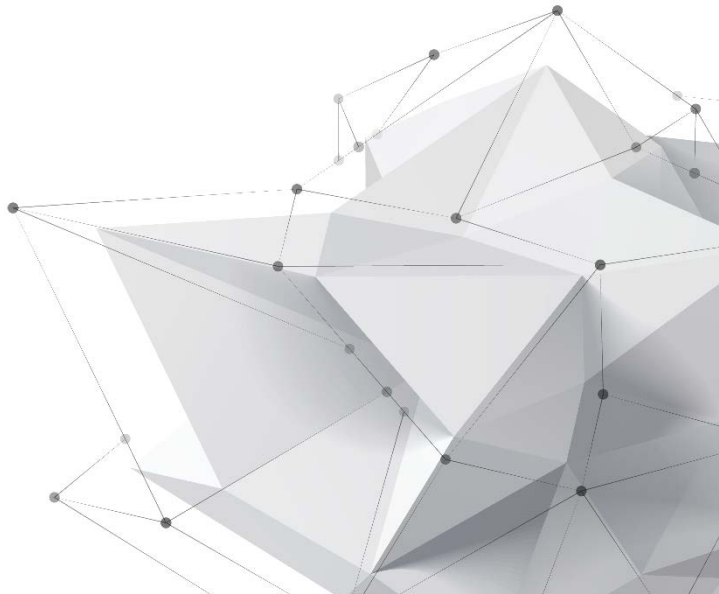
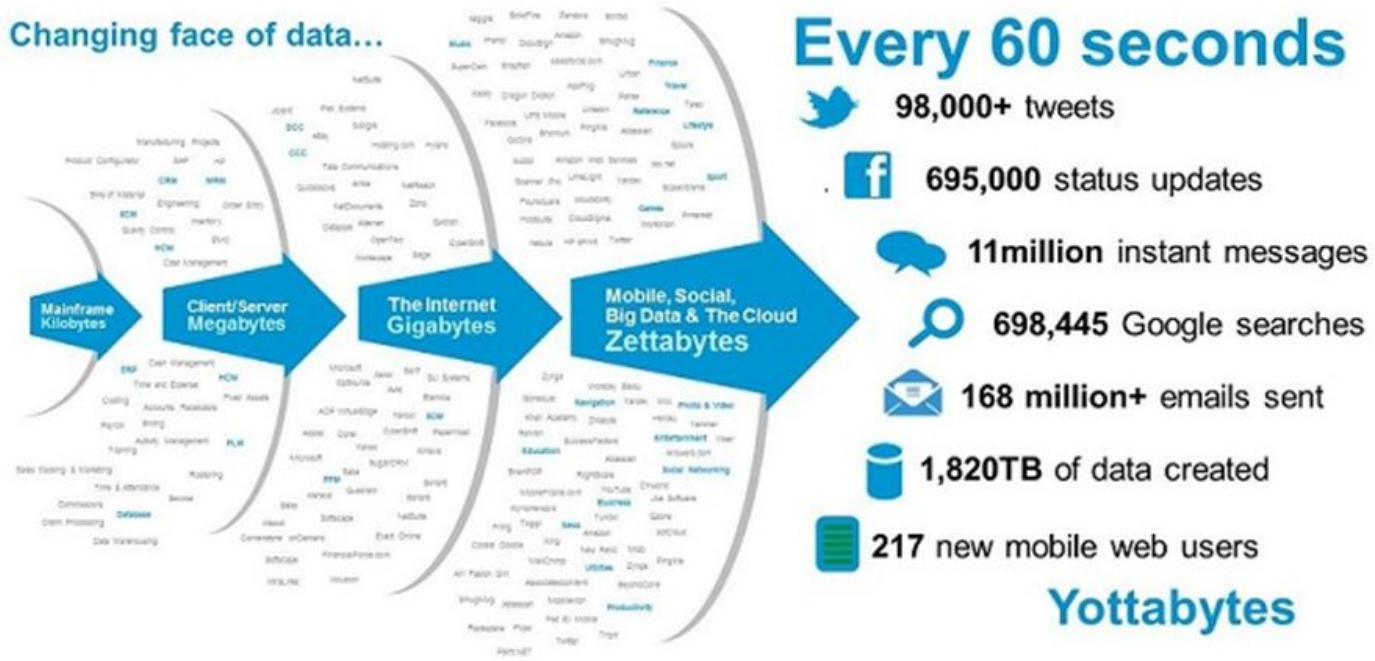


Data is Everywhere!

….. Is the exponential growth and availability of data,
both structured and unstructured,
because of the Internet & fast growing technology advancements



