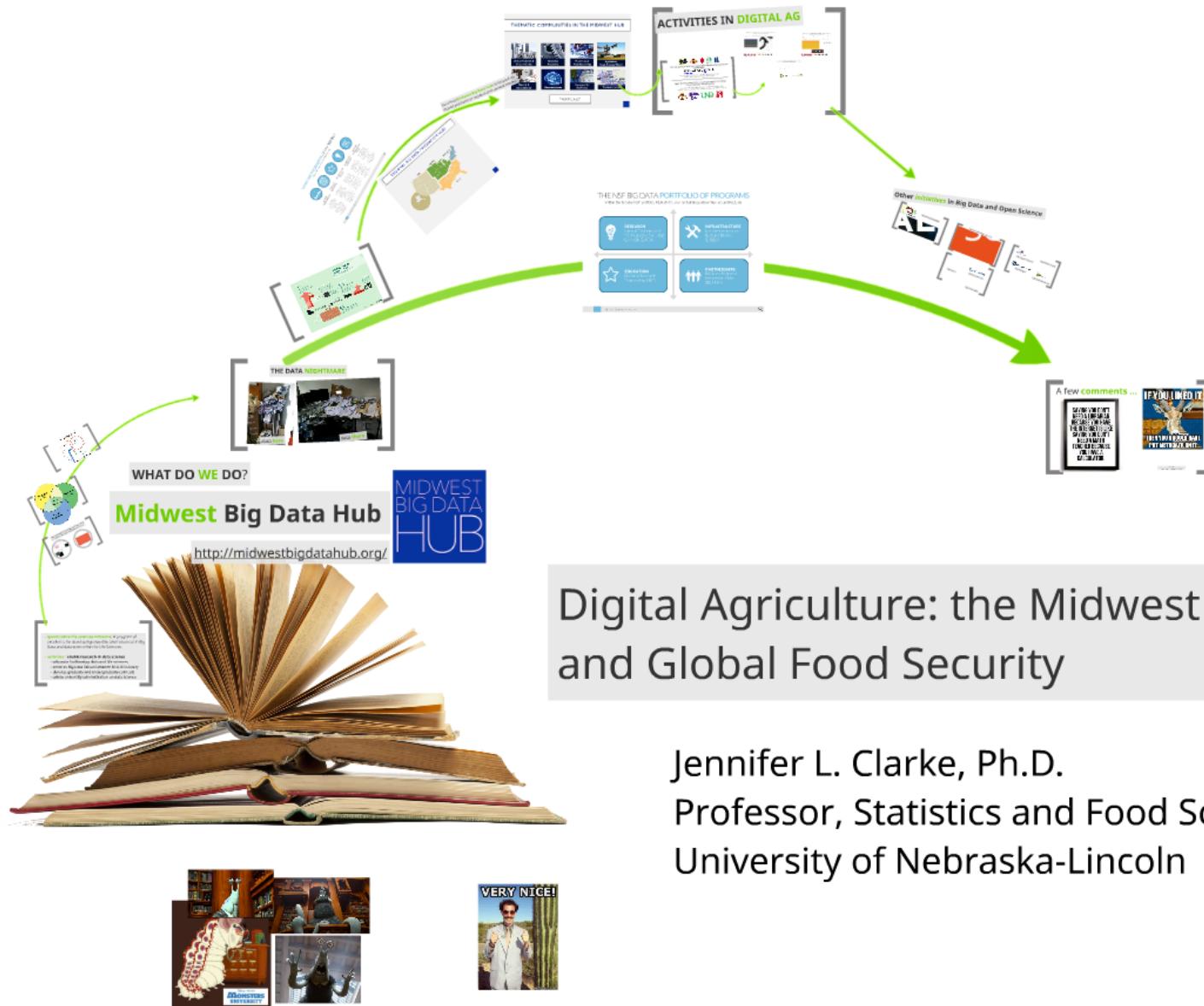


**JENNIFER L. CLARKE**

jclarke3@unl.edu #UNLBIGDATA



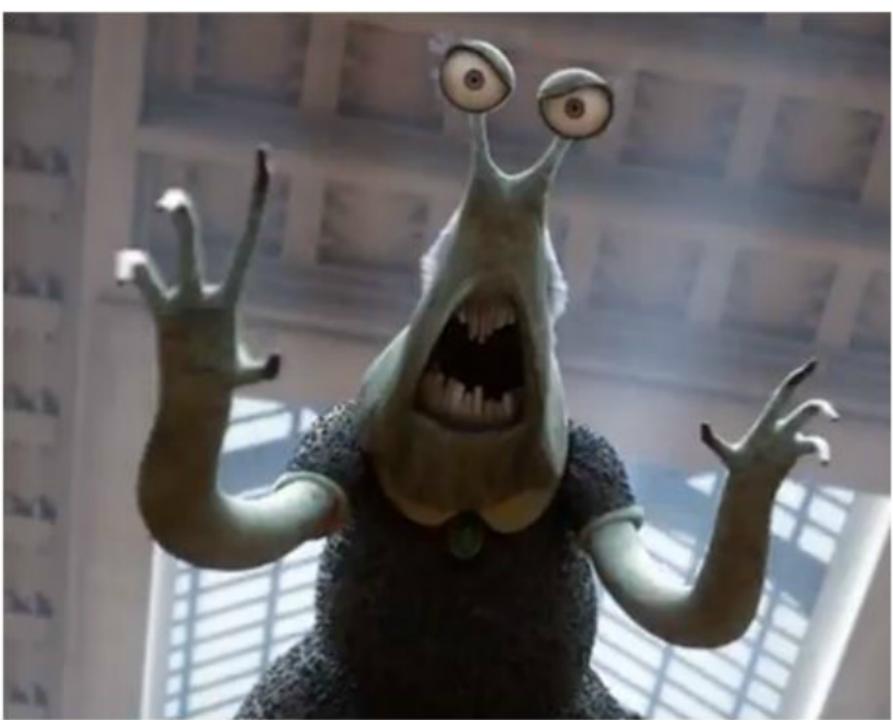
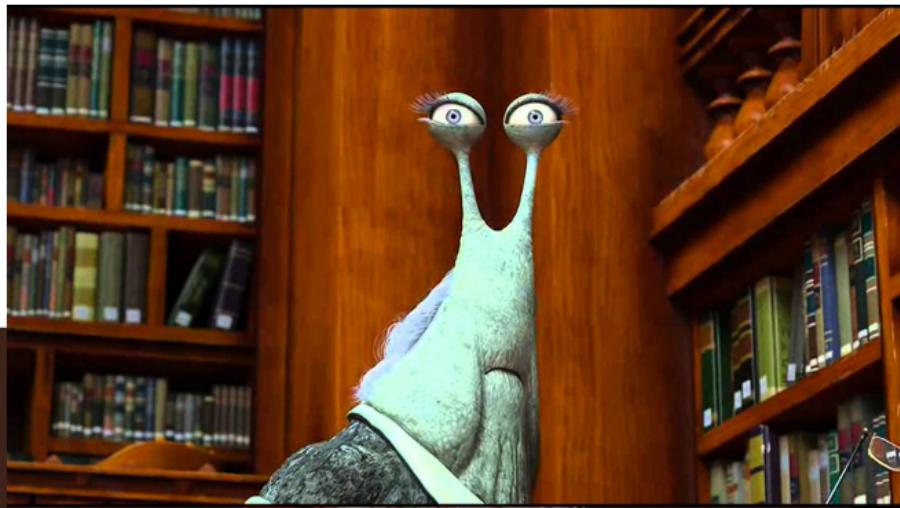


