Data Science is for Everyone

Two-Year College Data Science Summit, May 10th 2018

Sallie Keller

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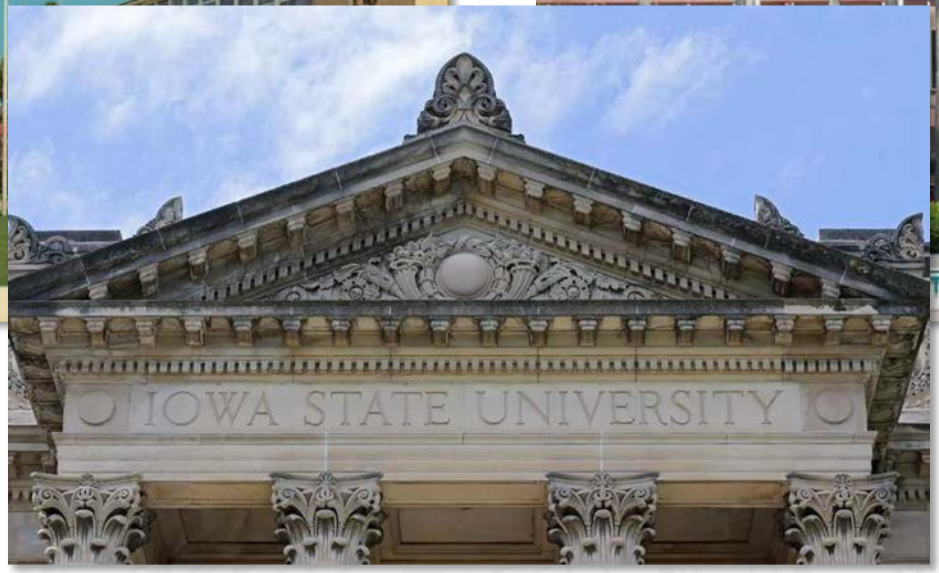
BIOCOMPLEXITY INSTITUTE
VIRGINIA TECH

SDAL SOCIAL & DECISION ANALYTICS LABORATORY

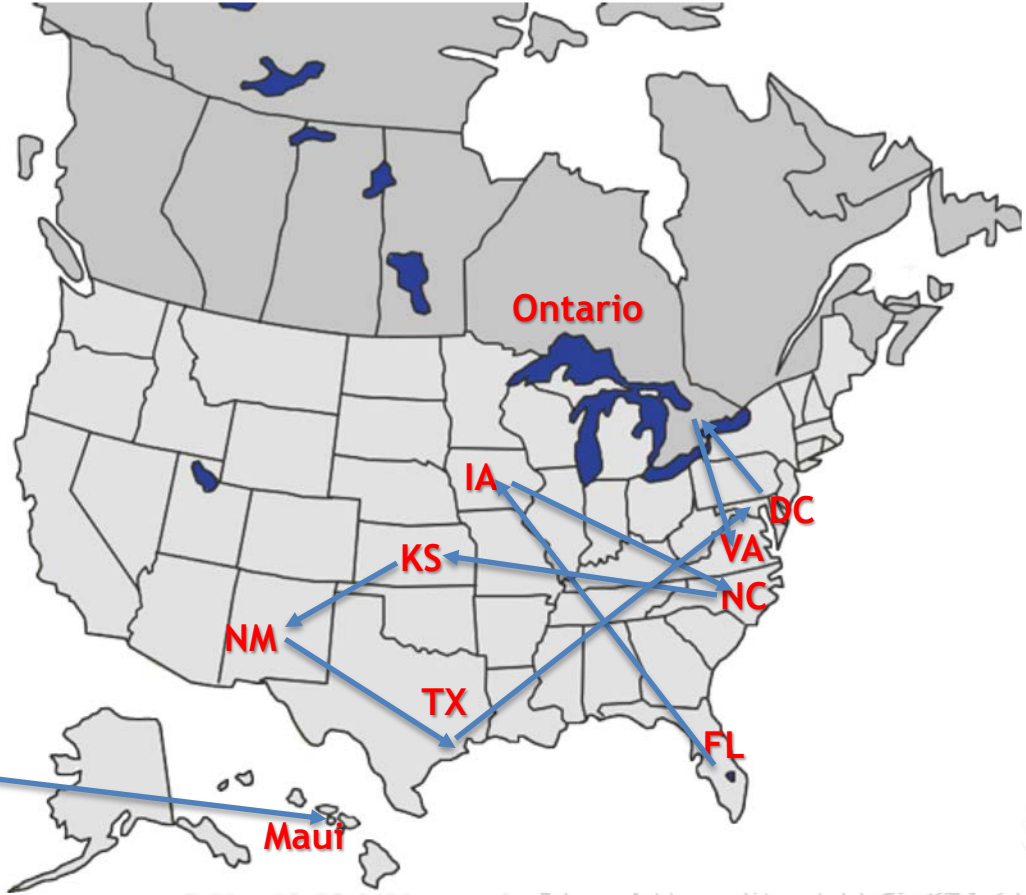
College


St. Petersburg Junior College


IOWA STATE UNIVERSITY


TH FLORIDA

Then what?



Biocomplexity Institute

The study of life and environment as a **complex system**

Understanding biology **in the context of** ecosystems and human-created systems

Transdisciplinary team science

“From molecules to policy”

Problem-Driven Science

Our information biology approach is putting research to work in the real world, breaking down barriers between science and policy.

Social and Decision Analytics Lab

The Social and Decision Analytics Laboratory brings together statisticians and social and behavioral scientists to embrace today's data revolution, developing evidence-based research and quantitative methods to inform policy decision-making.