http://slideplayer.com/slide/7795050/

Data here, Data there, data data everywhere. And no – it's not funny

By Cheryl Biswas on LinkedIn

https://infospectives.co.uk/2015 /12/04/vtech-breach-data-data-everywhere/

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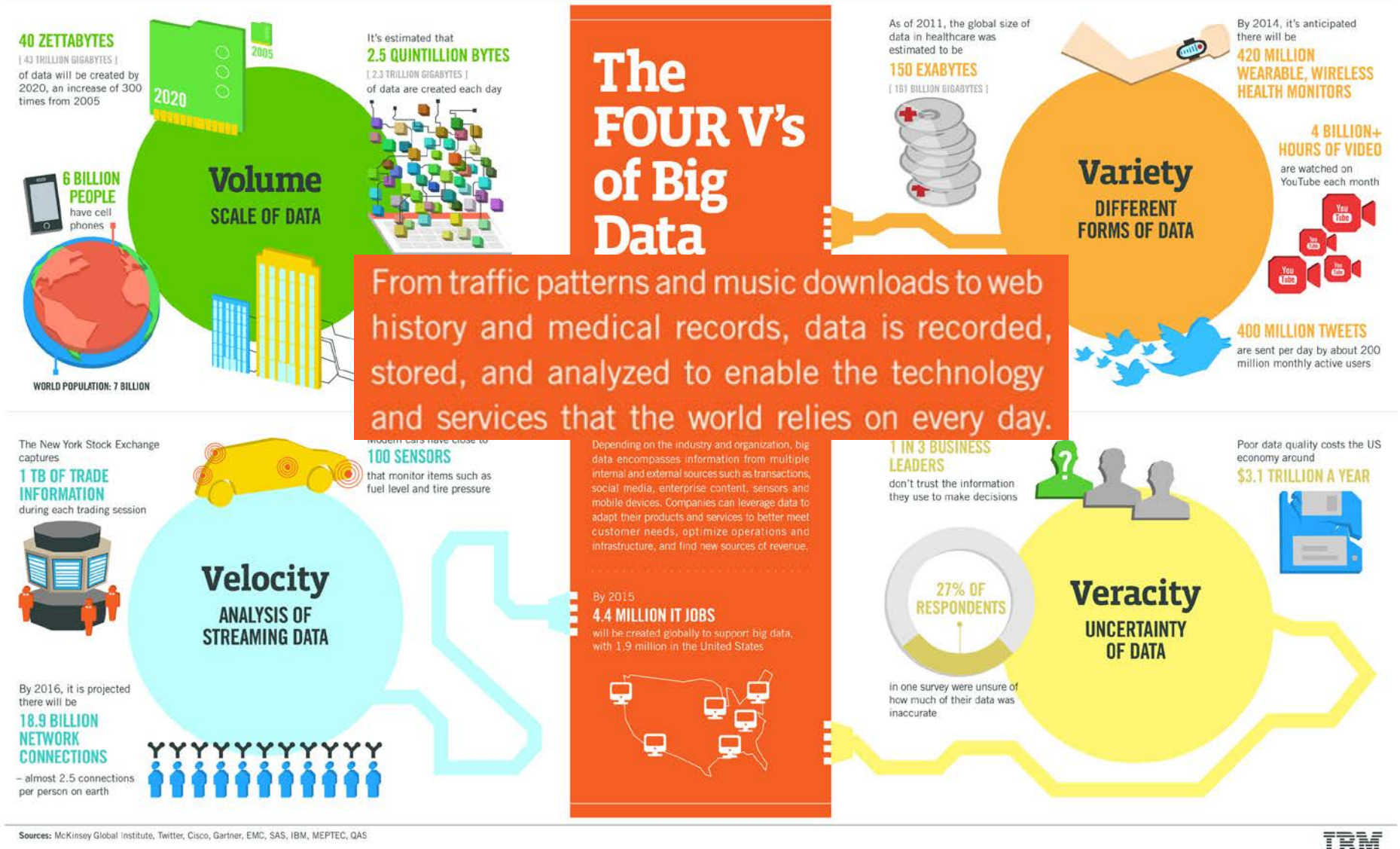
IBM Big Data Platform

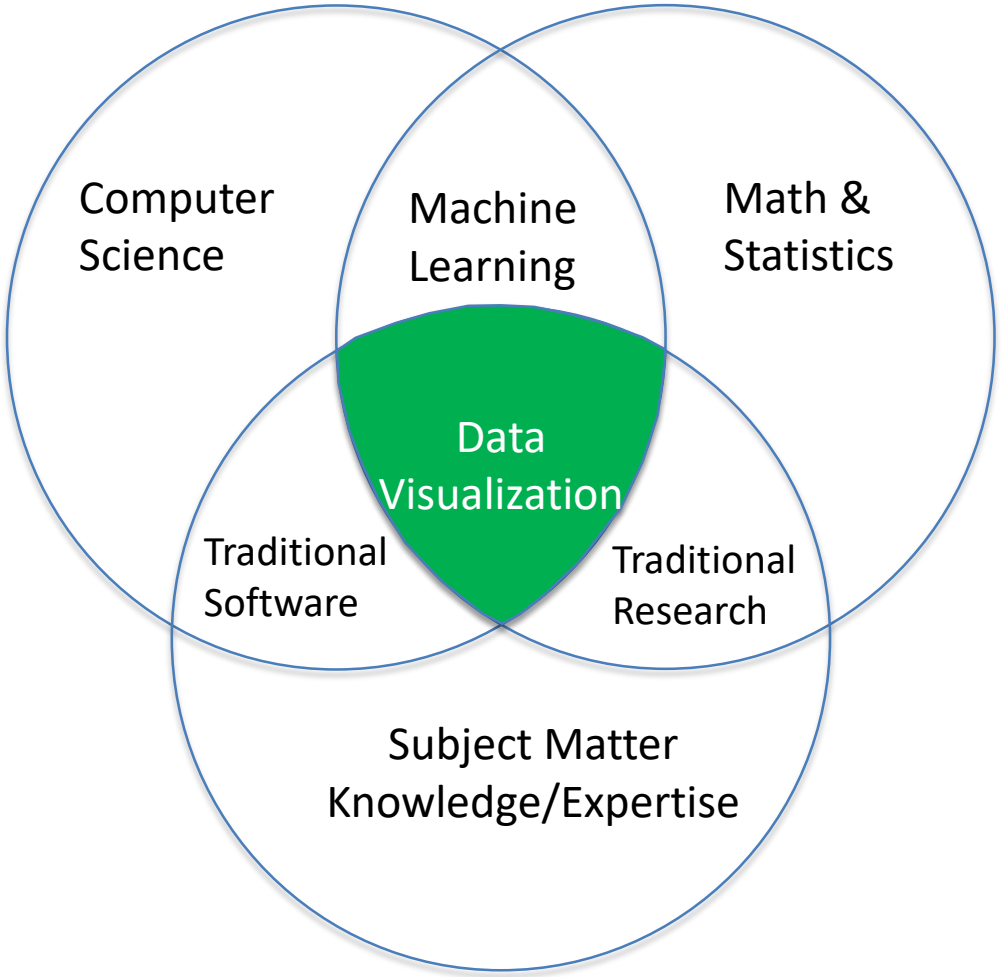


https://www-01.ibm.com/software/data/bigdata/images/4-Vs-of-big-data.jpg

Data is Everywhere!

Image Source: http://www.centrodeinnovacionbbva.com/en/news/practical-examples-big-data-use

Data Science



Johnson, J. (2017). Data science & computing across the curriculum. Journal of Computing Sciences in Colleges., 32, 187-188.