## Digital Agriculture: the Midwest Big Data Hub and Global Food Security

Jennifer L. Clarke, Ph.D.  
Professor, Statistics and Food Science and Technology  
University of Nebraska-Lincoln

# VERY NICE!





- **quantitative life sciences initiative**: A program of excellence for developing expertise and resources in Big Data and data science for the Life Sciences.
- **activities : enable research in data science**
  - advocate for/develop data and life sciences
  - serve as Big Data liaison between UNL & industry
  - develop graduate and undergraduate curricula
  - advise university administration on data science

# The ways in which we analyze, process, store, and interact with data are rapidly changing

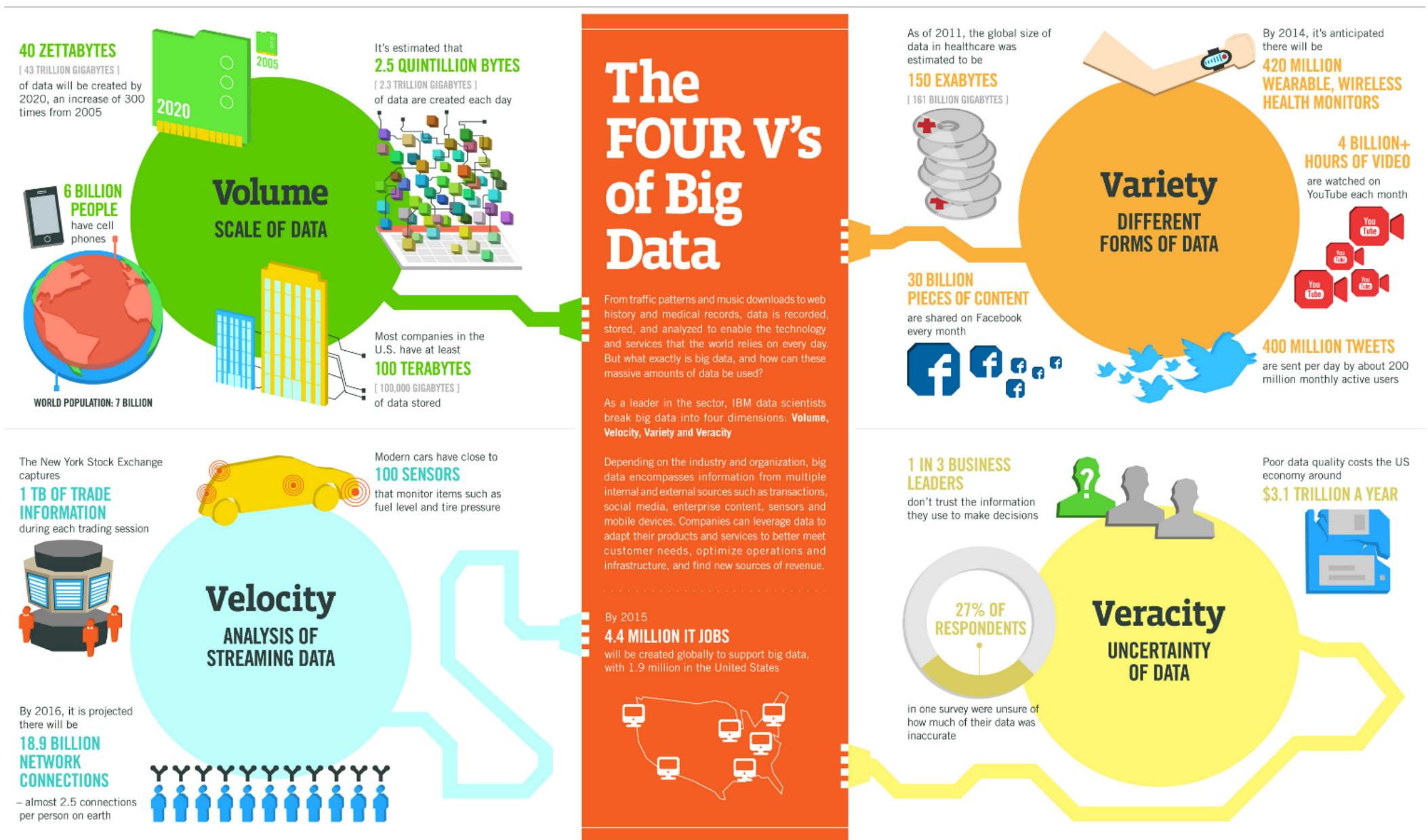


# 20th Century



# 21st Century

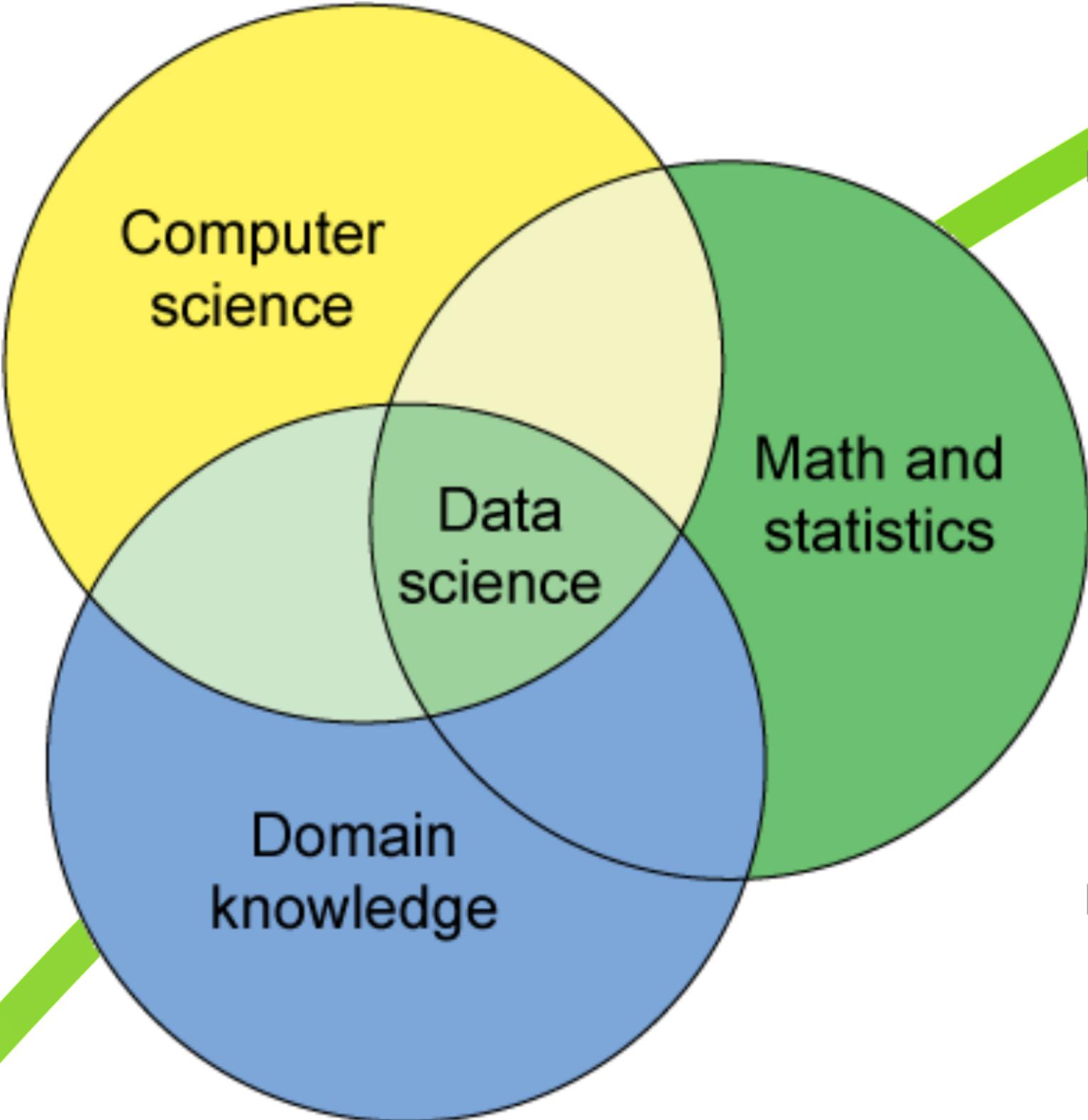




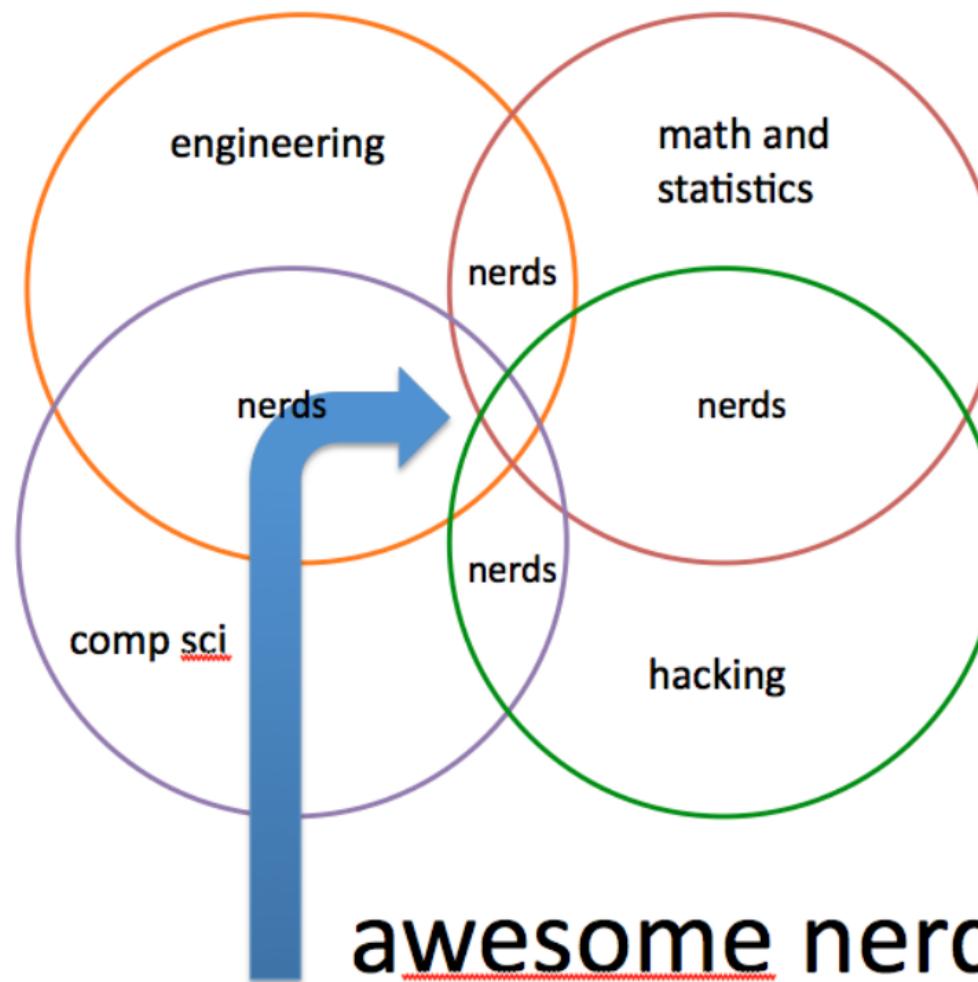
Sources: McKinsey Global Institute, Twitter, Cisco, Gartner, EMC, SAS, IBM, MEPTEC, QAS

