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INTERACTION

EFFECTS

=/=

INTERSECTIONALITY

(\\_/) ||

(•人•) ||

/ づ

MACHINE  
LEARNING  
IS  
INDUCTIVE

(\\_/) ||  
(・人・) ||  
/ づ

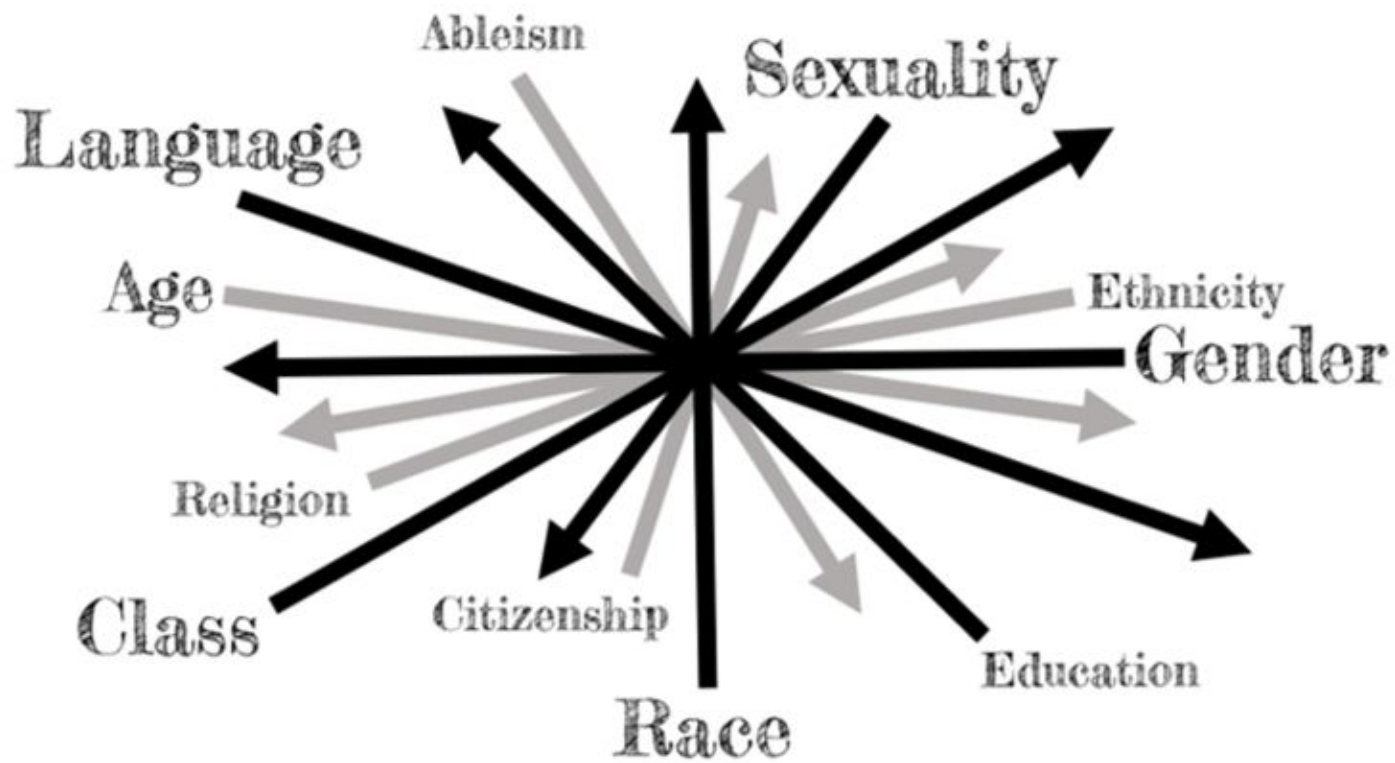
A (the?) FUTURE  
OF  
MACHINE  
LEARNING  
IS  
**INTERSECTIONAL**