- **Science of *ALL* Data**
- **Community Learning Data Driven Discovery**
  - Defense analytics
  - Education and Labor Force Analytics
  - Health and Well Being Analytics
  - Emergency Management Analytics
  - Industrial Innovation Analytics
- **Information Diffusion Analytics**

We are in an *ALL* Data Revolution

A new lens for social observing

Infrastructure

- Condition
- Operations
- Resilience
- Sustainability

Environment

- Climate
- Pollution
- Noise
- Flora/ Fauna

People

- Relationships
- Location
- Economic Condition
- Communication
- Health

It is time to leverage *ALL* the data sources

Local, State/Provence, and Federal

Designed Data

Administrative Data

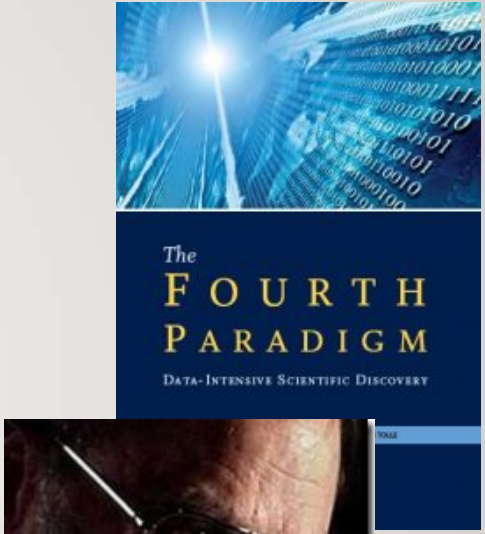
Opportunity Data

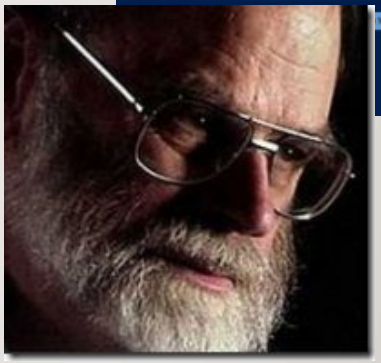
Procedural Data

What is Data Science?

Fourth paradigm

> "… change of all sciences moving from observational, to theoretical, to computational and now to the 4th Paradigm – Data-Intensive Scientific Discovery"



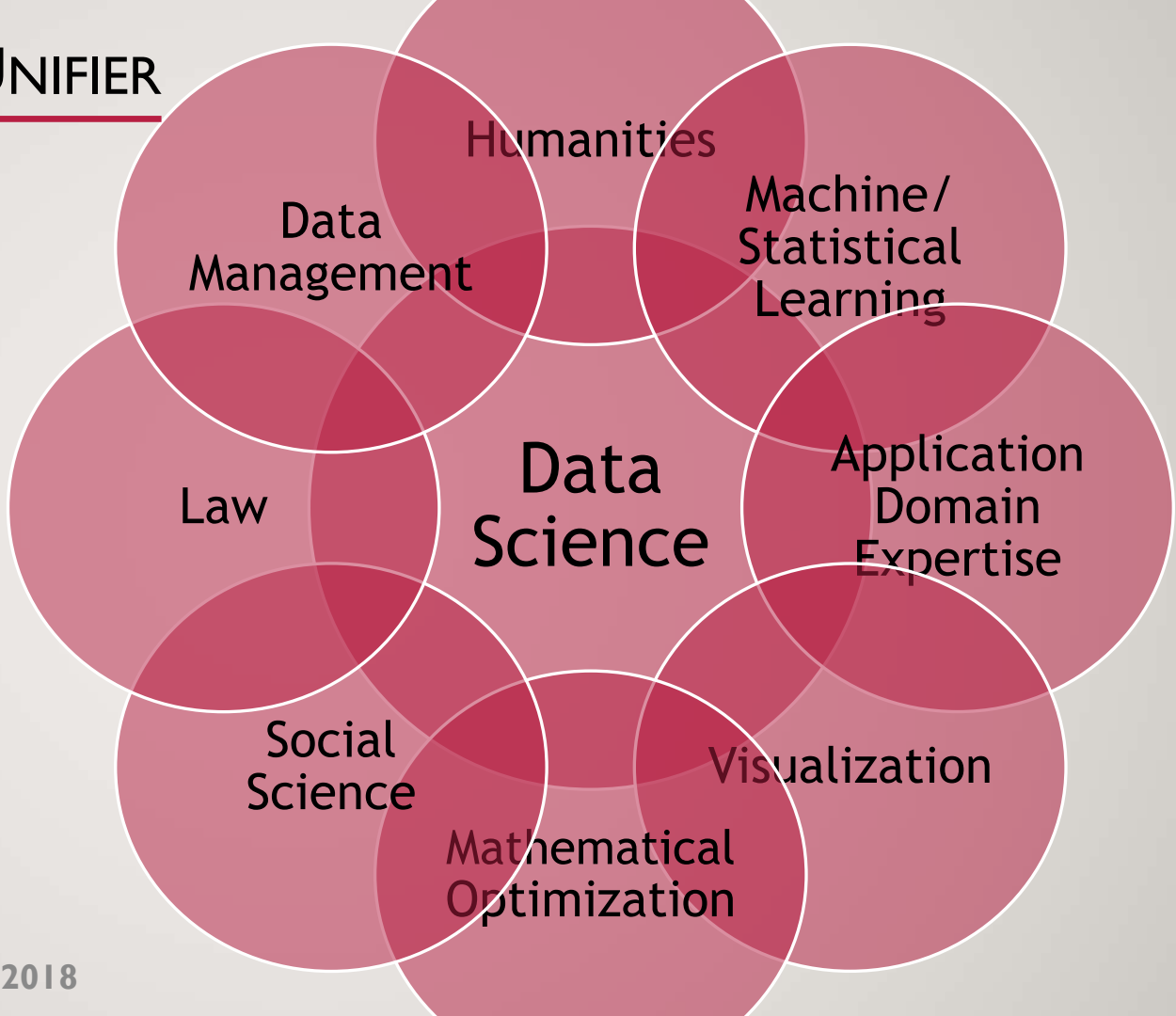


Jim Gray

What is Important?