<http://blogs.gartner.com/doug-laney/batman-on-big-data/>

IBM



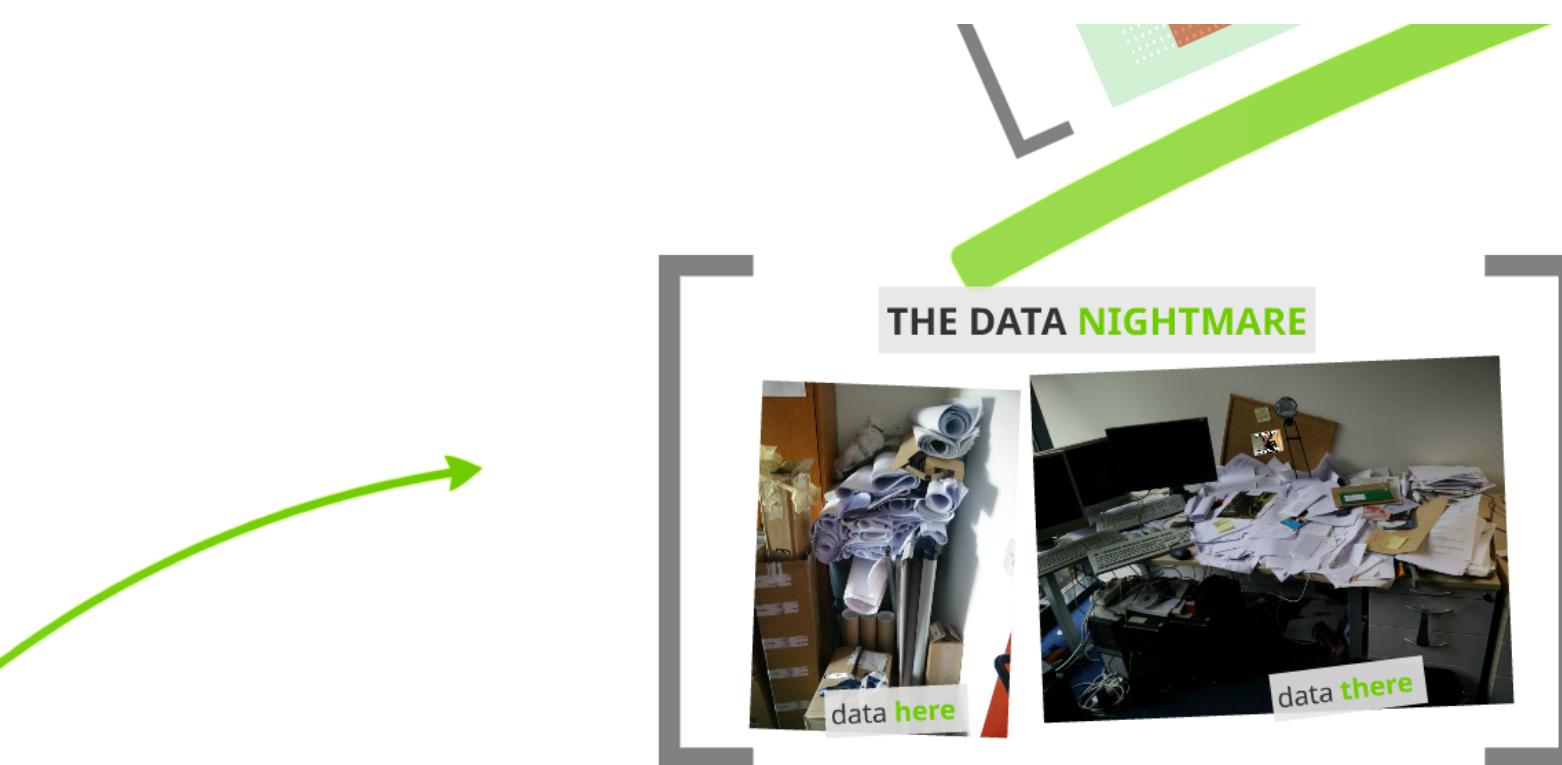
# Data scientists?



# THE DATA NIGHTMARE







WHAT DO WE DO?

# Midwest Big Data Hub

<http://midwestbigdatahub.org/>

MIDWEST  
BIG DATA  
HUB

## INCREASING CROP YIELDS

# 90%

of all crops losses are due to weather.

Weather-related crop damage could be reduced by 25% using predictive weather modeling and precision agriculture techniques.



## PRECISION AGRICULTURE

IBM is using data to help farmers be more efficient in their operations and make more precise decisions about planting, growing, harvesting and transporting crops, leading to better price points and a stable supply chain.

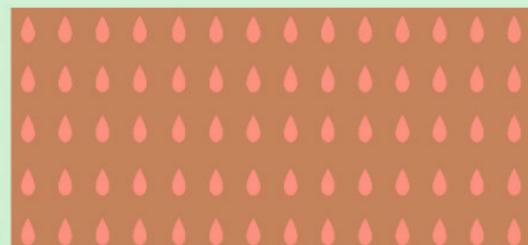
WEATHER MODELING



### DEEP THUNDER

IBM's Deep Thunder is a service that provides a hyperlocal forecast up to 36 hours in advance with 90% accuracy.

SENSORS



## GROWING

# 70%

of fresh water worldwide is used for agriculture purposes.

If farmers know when and where it's going to rain they can better schedule their irrigation and know when they should put down fertilizer, to avoid run off.

## FEEDING FUTURE GENERATIONS

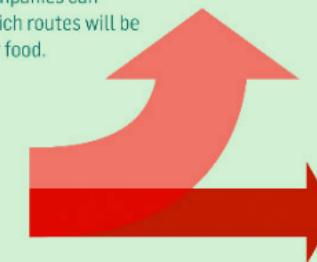
How weather affects agriculture and what IBM can do with precision weather forecasts to help farmers

## TRANSPORTATION

# 50%

of food ready for harvest never reaches the consumers mouth.

By understanding the effect of weather on transportation networks, companies can make better decisions on which routes will be the fastest to transport their food.