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# **Part I: Groundwork**

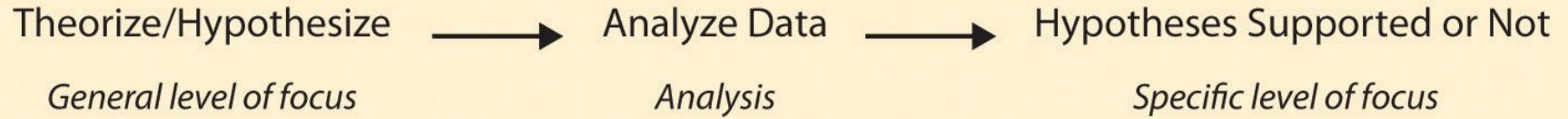


Intersectionality is a theoretical framework for understanding how **social identities** and categories **combine** and **interact** with **systems** of social, cultural, economic, and political **power** to create distinct, and **unequal, lived experiences**.

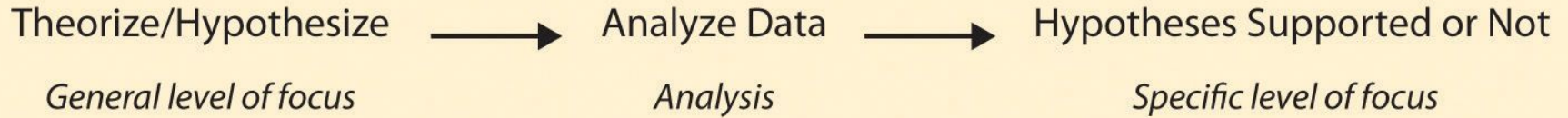
# **Intersectionality as Epistemology**

1. Identities and institutions are relational
2. Identity is an embedded experience
3. Nested hierarchies are situationally specific
4. Context is key to knowing
5. Categories are mutually constitutive

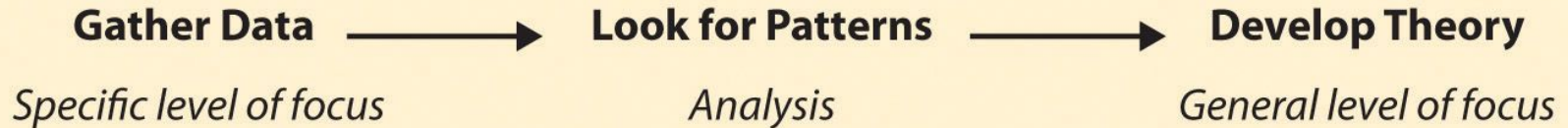




# Deductive



## Deductive



## Inductive

# **The tyranny of variable-based regression analysis**

**Let's Talk Math**

# Let's Talk Math

$$Y = \alpha + \beta X + \epsilon$$

# Let's Talk Math

$$Y = \alpha + \beta X + \epsilon$$

$$Y = \alpha + \beta_1 X + \beta_2 X + \epsilon$$

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# Let's Talk Math

$$Y = \alpha + \beta X + \epsilon$$

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$$Y = \alpha + \beta_1 X + \beta_2 X + \beta_3 X + (\beta_1 * \beta_3) X + \epsilon$$



# Let's Talk Math

$$Y = \alpha + \beta X + \epsilon$$

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$$Y = \alpha + \beta_1 X + \beta_2 X + \beta_3 X + (\beta_1 * \beta_3) X + \epsilon$$