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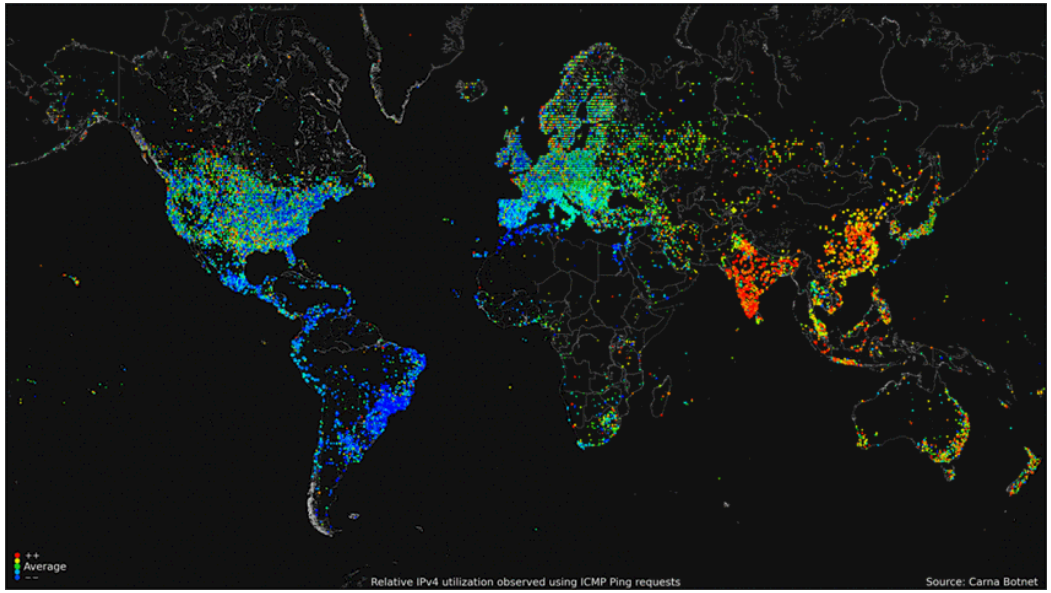
Visualization Applications

Information Visualization (InfoVis)

Interdisciplinary

Study of the “visual representation of large-scale collections of non-numerical information

InfoVis



Internet Usage
Source: http://www.cernea.net/wp-content/uploads/2013/03/internet.gif

Visualization Applications

Biovisualization (BioVis)

The visualization of biological data

Often grouped with computer animation

Scientific visualization (SciVis)

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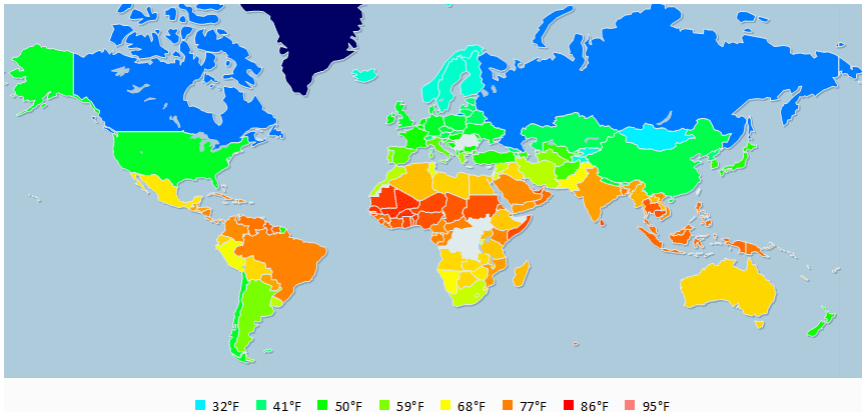
Visualization Applications

Geographic Visualization

GeoVis

Communicates geospatial information in ways that, when combined with human understanding, allow for data exploration and decision-making processes.



MacEachren, A.M. and Kraak, M.J. 1997 Exploratory cartographic visualization: advancing the agenda. Computers & Geosciences, 23(4), pp. 335-343.
Jiang, B., and Li, Z. 2005. Editorial: Geovisualization: Design, Enhanced Visual Tools and Applications. The Cartographic Journal, 42(1), pp. 3-4
MacEachren, A.M. 2004. Geovisualization for knowledge construction and decision support. IEEE computer graphics and applications, 24(1), pp.13-17

Current Visualization Challenges

Virtual reality is going to have a huge impact on the potential for data visualizations, allowing people to interact with data in the third dimension for the first time.

Augmented reality may well be the single biggest change that we are going to see regarding the use of data visualizations.

Development. VR and AR are likely to be interesting technologies in the future, but for the time being, we are still going to be consuming the majority of our data through traditional 2D screens.

Differing Levels Of Understanding

Technical Skills As we move toward more interactive and complex trends for data visualizations, we are going to be seeing an increased need for technical skills to first understand and translate the data then create visualizations around the results

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Computers & Education 122 (2018) 119–135

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Computers & Education

journal homepage: www.elsevier.com/locate/compedu

Visual learning analytics of educational data: A systematic literature review and research agenda

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[b] Knoy Hall of Technology, Rm 341, Department of Computer Graphics Technology, Purdue Polytechnic Institute, Purdue University, United States
[c] Knoy Hall of Technology, Rm 307, Department of Computer Graphics Technology, Purdue Polytechnic Institute, Purdue University, United States

ARTICLE INFO

Keywords:
Visual analytics
Learning analytics
Educational data mining
Literature review

ABSTRACT

We present a systematic literature review of the emerging field of visual learning analytics. We review existing work in this field from two perspectives: First, we analyze existing approaches, audiences, purposes, contexts, and data sources—both individually and in relation to one another—that designers and researchers have used to visualize educational data. Second, we examine how established literature in the fields of information visualization and education has been used to inform the design of visual learning analytics tools and to discuss research findings. We characterize the reviewed literature based on three dimensions: (a) connection with visualization background; (b) connection with educational theory; and (c) sophistication of visualization(s). The results from this systematic review suggest that: (1) little work has been done to bring visual

Paper ID #19050

Visualization: A Conduit for Collaborative Undergraduate Research Experiences

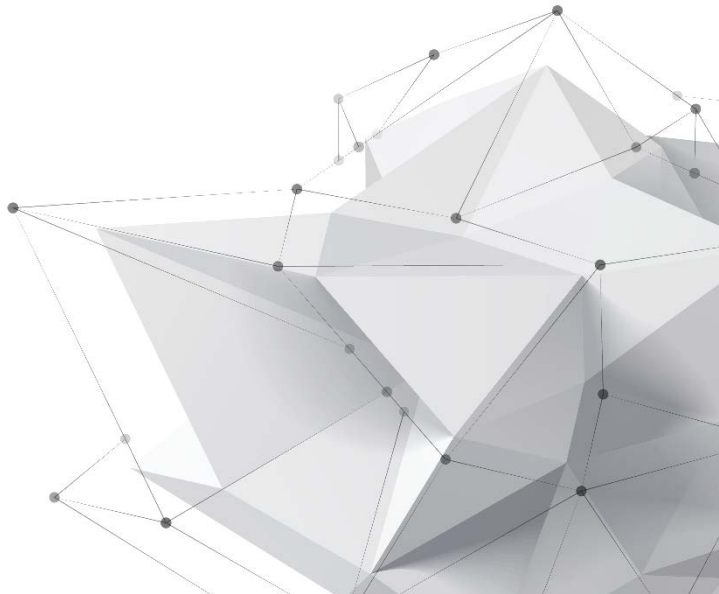
Dr. Vetria L. Byrd Ph.D., Purdue University