## THE IMPACT

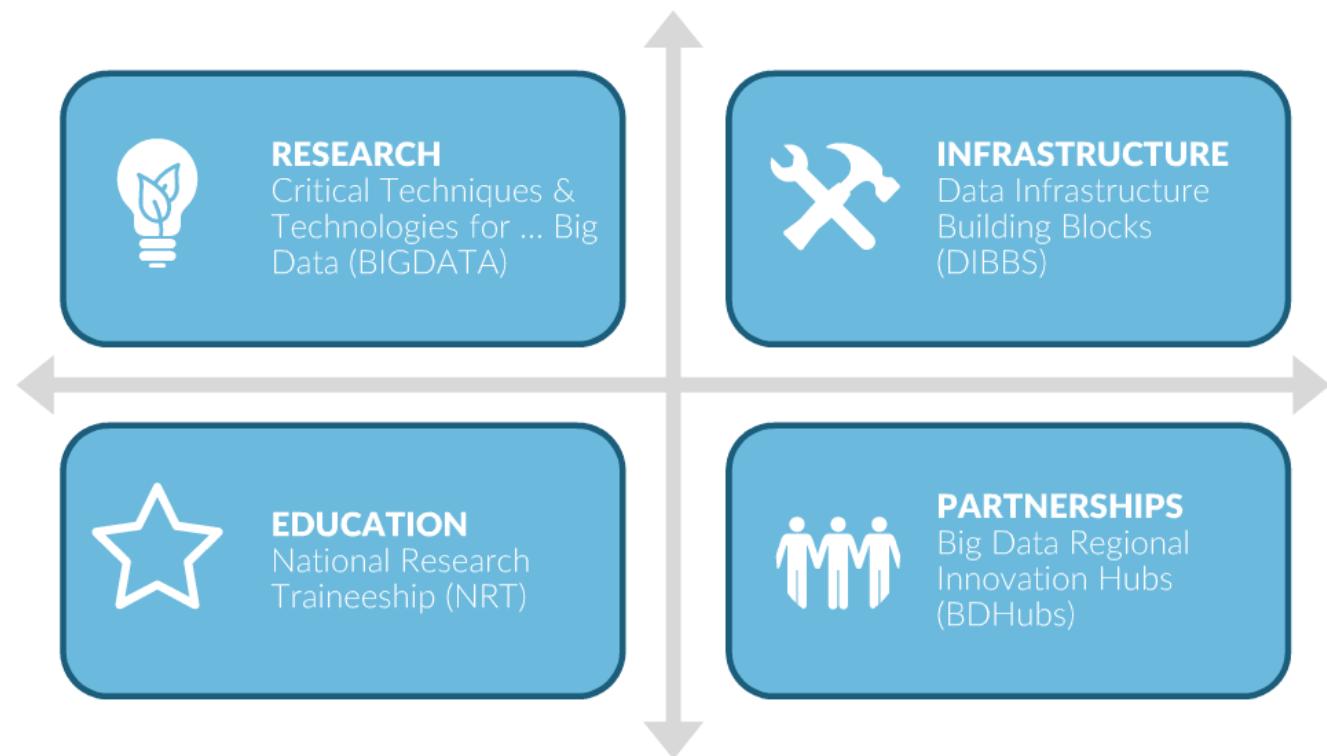
As farmers reduce waste and increase crop yields, consumers will feel the positive economic impact at the grocery store.

For more information on IBM's Deep Thunder and how it can help farmers visit: [www.ibm.com/research](http://www.ibm.com/research)



# THE NSF BIG DATA PORTFOLIO OF PROGRAMS

Within the broader NSF portfolio, BDHubs focuses on building partnerships around Big Data



# WHAT ARE THE BENEFITS OF PARTNERING?

Achieve collectively what is impossible individually



## INITIATE PARTNERSHIPS

Hubs will bring together academia, industry, non-profits, and government to initiate new partnerships.

By collectively ideating and bringing together resources from across sectors, partnerships can drive faster innovation and more novel ideas



## COMMON RESOURCES

Participants can leverage the resources contributed by partners to Hub partnerships. Hubs can help develop "plug and play" infrastructure resources for partners.

Resource providers can find users that will develop novel applications for their infrastructure.



## ACCESS TO TOP TALENT

In a world where demand for Big Data talent far exceeds supply, Hubs will connect partners with students in academia.

Projects with academia will train those students in projects of interest to partners before they even leave school.



## SHARED BEST PRACTICES

Big Data practices, especially in a socio-technical context, are increasingly complex.

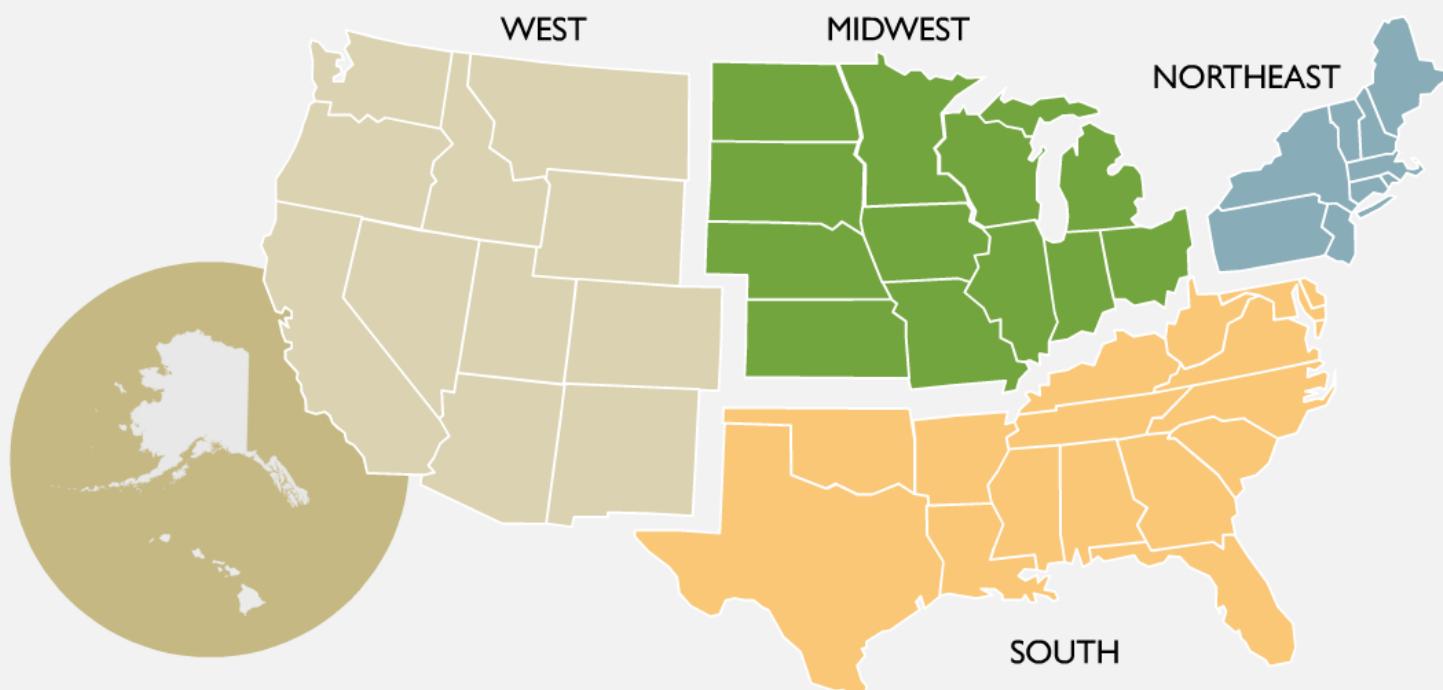
Partners can develop and share best practices in areas such as privacy, discrimination, and ethics to ensure adoption while minimizing unwanted consequences.