$$Y = \alpha + \beta_1 X + \beta_2 X^2 + \epsilon$$

# **Inferential Statistics**

assume known relationships → assess fit

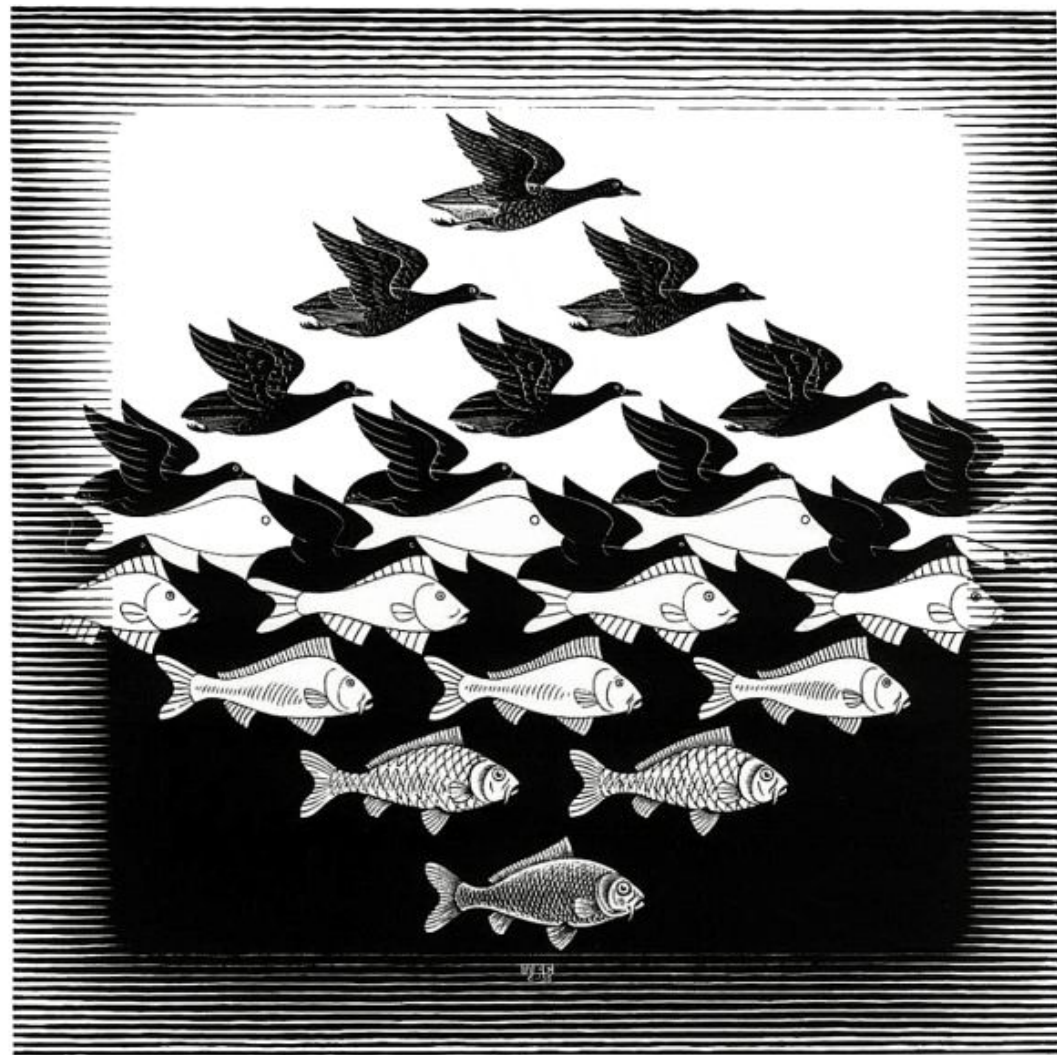
mathematical

rigid

statistical significance

interpretable parameters















**Enter: Machine Learning**

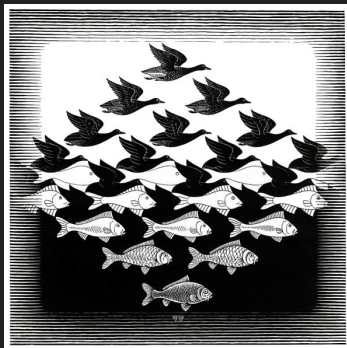


# Enter: Machine Learning

Machine learning is the algorithms and statistical models that computer systems use to perform a specific task **without using explicit instructions**, relying on patterns and inference instead.