Need to solve a real problem using data…
No applications, no data science.

Data Science as a Unifier



In our lab data science is policy focused on other people's problems

NCSES National Center for Science and Engineering Statistics

Local / State Government

Federal Statistical Agencies

Department of Defense

Industry

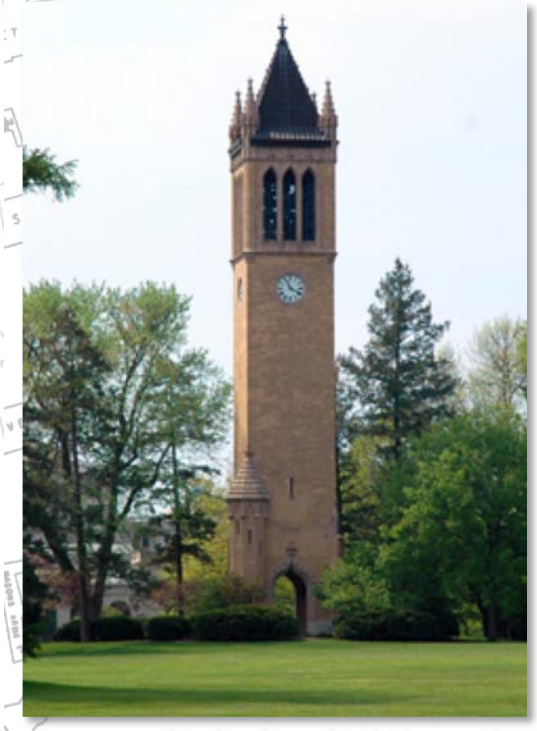
MITRE

Enhancing Prosperity through Data Science

VIRGINIA TECH

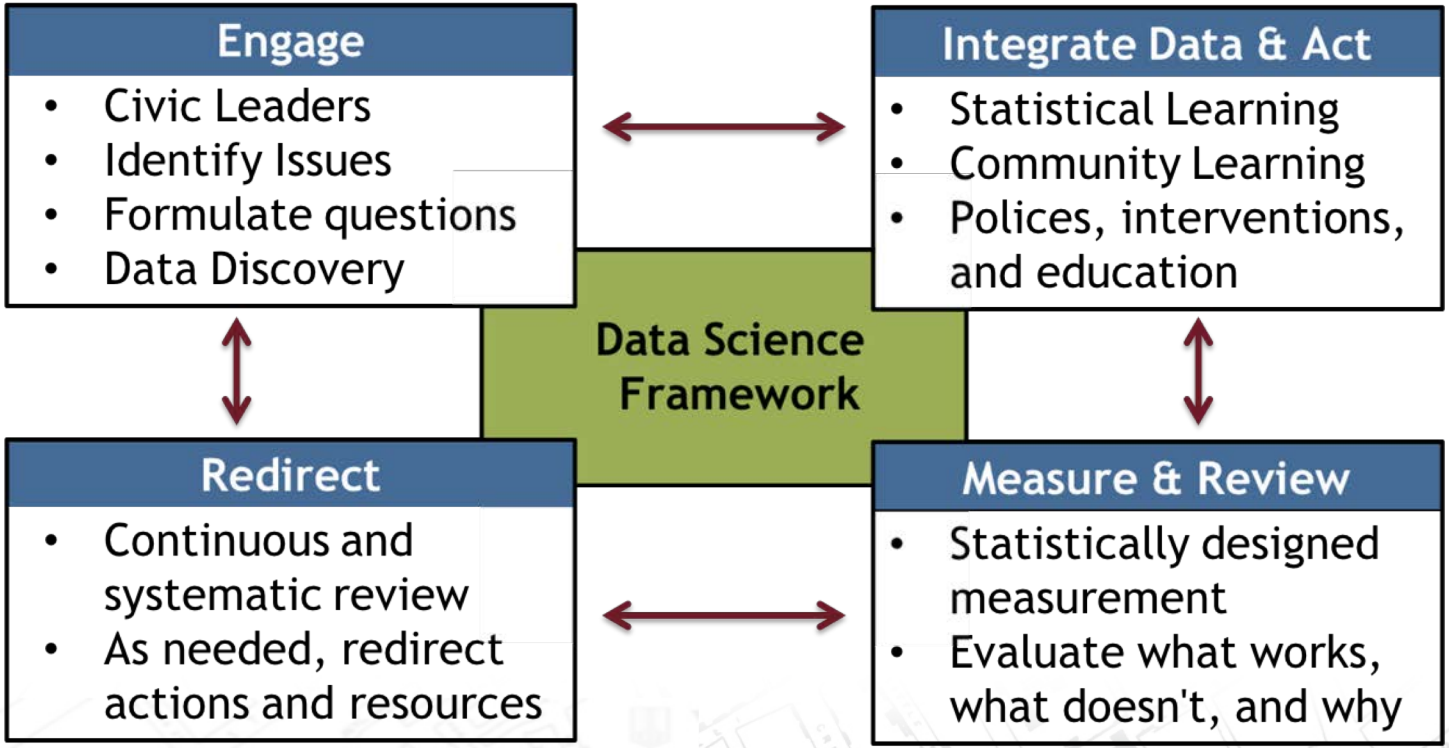
IOWA STATE UNIVERSITY
OF SCIENCE AND TECHNOLOGY

How have Virginia Tech and Iowa State come together to develop this vision?