## REDUCED COORDINATION COSTS

Partnerships always come with a logistical cost. With BDHubs, NSF will fund the staff and logistics support necessary for more complex collaborations, reducing overhead and maximizing benefits for participants.

# REGIONAL BIG DATA INNOVATION HUBS



Each Hub (**Midwest Big Data Hub**) is focused on shared problems of regional and societal interest.

BS

Urb  
Sma

Health &  
Biomedicine

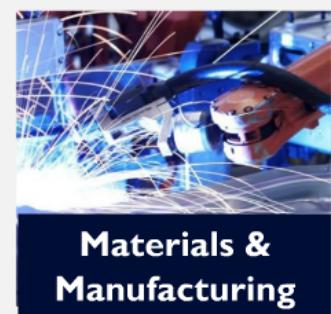
# THEMATIC COMMUNITIES IN THE MIDWEST HUB



**Urban Science &  
Smart Cities**



**Business  
Analytics**



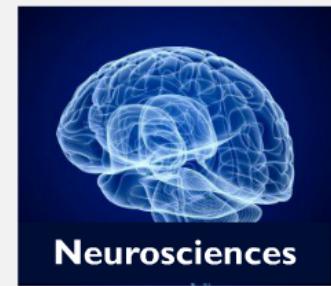
**Materials &  
Manufacturing**



**Agriculture  
Food-Energy-Water**



**Health &  
Biomedicine**



**Neurosciences**



**Community  
Resilience**



**Transportation**

The Midwest Big Data Hub is focused on regional and societal interest.

“VERTICALS”

# ACTIVITIES IN DIGITAL AG



BD Hubs: Midwest: "SEEDCorn: Sustainable Enabling Environment for Data Collaboration"

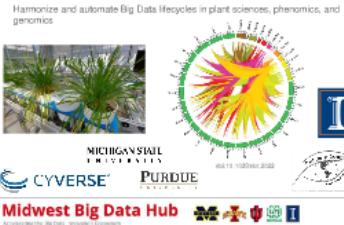
**Midwest Big Data Hub**  
Accelerating the Big Data Innovation Ecosystem

One of four Big Data Regional Innovation Hubs (BD Hubs) funded by the National Science Foundation through award #1550320

Spoke: DIGITAL AGRICULTURE – UNMANNED AIRCRAFT SYSTEMS, PLANT SCIENCES, AND EDUCATION



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Midwest Big Data Hub



BD Hubs: Midwest: “SEEDCorn: Sustainable Enabling Environment for Data Collaboration”

## Midwest Big Data Hub

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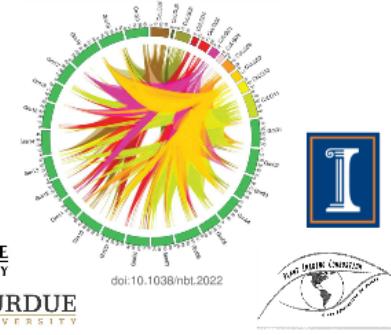
Joshua Riedy (University of North Dakota), Joe Colletti (Iowa State University), Greg Monaco (Kansas State University), Jennifer Clarke (University of Nebraska Lincoln)



# DIGITAL AG

Spoke: DIGITAL AGRICULTURE – UNMANNED AIRCRAFT SYSTEMS,  
PLANT SCIENCES, AND EDUCATION

Harmonize and automate Big Data lifecycles in plant sciences, phenomics, and genomics



MICHIGAN STATE  
UNIVERSITY  
**CYVERSE**

PURDUE  
UNIVERSITY

**Midwest Big Data Hub**

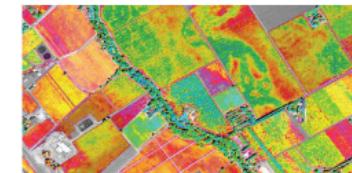
Accelerating the Big Data Innovation Ecosystem



Spoke: DIGITAL AGRICULTURE – UNMANNED AIRCRAFT SYSTEMS,  
PLANT SCIENCES, AND EDUCATION

Harmonize and automate Big Data lifecycles in unmanned aircraft systems (UAS) in agriculture

- large volumes of imaging data related to greenness, geography, temp
- associate with yield, weather, soil measurements, farm management



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CORPORATION

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PRECISION OPTICS

NORTHERN PLAINS  
UAS TEST SITE

**Midwest Big Data Hub**

Accelerating the Big Data Innovation Ecosystem



Spoke: DIGITAL AGRICULTURE – UNMANNED AIRCRAFT SYSTEMS,  
PLANT SCIENCES, AND EDUCATION

Information sharing/education and training at all levels.