**intercategorical  
complexity**



**intracategorical  
complexity**



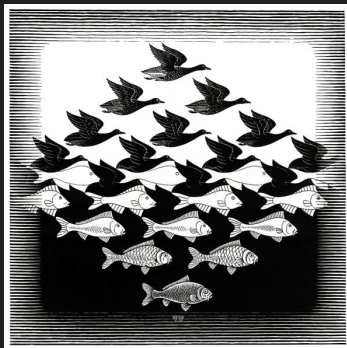
**anticategorical  
complexity**



**processes**



**intercategorical  
complexity**



**intracategorical  
complexity**



**anticategorical  
complexity**



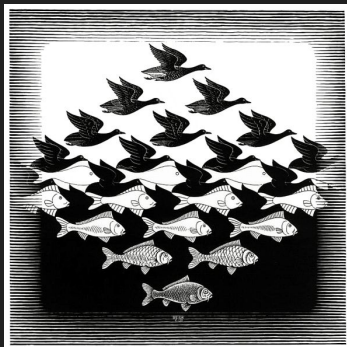
**processes**



**moar data**



**intercategorical  
complexity**



**intracategory  
complexity**



**anticategory  
complexity**



**processes**



**moar data**



**high-  
dimensional  
data**

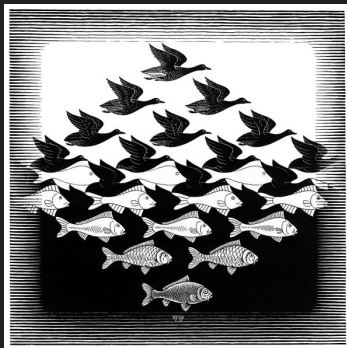




**intercategory  
complexity**



**moar data**



**intracategory  
complexity**



**high-  
dimensional  
data**



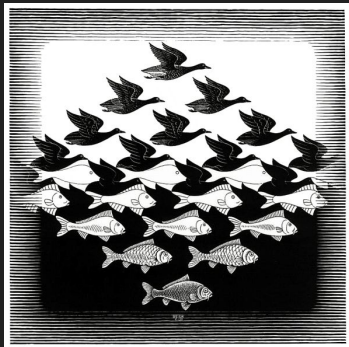
**anticategory  
complexity**



**unsupervised**



**processes**



**intercategorical  
complexity**

**intracategorical  
complexity**

**anticategorical  
complexity**

**processes**

**moar data**

**high-  
dimensional  
data**

**unsupervised**

**#oversharing**

## **Inferential Statistics**

assume known relationships → assess fit

mathematical

rigid

statistical significance

interpretable parameters

## **Machine Learning**

unknown relationships → fit the data

empirical

elastic

generalizability

black box (or prediction)



<b>Inferential Statistics</b>	<b>Machine Learning</b>
assume known relationships → assess fit	unknown relationships → fit the data
mathematical	empirical
rigid	elastic
statistical significance	generalizability
interpretable parameters	black box (or prediction)



# **Inferential Statistics**



## **Deductive**

**Inferential Statistics**



**Deductive**

**Inductive**



**Machine Learning**

**Inferential Statistics**



**Deductive**

**Inductive**



**Machine Learning**

**Yup, even  
supervised  
machine  
learning!**



**Quantitative  
Method  
with a  
Parametric  
Epistemology**



**Quantitative  
Method  
with a  
Qualitative  
Epistemology**

The mathematical assumptions of machine learning are **perfectly aligned** with intersectionality as epistemology.

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**perfectly aligned** with intersectionality as epistemology.