- ***Big data*** initiatives
- Experience with ***data science community based research***
- Practicing ***engaged scholarship***
- Commitment from leadership to steward ***collaborative processes*** going forward

CLD3 – Community learning through data-driven discovery

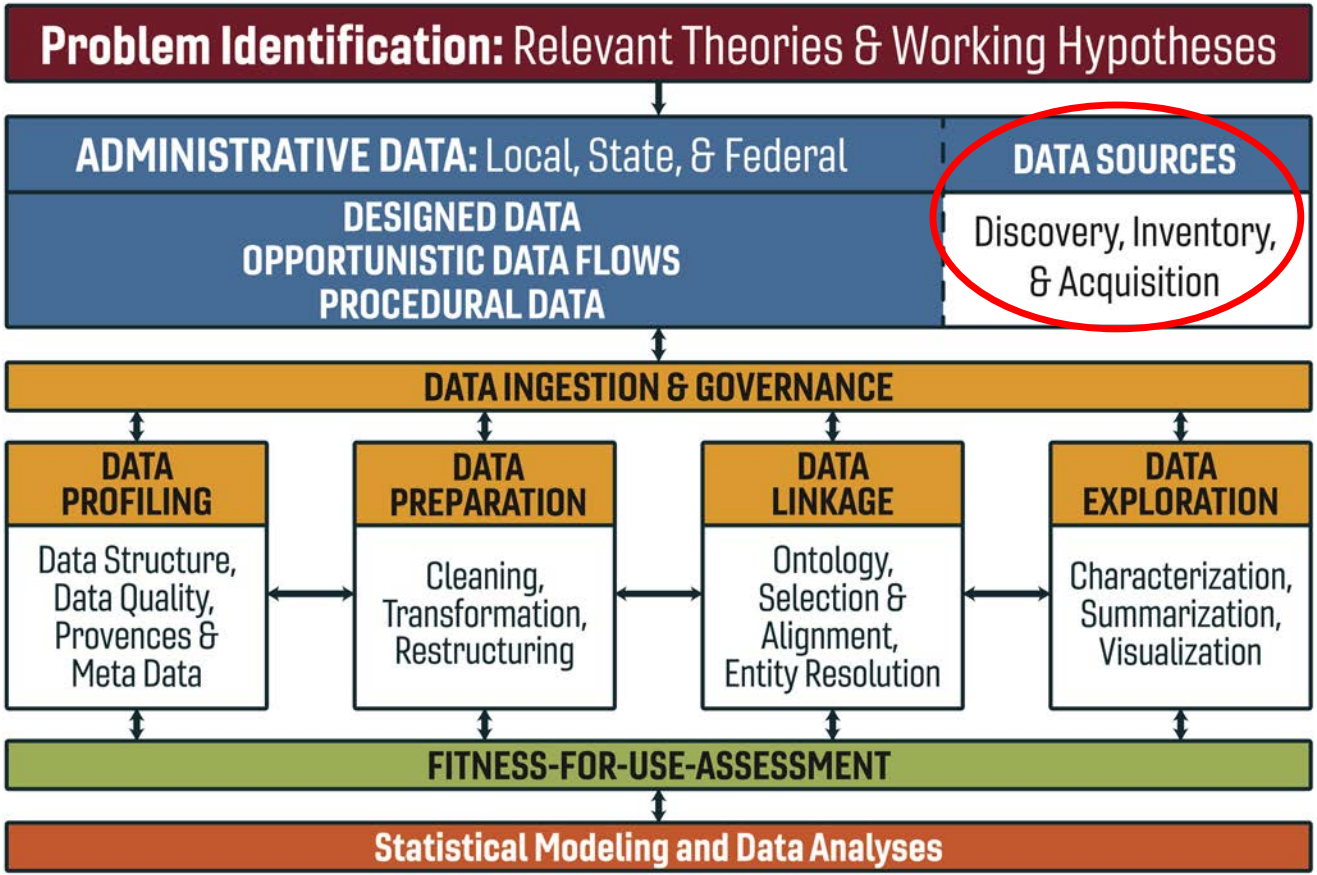


Common CLD3 themes need data science training to address

- **Locating** and **describing** a population within a community
- **Estimating** a statistical summary and its margin of error to evaluate its usefulness **for the purpose at hand**
- **Forecasting** future needs
- **Evaluating** a program, policy, or standard operating procedure