- data in precision agriculture
- high performance computing
- image processing
- systems biology
- national data service
- globus
- metadata and ontologies



AgBioData

GPN  
ADVANCING RESEARCH... CREATING SOLUTIONS

**Midwest Big Data Hub**

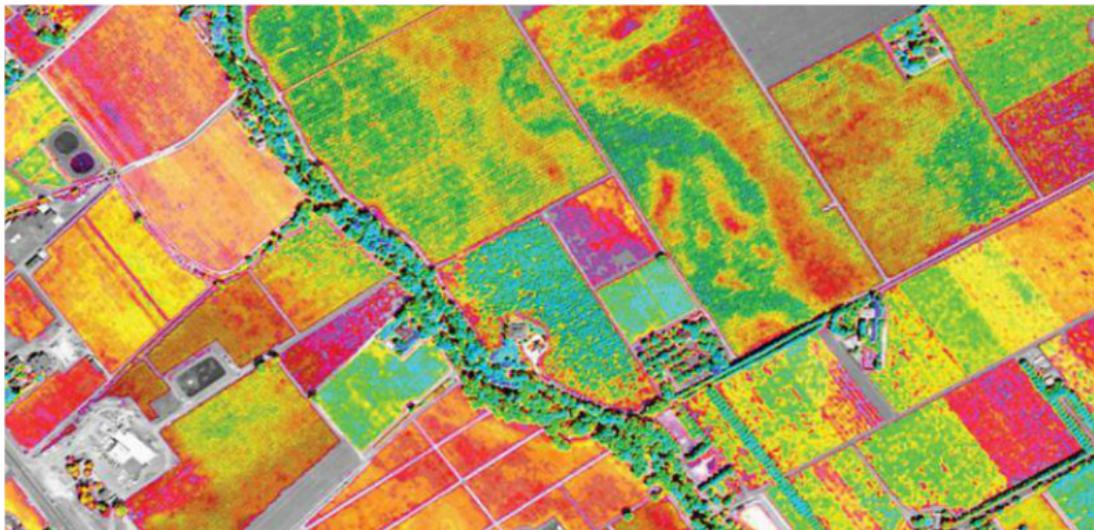
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[www.xyht.com](http://www.xyht.com)



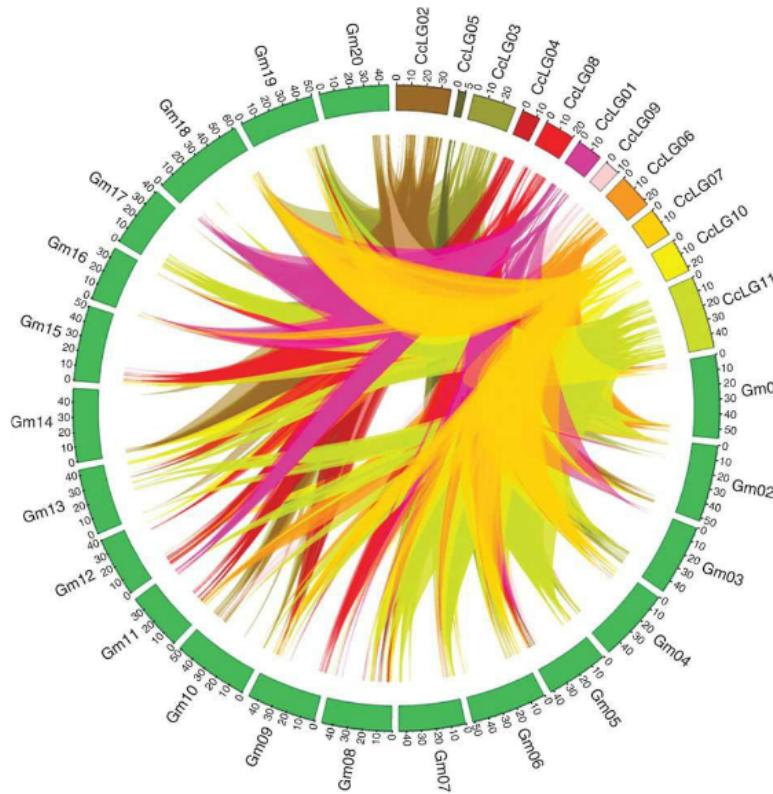
# Midwest Big Data Hub

Accelerating the Big Data Innovation Ecosystem



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Harmonize and automate Big Data lifecycles in plant sciences, phenomics, and genomics



MICHIGAN STATE  
UNIVERSITY



PURDUE  
UNIVERSITY

doi:10.1038/nbt.2022



## Midwest Big Data Hub

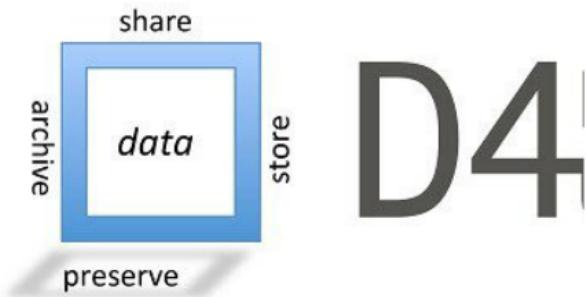
Accelerating the Big Data Innovation Ecosystem



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Information sharing/education and training at all levels.

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## Midwest Big Data Hub

Accelerating the Big Data Innovation Ecosystem



# Other initiatives in Big Data and Open Science



RESEARCH DATA ALLIANCE



<https://www.rd-alliance.org/>

A screenshot of the National Data Service (NDS) website. The header reads "The National DATA SERVICE". Below it, a main section says: "The National Data Service (NDS) is an emerging vision for how scientists and researchers across all disciplines can find, reuse, and publish data. It builds on the data archiving and sharing efforts already underway within specific communities and links them together with a common set of tools designed around the following capabilities." Below this are four cards: "Search" (blue), "Publish" (orange), "Link" (green), and "Reuse" (purple).

<http://www.nationaldataservice.org/>



<http://agdatacoalition.org/>



Open Ag Data Alliance

<http://openag.io/>

<https://www.godan.info/>



<https://www.agbiodata.org/>



<https://cos.io/>



<http://www.cyverse.org/>



<https://socopen.org/>



RESEARCH DATA ALLIANCE

<https://www.rd-alliance.org/>



**RDA** 10<sup>TH</sup> PLENARY MEETING / CONFÉRENCE

**BETTER DATA  
BETTER DECISIONS**

**TRÈS** BONNES DONNÉES  
BONNES DÉCISIONS

19-21 SEPTEMBER/SEPTEMBRE 2017  
MONTRÉAL, CANADA

**RDA**  
RESEARCH DATA ALLIANCE

**RDC** RDC  
Research Data Canada - Données de recherche Canada

**Université de Montréal**

The National Data Service (NDS) is an emerging vision for how scientists and researchers across all disciplines can find, reuse, and publish data. It builds on the data archiving and sharing efforts already underway within specific communities and links them together with a common set of tools designed around the following capabilities:

## 1 Search

The NDS will allow users to easily search for data across disciplinary boundaries. As users hone in on data of interest, they can easily switch to discipline-specific tools.