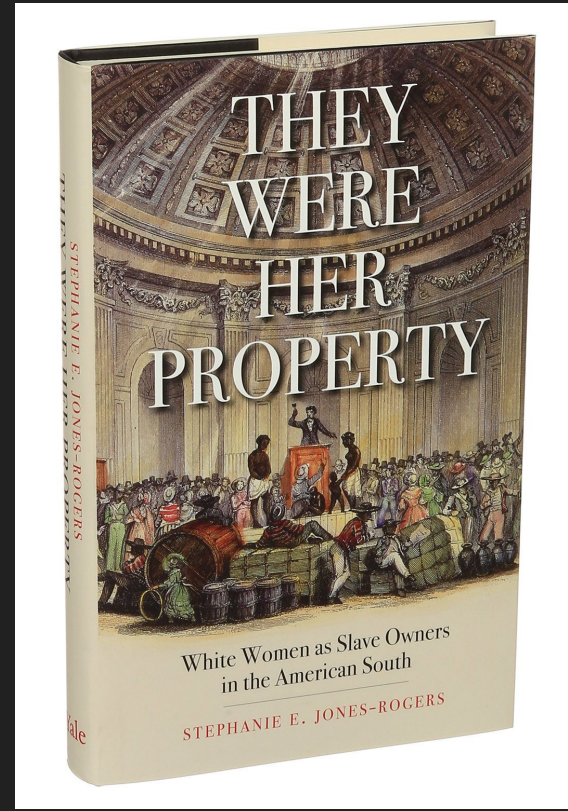
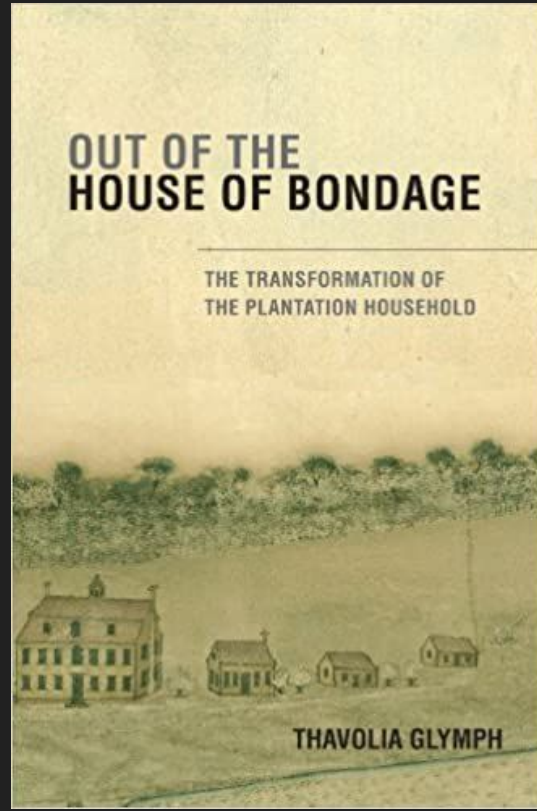
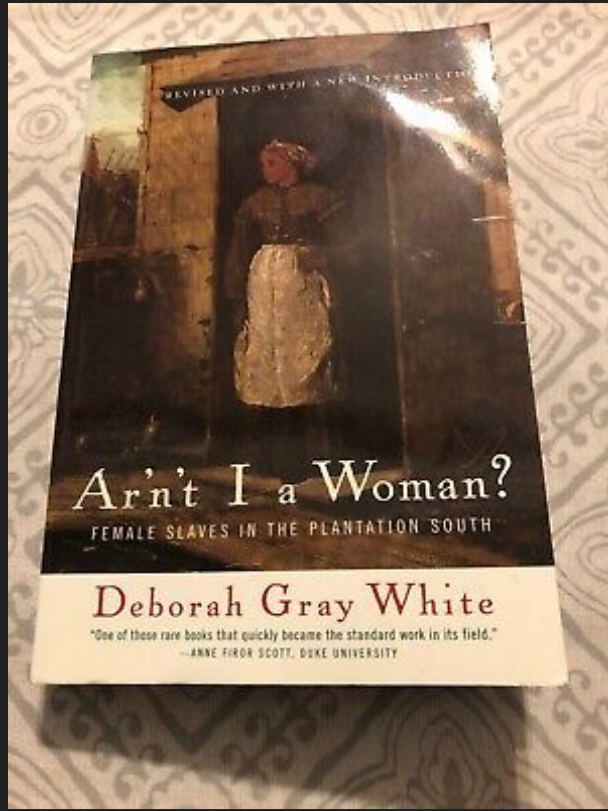