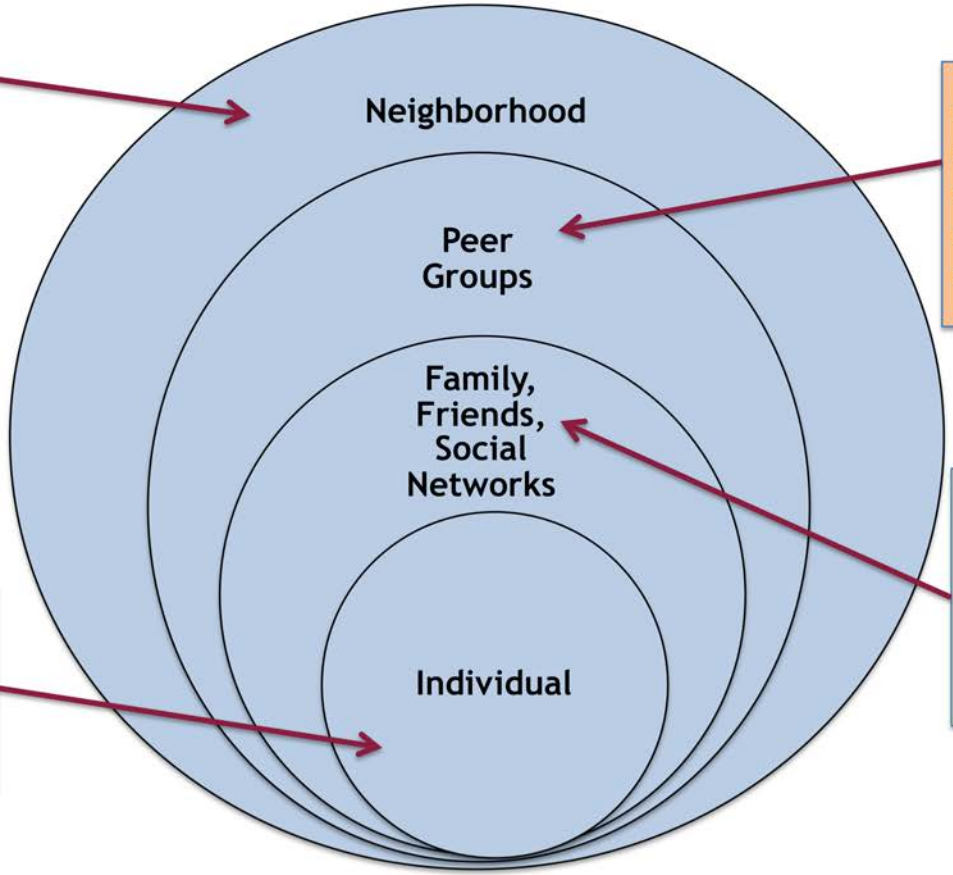
CLD3 provides inputs to data science training

Data Science Framework



Local community Data Map

- Access to healthy food - grocery stores, community gardens, farmers markets, restaurants (fast food, other)
- Living Conditions
- Personal Safety
- Engagement
- Support Networks



- Education
- English Literacy
- Health Literacy
- Engagement
- Support Networks

- Behavioral Health
- Physical Health
- Social Wellness
- Support Networks

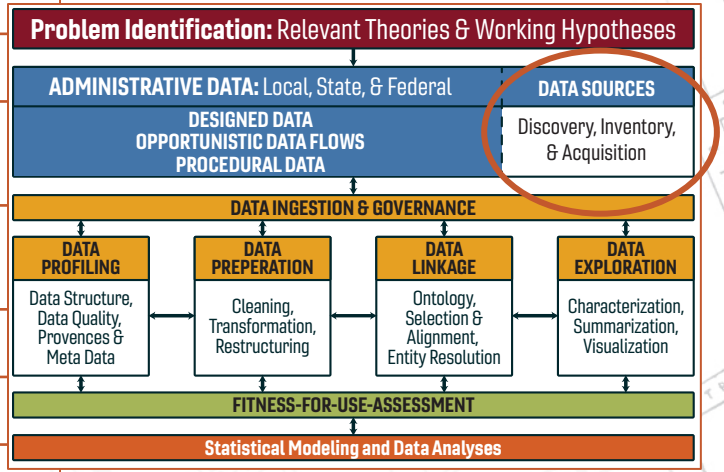
- Family Stability
- Income Stability
- Living Conditions
- Health Literacy
- Support Networks

Data Discovery, Inventory & Acquisition

Data Source	Geography
American Community Survey data (Census), 2011-2015 **(updating now to 2012-2016)**	Census Tracts and Block Groups
American Time Use Survey (BLS), 2017	National
Youth Risk Behavior Surveillance System, 2015	State
County Health Rankings, 2017	County
Built Environment, e.g., Grocery stores, SNAP retailers, recreation centers, community gardens	Address Level
Fairfax real estate tax assessment data	Address Level
Fairfax Open data: Zoning, Environment, water, Parks, Roads	Shapefiles
Fairfax County Youth Survey, 2016 8th, 10th, 12th graders	High School Attendance Area
Virginia Department of Education, 2017	High School
National Center for Education Statistics, 2014-2015	High School
Center for Disease Control, 2014-2015	High School

Initial data sources used with geographic specificity

- **All** are **updated** as new data are available



Data Discovery, Inventory, & Acquisition

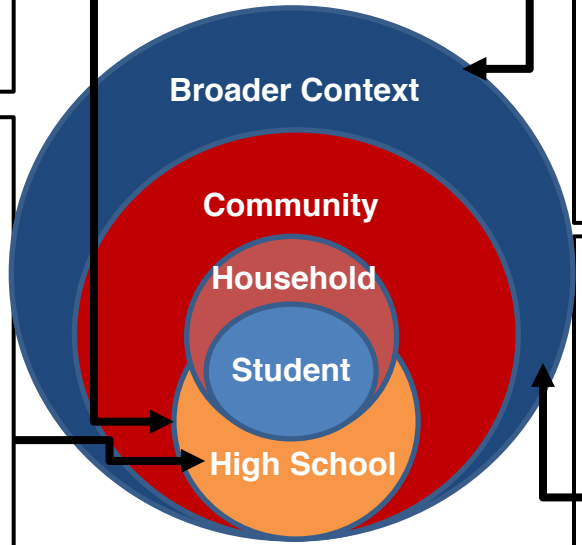
Data Map

High School Student Body Characteristics

- % Students disadvantaged (VDOE)
- % Students by gender (VDOE)
- Student offenses and disciplinary outcomes (VDOE)
- Drop-out rates (VDOE)