## 2 Publish

The NDS will connect users to tools for building and sharing collections of data. It will help users find and deliver data to the best repository for data-publishing.

## 3 Link

The NDS will create robust connections between data and published articles. When researchers reference an article, they have ready access to the underlying data.

## 4 Reuse

The NDS will not only provide access to data for download, it will provide tools for transferring data to processing platforms or allow analysis to be attached to the data.



<http://agdatacoalition.org/>



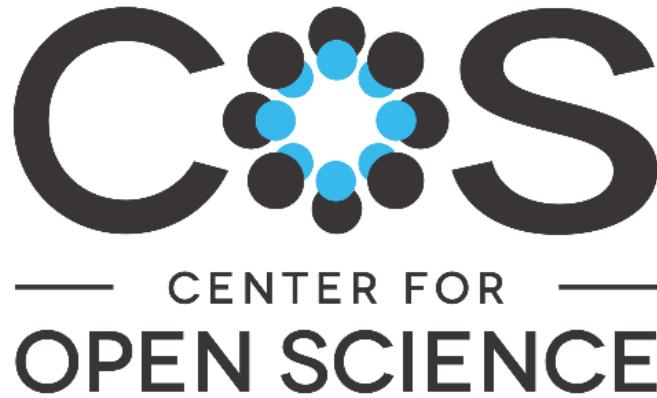
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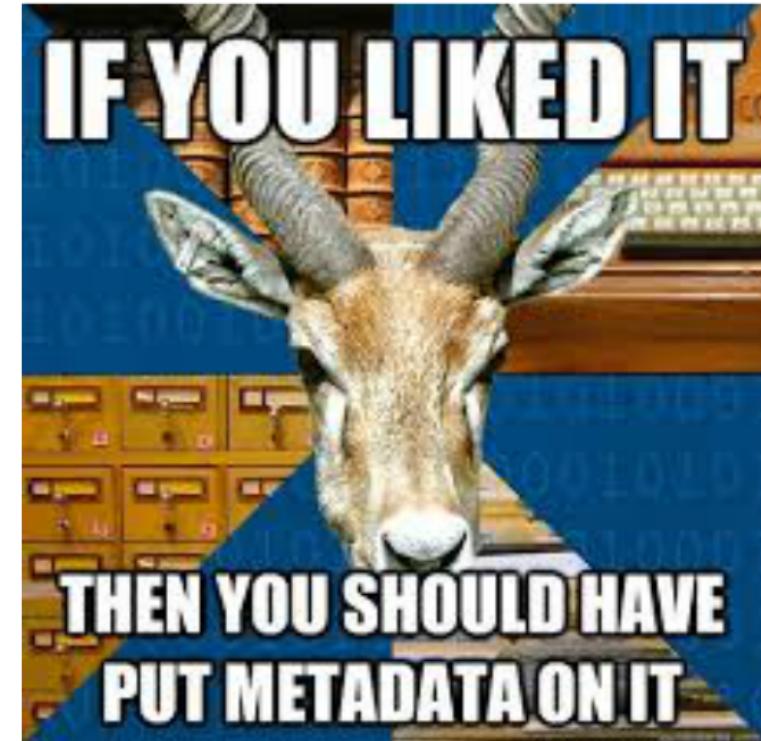
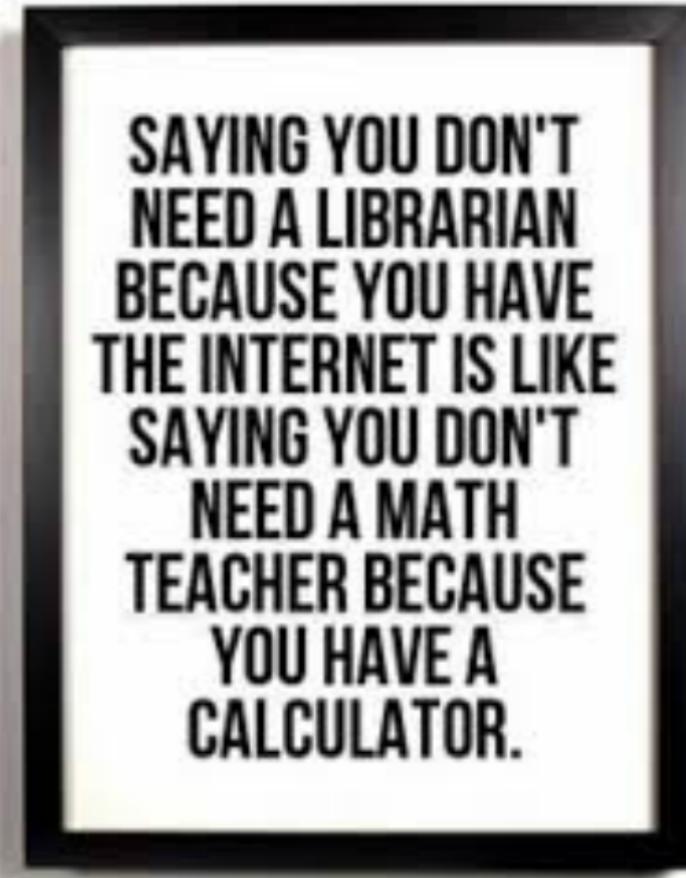


<http://www.cyverse.org/>



<https://socopen.org/>

## A few **comments** ...



Big Data Regional Innovation Hubs: Establishing Spokes to Advance Big Data Applications (BD Spokes)

Available Formats: PDF | ZIP  
Document Type: Program Announcement | Request for Proposals  
Document Number: RFP-BD-16-006

Document Last Updated: March 10, 2017 | Response Deadline:

For more information about the terms used on this document, see the [Frequently Asked Questions](#) page.

NSF 17-546  
Proposal Deadline: September 17, 2017

# Big Data Regional Innovation Hubs: Establishing Spokes to Advance Big Data Applications (BD Spokes)

Available Formats: [HTML](#) | [PDF](#)

Document Type: Program Announcements & Information [View Program Page](#)

Document Number: nsf17546

Document History: Posted: March 16, 2017. Replaces: [nsf16510](#).

For more information about file formats used on the NSF site, please see the [Plug-ins and Viewers](#) page.

NSF 17-546  
Proposal Deadline: September 17, 2017

**JENNIFER L. CLARKE**

jclarke3@unl.edu #UNLBIGDATA