Dr. Vetria Byrd is an assistant professor in the Department of Computer Graphics Technology in the Polytechnic Institute at Purdue University in West Lafayette, Indiana. Dr. Byrd is the founder and organizer of the biennial Broadening Participation in Visualization (BPViz) Workshop co-funded by The Committee on the Status of Women in Computing Research/Coalition to Diversify Computing (CRA-W/CDC) and the National Science Foundation (NSF). Dr. Byrd has given numerous invited talks and workshops on visualization including: XSEDE14 plenary address (featured in HPC Wire online magazine), and an invited presentation at The Banbury Center at Cold Spring Harbor Laboratory. Dr. Byrd works with XSEDE to provide on campus training on scientific visualization. She was the Principal Investigator for the highly competitive NSF VisREU Site: Research Experience for Undergraduates in Collaborative Data Visualization Applications for 2014/2015 at Clemson University. Dr. Byrd continues to mentor VisREU research fellows as well as students at Purdue University. Dr. Byrd received her graduate and undergraduate degrees at the University of Alabama at Birmingham, in Birmingham, Alabama which include: Ph.D. in Computer and Information Sciences, Master's degrees in Computer Science and Biomedical Engineering and a Bachelor's degree in Computer Science. Dr. Byrd's research interests include: data visualization, high performance visualization, big data, uncertainty visualization, collaborative visualization, broadening participation and inclusion.

Teaching

Data Visualization Capacity Building

Byrd, V (2018) A Formal Definition of Visualization Capacity Building Based on its Essential Features *(Manuscript in preparation)*



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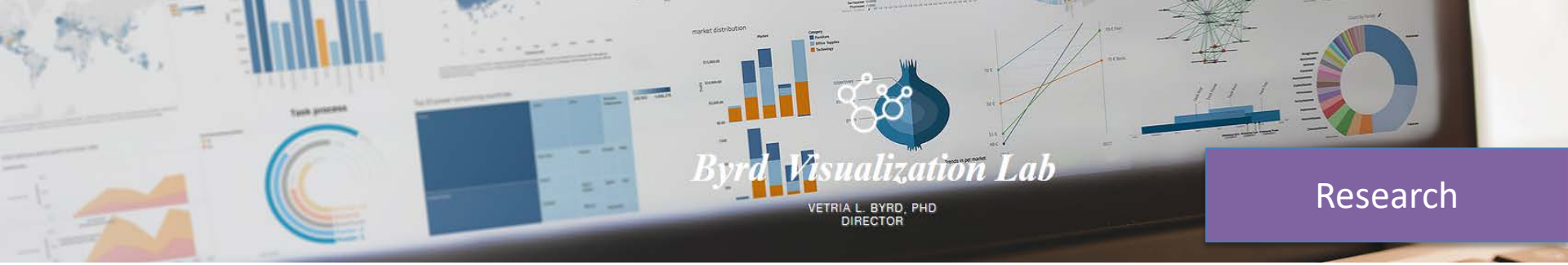

Research

Byrd Vis Lab

POLYTECHNIC

Transforming Data into Insight

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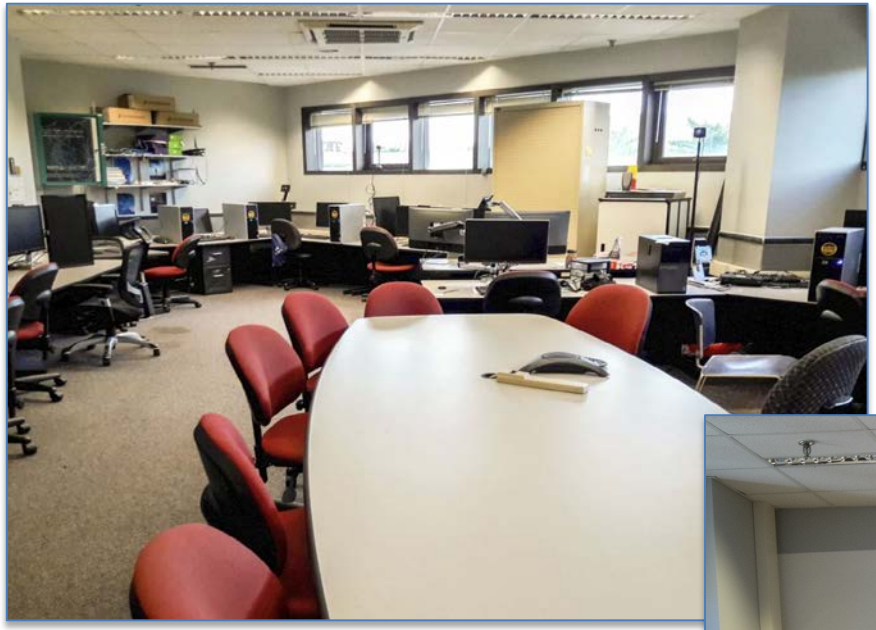
Data Vis Lab



Danielle Zhang (not shown)

Research Focus

Research

- Visualizing Heterogeneous Data
- Visual Analytic Approach to Secondary Data Analysis
- High Performance Computing (Visualization)

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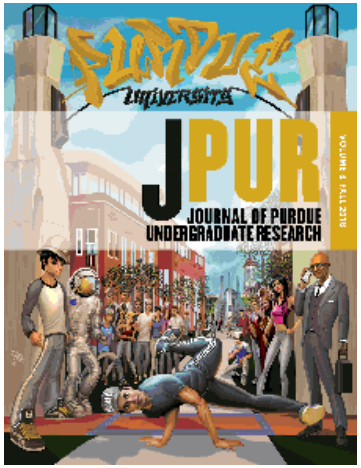
Undergraduate Research

Research



Special Snapshot Section: Making a Case for Data Visualization at the Undergraduate Level

Features abstracts by undergraduates from Purdue's Undergraduate Data Visualization Major and data visualization course.

Byrd, Vetria L. (2018) "**Special Snapshot Section: Making a Case for Data Visualization at the Undergraduate Level**," The Journal of Purdue Undergraduate Research: Vol. 8, Article 26.
DOI: https://doi.org/10.5703/1288284316776

CGT 270 DATA VISUALIZATION

Geographic and Demographic Analysis of Claims Serving Mental Health Patients in Indiana

Student researcher: Bin Han, Senior

Mental health issues, such as depression and schizophrenia, have displayed pervasive and increasing patterns in the United States, leading to the negative results of rising emotional and psychological destruction and decreasing level of social well-being. According to the report *Behavioral Health Barometer: Indiana, 2015*, 12.2% of adolescents

OUR SCHOLARS

Spotting Trends in Side Effects and Drug Interactions: Data Visualization Tools Can Supplement Decision Making for Medical Prescribers

Student researcher: Jackalyn R. Dodson, Senior

Most Americans today are prescribed at least one prescription medication, and many take two or more. Pharmaceutical drug combinations greatly increase the risk for an adverse reaction and an assortment of differing side effects. Doctors today are faced with deciding which drugs to prescribe to their patients that will result in the greatest outcome to the patient with the least possible harm.