High School "Postsecondary-Going" Culture

- Graduation rate (VDOE)
- Advanced/regular degree ratio (VDOE)
- % CTE program graduates (VDOE)
- College application rate (SCHEV)
- College acceptance rate (SCHEV)
- % Enrolled in AP classes (VDOE)
- % Passed AP tests (VDOE)
- % in Dual Enrollment courses (VDOE)
- % Teachers w/ graduate degrees (VDOE)
- % Students took the SAT (College Board)
- Mean SAT scores (College Board)
- ….



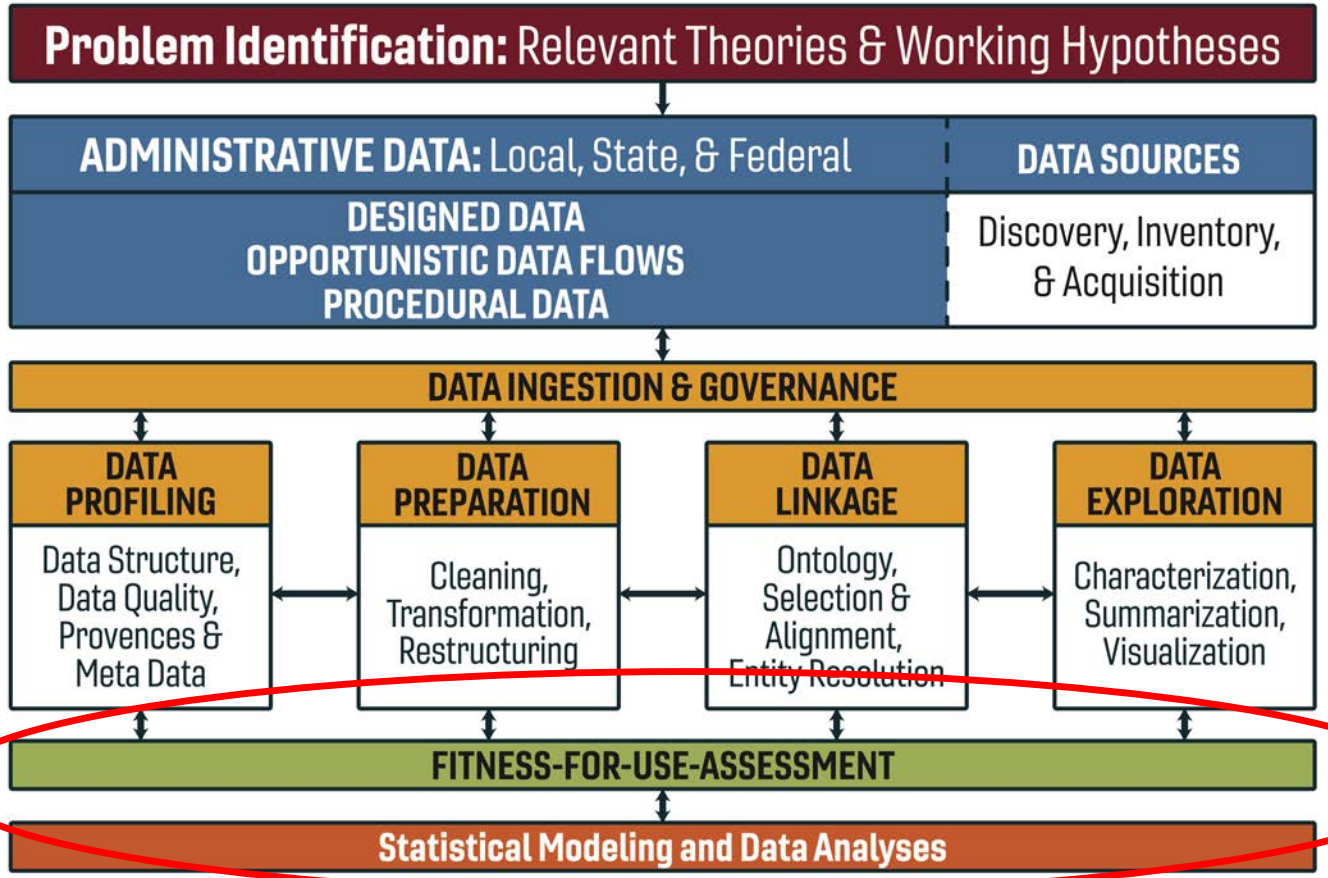
Community Characteristics

- % Population w/ Postsecondary Ed (ACS)
- % Households on SNAP (ACS)
- % Households with limited English proficiency (ACS)
- % Employment opportunities by education requirement (Open Data Jobs)
- % Employment opportunities by experience level (Open Data Jobs)