Food Deserts and Their Effect on the Rate of Obesity

Student researcher: Edith R. Mauro, Sophomore

The United States is widely considered the most obese country in the world. One of the most influential factors on the rate of obesity is the excessive consumption of unhealthy food. America's obesity rate is a significant issue, and has continued to increase since 1990. As a result, the average life-expectancy rate will decrease by about 10 years if the obesity rate continues to rise. A method of combating the obesity crisis includes identifying the reasons why the crisis is occurring in the first place. This paper focuses on finding a correlation between the rate of obesity and food deserts. Food deserts are communities located outside a one-mile radius of suppliers of fresh whole foods. In other words, these

Analysis and Visualization of Environmental Causes on Automobile Accidents in Dense Traffic Float Areas

Student researcher: Qiuhan Zhang, Sophomore

Driving has become one of the most efficient ways to commute in past decades. Yet, there are over 3,200 fatalities caused by car accidents each day. Our society tends to blame the factors of these casualties on individuals—speeding, not paying attention to the road, and drowsy driving. However, possible external causes of car accidents are often overlooked. Horrible road conditions, confusing road signs, baffling weather, and pedestrians crossing the

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Visualizing Heterogeneous Data

Research

Machine Learning	AI	High Performance Computing	Optimization

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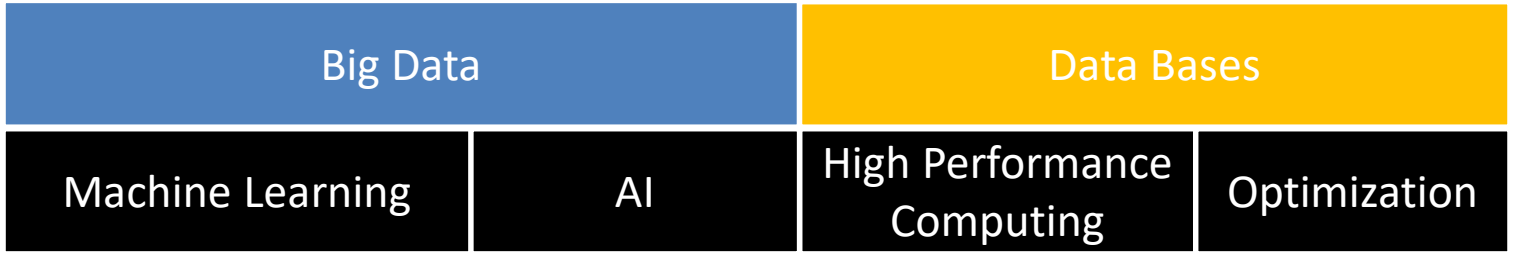
Visualizing Heterogeneous Data

Research



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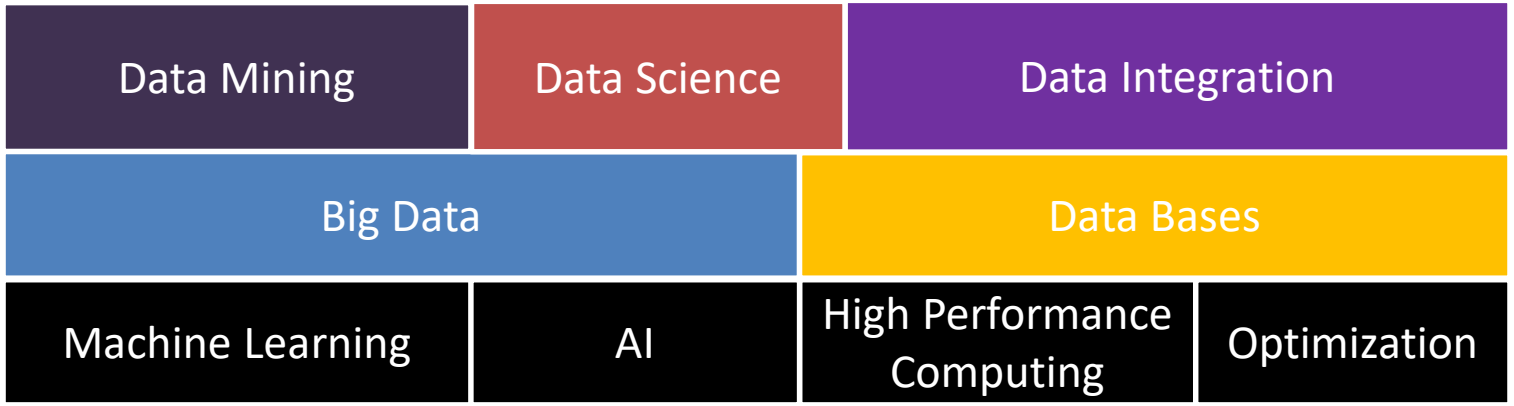
Visualizing Heterogeneous Data

Research



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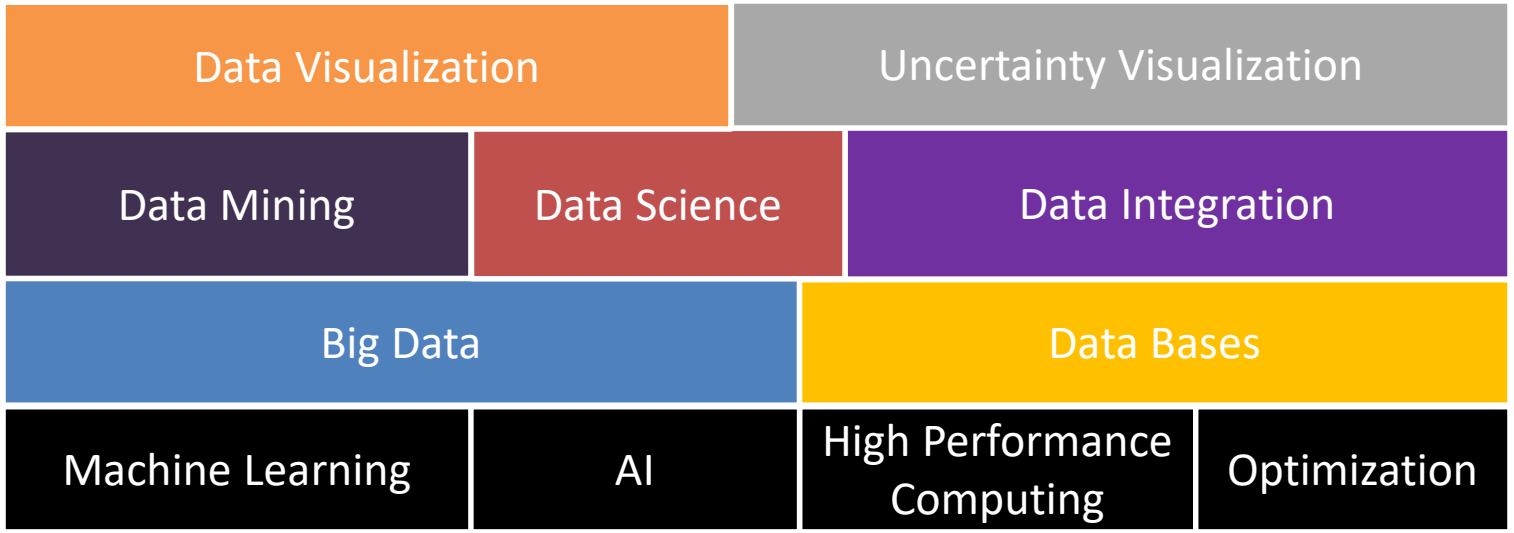
Visualizing Heterogeneous Data

Research



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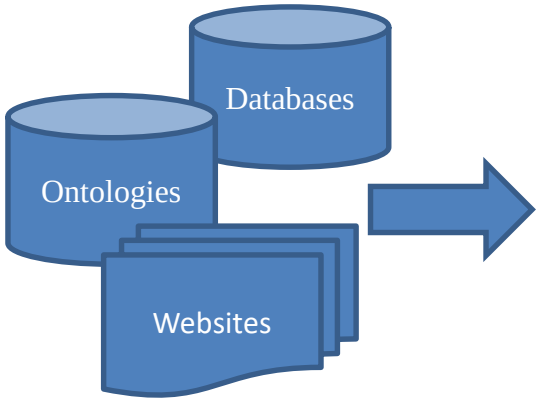
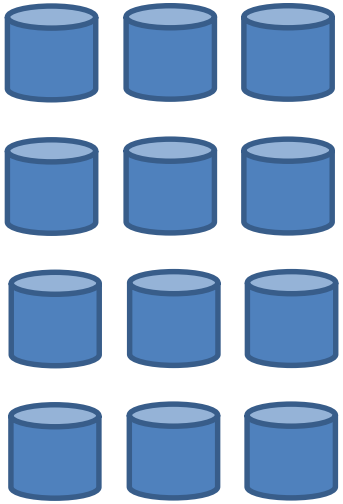
Visualizing Heterogeneous Data

Research

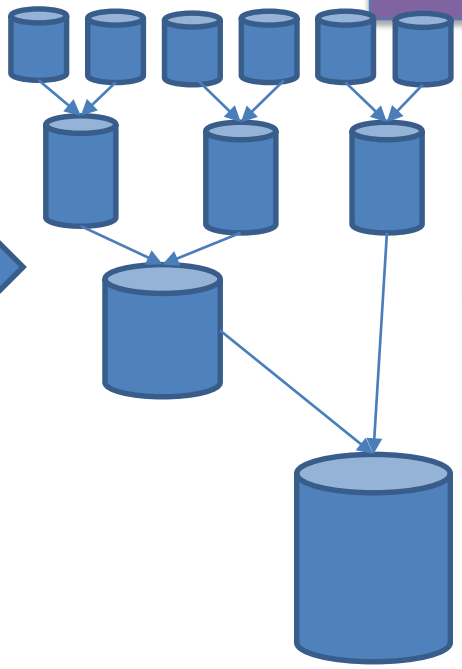
Disparate Data Sources and Data Types



Virtual Tables

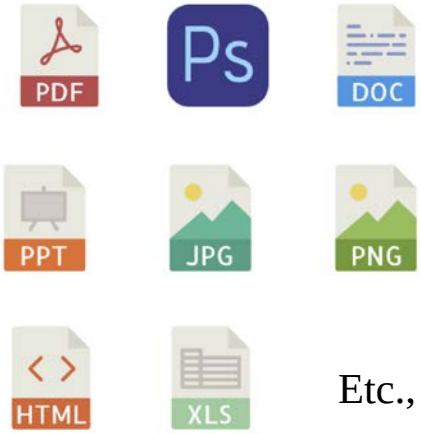


Integration



Insight

File Types:



Etc.,

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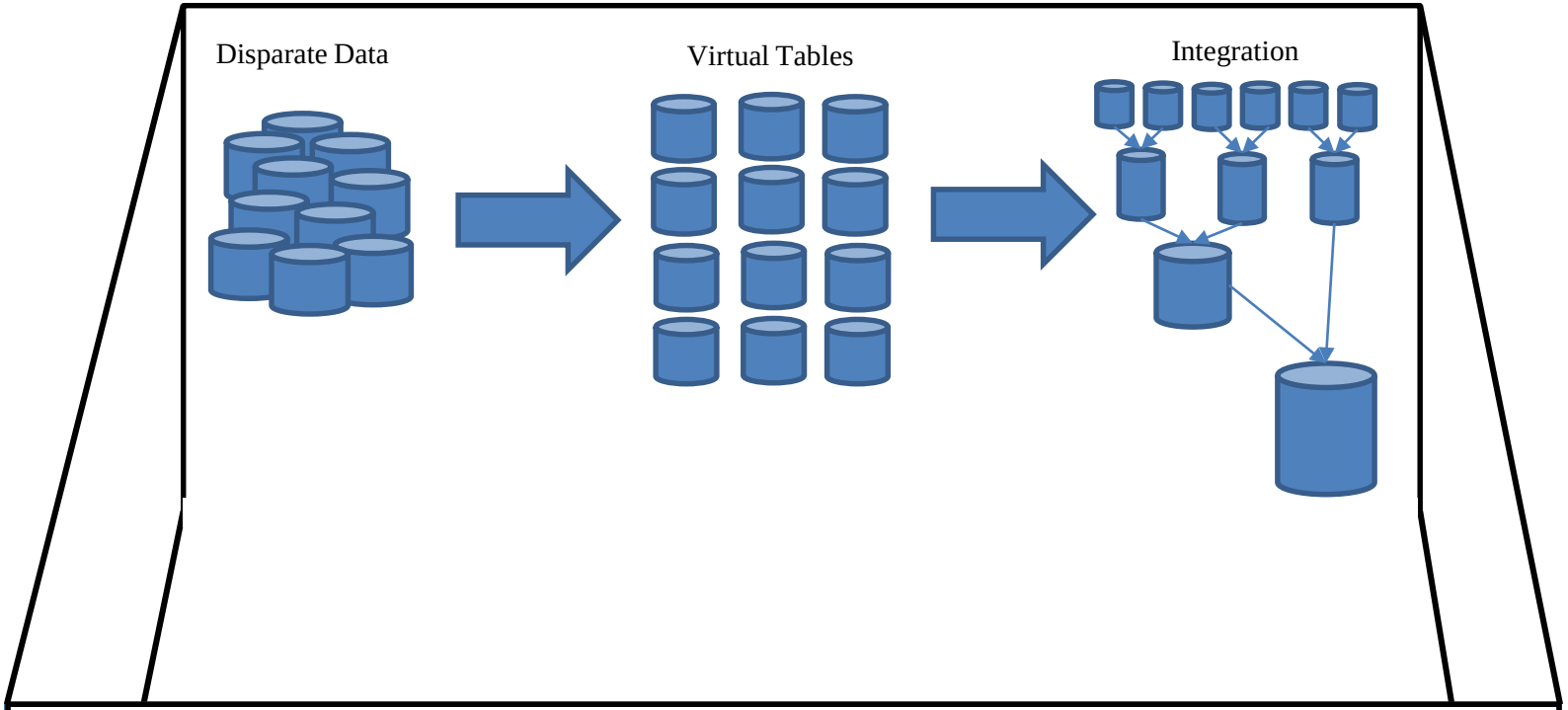
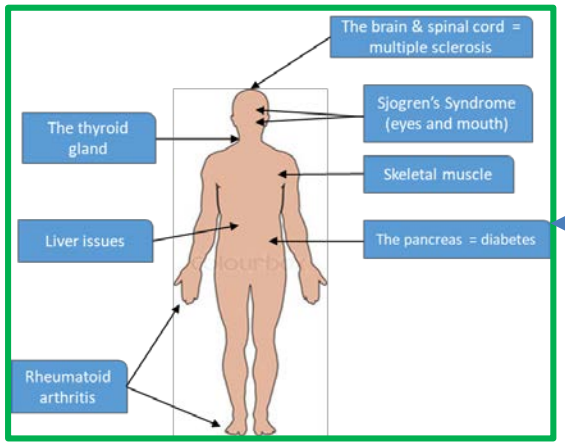


Visual Display of Integrated Heterogeneous Data

Medical Application

Collaboration with IUPUI Medical School



Adopted from Isenberg & Manzi (2008) pg16

Associated Genes

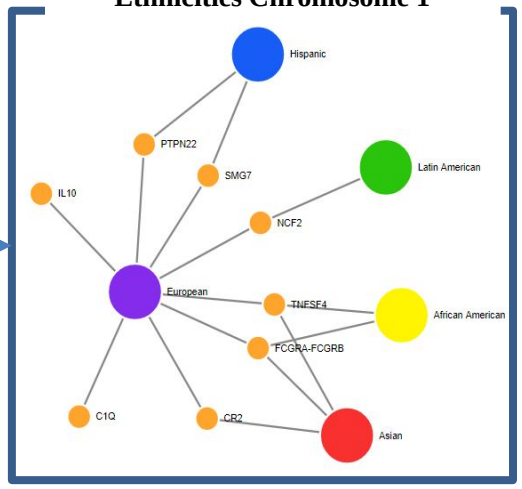
Symptoms

Treatment

Disparities

Env. Factors

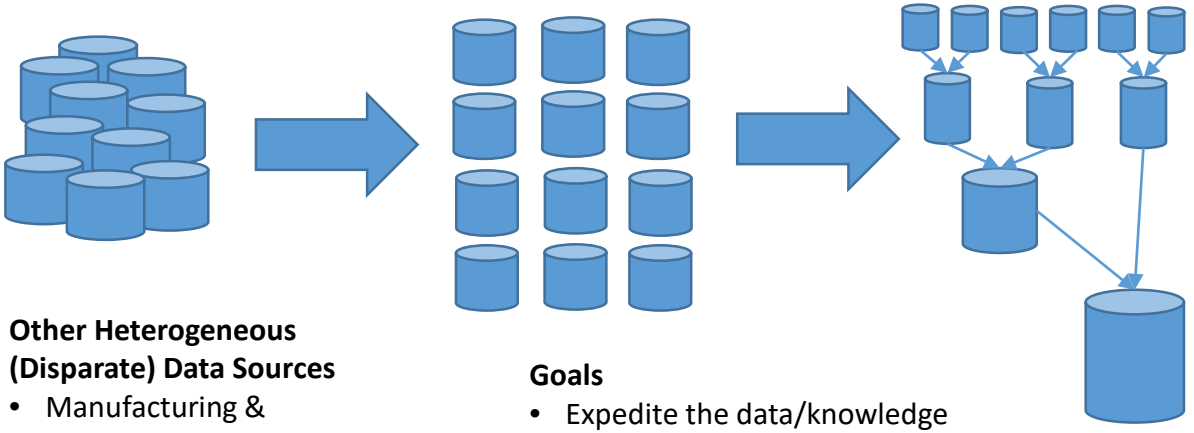
Genetic Disparities Between Ethnicities Chromosome 1



Disparate Data

Virtual Tables

Integration



Other Heterogeneous (Disparate) Data Sources

- Manufacturing & Supply Chain Data
- Cyber Security
- Agriculture Data (From Farm to Table)
- Quality Control Systems

Goals

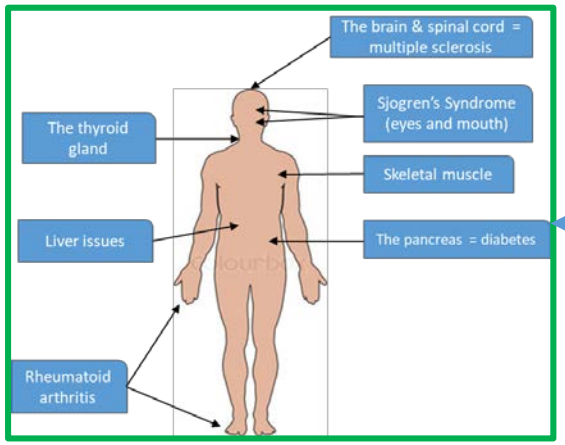
- Expedite the data/knowledge discovery process
- Construct better visualization models
- Assist with predictive analysis