Perception of Postsecondary Availability

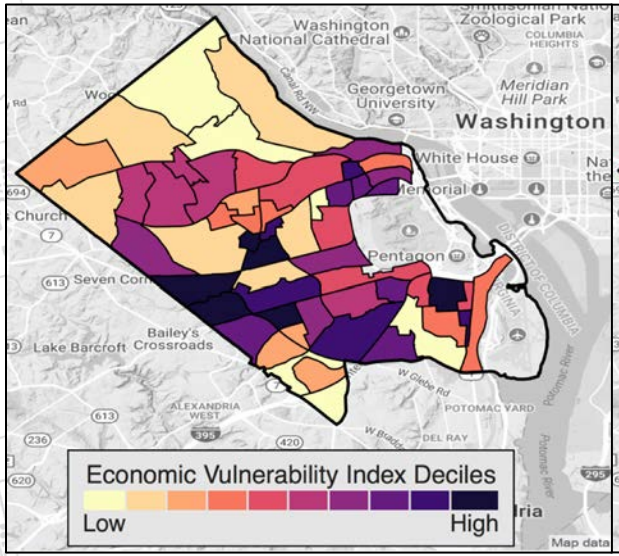
- Number of vocational schools, colleges, and universities in geographic area (IPEDS)
- Cost (tuition, fees, room and board, financial aid) of colleges in geographic area (IPEDS)
- Acceptance rate/college selectivity of colleges (IPEDS/SCHEV)
- College "choice set" of peers (SCHEV)
- College enrollment rates of students within school district (SCHEV)

Data Science Framework

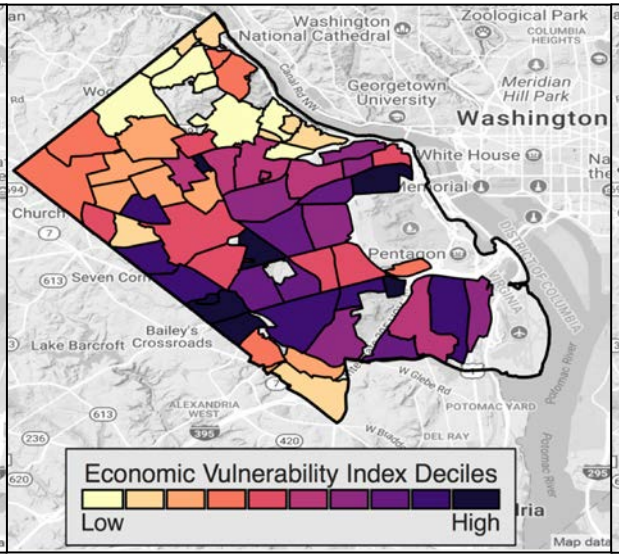


Arlington County Vulnerability Indicators

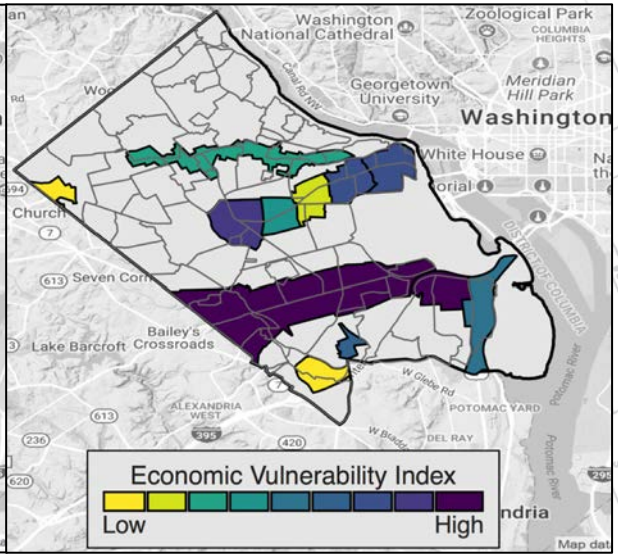
Census Tracts



Civic Association Neighborhoods



High-Density Planning Regions



Based on a **statistical combination** of the percentage of Households with:

- housing burdens > 50% of Household income
- no vehicle
- receiving Supplemental Nutrition Assistance Program (SNAP)
- in poverty

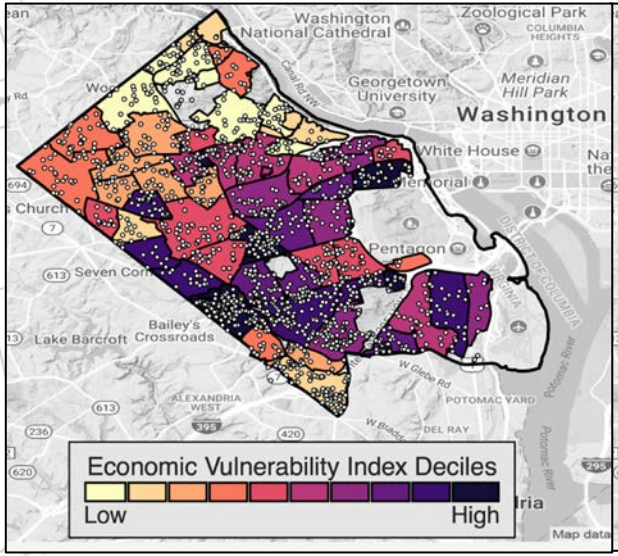
Source: American Community Survey 2012-20156 aligned to geographic areas using **SDAL Synthetic Technology**.