Applications

Other

Medical Application

Visual Display of Integrated Heterogeneous Data



Adopted from Isenberg & Manzi (2008) pg16

Associated Genes

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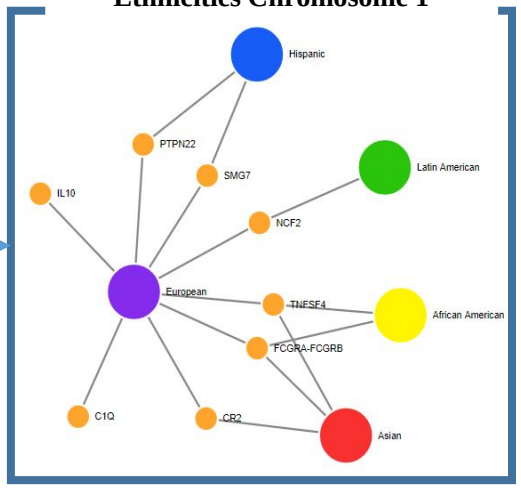


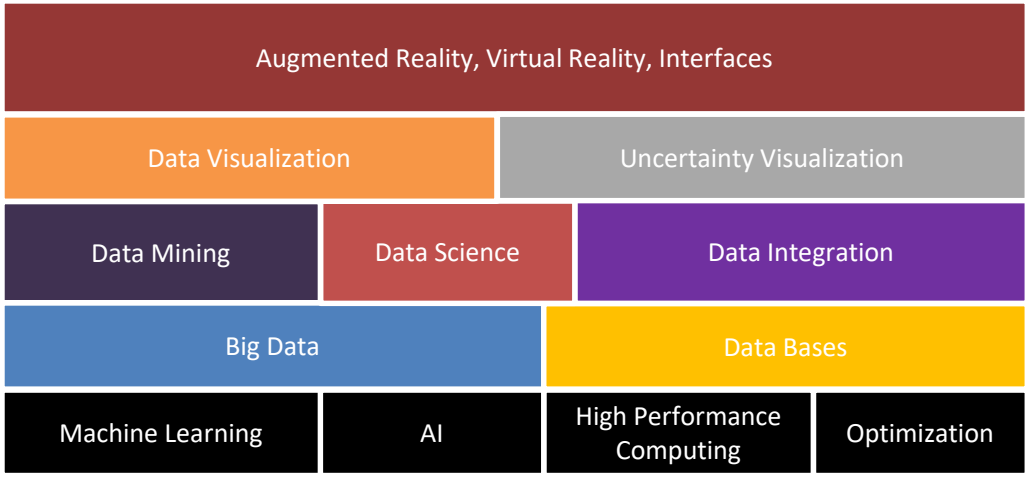
Goals

Research

Expedite the data/knowledge discovery process

Construct better visualization models

Assist with predictive analysis



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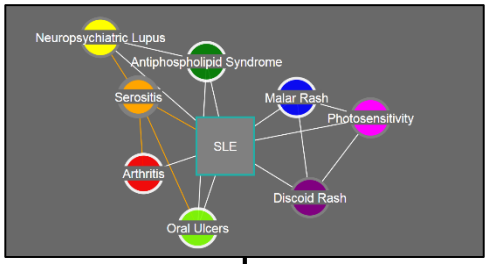
DISEASE DIAGNOSTICS INVENTORS CHALLENGE

TECHNOLOGY

Data Visualization & Visual Analytics

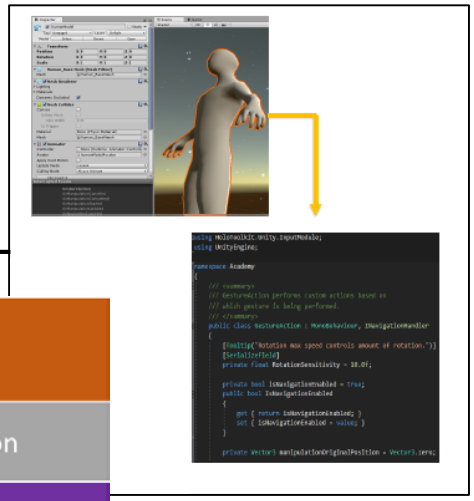
Symptom Cluster Management



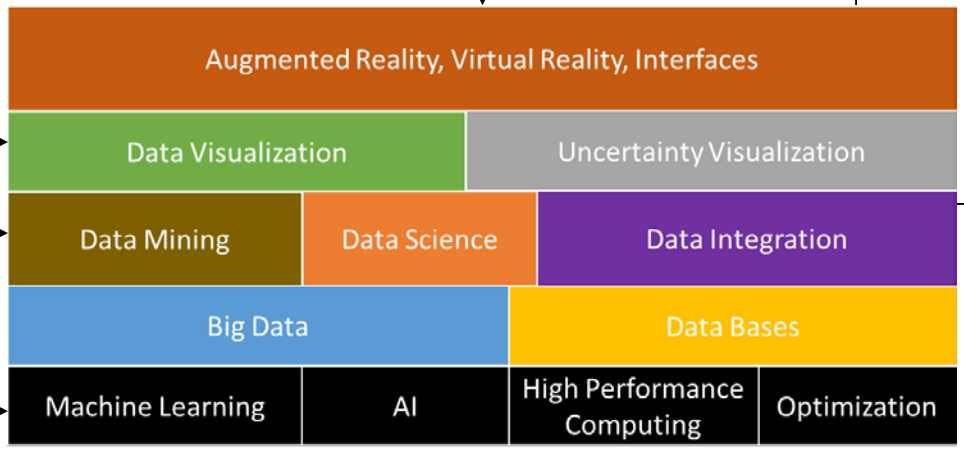
Lauren Washington, Undergraduate Researcher

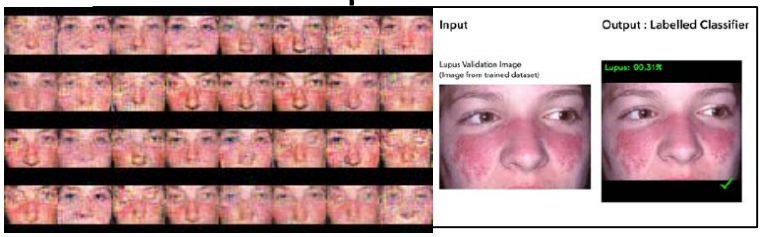
Data Driven Documents

https://www.microsoft.com/en-us/hololens



Dylan Martin, Undergraduate Researcher





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