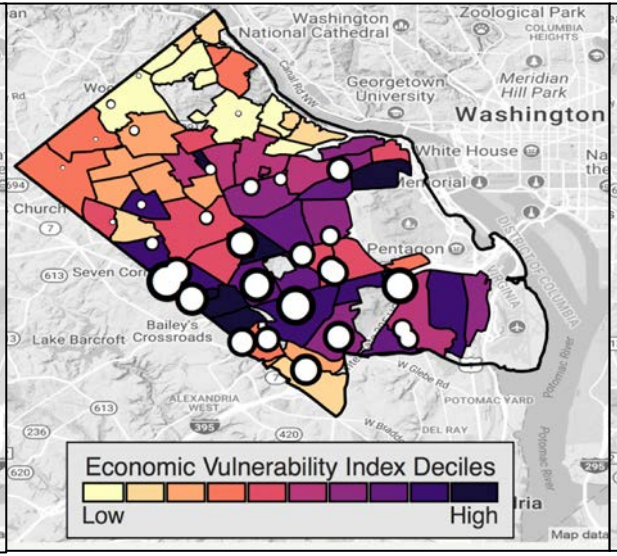
Arlington County Neighborhood Insights

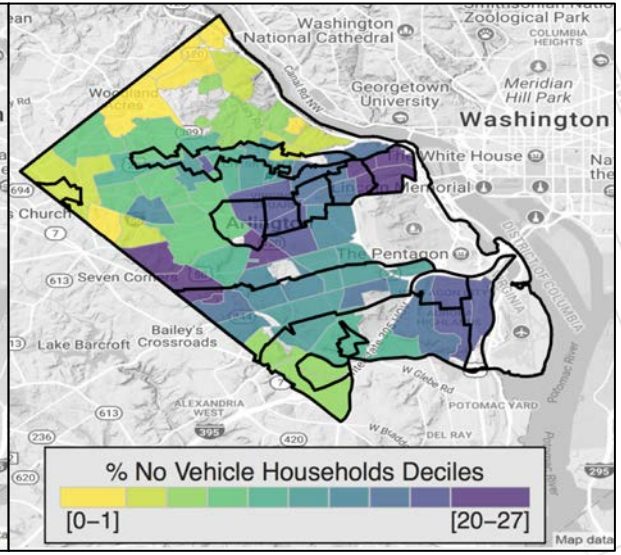
Households **receiving subsidies** from Department of Parks and Recreation

School and neighborhood vulnerability indices

High-Density Planning Regions with % households with no vehicles







Sources: ACS 2012-2016; NCES, CDC, and VDOE 2014-2015; Arlington County Department of Parks & Recreation 2016.

Building Data Science Capacity

Engage partners that can help scale the benefits of data science

- Mission of ***Land Grant Universities*** is to **enhance** the security and ***social well-being of its communities***
- Cooperative Extension professionals know how to involve university researchers in ***community based research through engaged scholarship***

Data Science for the Public Good (DSPG)

Build momentum through purposeful experiential learning

IDENTIFYING STEM EDUCATION PATHWAYS

Sponsor: Pat Buggies, The National Center for Science & Engineering Statistics at the National Science Foundation (NSF)

EXPLORING MENTAL HEALTH SERVICES FOR FAIRFAX COUNTY YOUTH

Sponsor: Michelle Gregory, Sophia Dutton, and Linda Hoffman, Fairfax Health and Human Services

RESIDENTIAL SMOKE ALARM NEED IN ARLINGTON COUNTY

Sponsor: Battalion Chief Mike Gowen, Arlington County Fire Department

HOW DO EVENTS AFFECT CRIME?

Sponsor: Captain Bruce Benson and Niki Levy, Arlington County Police Department

MODELING THE IMPACT OF OPEN SOURCE SOFTWARE: NETWORK OF R PACKAGES

Sponsor: Carol Robbins, The National Center for Science & Engineering Statistics at the National Science Foundation

MODELING RESPONSE TIME FOR STRUCTURE FIRES

Sponsor: Battalion Chief Mike Gowen, Arlington County Fire Department

PROFILE OF NEW KENT, VA

David Park, Joseph Kim, David Hinkle, Lata Kodali (Virginia Tech) with Di
Sponsor: Carl Frick, Virginia Corporate Extension (VCE) representative

CREATING SYNTHETIC DATA FOR VIRGINIA LONGITUDINAL DATA SYSTEM

Sean Pili, Kyle Morgan, Ronnie Fesco, and Lata Kodali (Virginia Tech) with Aar ser (SDAL)
Sponsor: Tod Massa (SCHEV – State Council for Higher Education in Virginia)

DEFINING AND MEASURING EQUITY IN ALEXANDRIA, VA

Sponsor: Emily Maslino, City of Alexandria

PROFILING ARMY BASES

Goal: identify publicly available data sources (e.g., Census and BLS data) to create social, demographic, economic, and other quantitative profiles of Army bases and their surrounding areas. Identify relevant variables for use in statistical models.
Sponsors: Greg Ruark, Andrew Slaughter, US Army Research Institute for Behavioral & Social Science Research

DISCOVERING NON-TRADITIONAL DATA SOURCES FOR BUSINESS INNOVATION

Harsimrat Pandher (VT), David Park (VT), Daniel Wilkin (VT), Joseph Kim (VT)
Claire Kelling (PSU) with Gizem Korkmaz and Stephanie Shipp (SDAL)
Sponsor: Gary Anderson, The National Center for Science & Engineering Statistics

A STUDY ON WMATA BUS FARE EVASION

Sponsor: Jayme M. Johnson, Catherine Vanderwaart, Washington Metropolitan Area Transit Authority

ANALYZING THE ECONOMIC IMPACT AND SOCIAL INTEGRATION OF REFUGEES IN ROANOKE, VIRGINIA

Claire Kelling (PSU), Kyle Morgan (VT), Craig Morton (VT), Hannah Brinkley (VT), Adrienne Rogers (VT, with Mark Orr, Stephanie Shipp, and Bianica Pires (SDAL)

Thank You