**and even  
ontology!**

## **Part II: The 19th Century U.S. South**







DOCUMENTING  
*the American South*



PRIMARY RESOURCES FOR THE STUDY OF SOUTHERN HISTORY, LITERATURE, AND CULTURE

# DOCUMENTING *the American South*



PRIMARY RESOURCES FOR THE STUDY OF SOUTHERN HISTORY, LITERATURE, AND CULTURE

**N = 414**

41 by white women

89 by white men

48 by Black women

243 by Black men or about Black persons

# **word embeddings**

# word embeddings

etariat , the modern **working** class , developed --  
prolongation of the **working** hours , by increase  
ial validity for the **working** class . All are inst  
the struggle of the **working** class against the bo  
nd nationality . The **working** men have no country  
he revolution by the **working** class , is to raise  
est of the exploited **working** class alone . Thus t  
measures against the **working** class ; and in ordin  
the cudgels for the **working** class . Thus arose p

re always during the **working** season members of an  
said , that two men **working** differently bring ab  
effect , and of two **working** similarly , one atta

# **word embeddings**

The Sociological Imagination

# **word embeddings**

The Sociological Imagination

**Skip-Gram:**

The ??? Imagination

# word embeddings

The Sociological Imagination

Skip-Gram:

The ??? Imagination

CBOW:

??? Sociological ???



# word embeddings

<b>sewing - carpentry</b>	<b>registered-nurse - physician</b>	<b>housewife - shopkeeper</b>
<b>nurse - surgeon</b>	<b>interior designer - architect</b>	<b>softball - baseball</b>
<b>blond - burley</b>	<b>feminism - conservatism</b>	<b>cosmetics - pharmaceuticals</b>
<b>giggle - chuckle</b>	<b>vocalist - guitarist</b>	<b>petite - lanky</b>
<b>sassy - snappy</b>	<b>diva - superstar</b>	<b>charming - affable</b>
<b>volleyball - football</b>	<b>cupcakes - pizzas</b>	<b>hairstylist - barber</b>

# de-biasing word embeddings

sewing - carpentry	registered-nurse - physician	housewife - shopkeeper
nurse - surgeon	interior designer - architect	softball - baseball
blond - burley	feminism - conservatism	cosmetics - pharmaceuticals
giggle - chuckle	vocalist - guitarist	petite - lanky
sassy - snappy	diva - superstar	charming - affable
volleyball - football	cupcakes - pizzas	hairstylist - barber

Tolga Bolukbasi et al. "Man is to Computer Programmer as Woman is to Homemaker? Debiasing Word Embeddings."  
NIPS 2016, Barcelona Spain.

# **reveal** intersecting systems of power

sewing - carpentry	registered-nurse - physician	housewife - shopkeeper
nurse - surgeon	interior designer - architect	softball - baseball
blond - burley	feminism - conservatism	cosmetics - pharmaceuticals
giggle - chuckle	vocalist - guitarist	petite - lanky
sassy - snappy	diva - superstar	charming - affable
volleyball - football	cupcakes - pizzas	hairstylist - barber

# reveal the **lived experience** under intersecting systems of cultural power

sewing - carpentry	registered-nurse - physician	housewife - shopkeeper
nurse - surgeon	interior designer - architect	softball - baseball
blond - burley	feminism - conservatism	cosmetics - pharmaceuticals
giggle - chuckle	vocalist - guitarist	petite - lanky
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# Intersectionality using Word Embeddings

Map four **combined** social identities - **Black and white men and women** - and four social institutions - **the polity, the economy, culture, and the domestic** - to produce four visualizations showing the **specific** and **relational** position of each identity **embedded** within the social institutions, as conveyed in the **context** of pro-abolitionist narratives from the 19th century U.S. South.

# Intersectionality using Word Embeddings

Black women = 'negro' + 'woman'

Black men = 'negro' + 'man'

white women = 'caucasian' + 'woman'

white men = 'caucasian' + 'man'

polity = 'nation' + 'state'

economy = 'money'

culture = 'culture'

domestic = 'housework' + 'children'

# Intersectionality using Word Embeddings

Black women = 'negro' + 'woman'

Black men = 'negro' + 'man'

white women = 'caucasian' + 'woman'

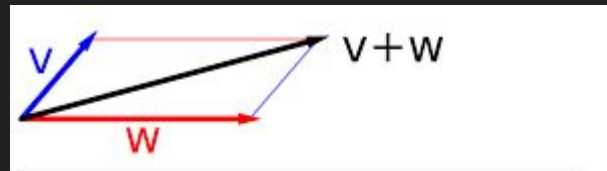
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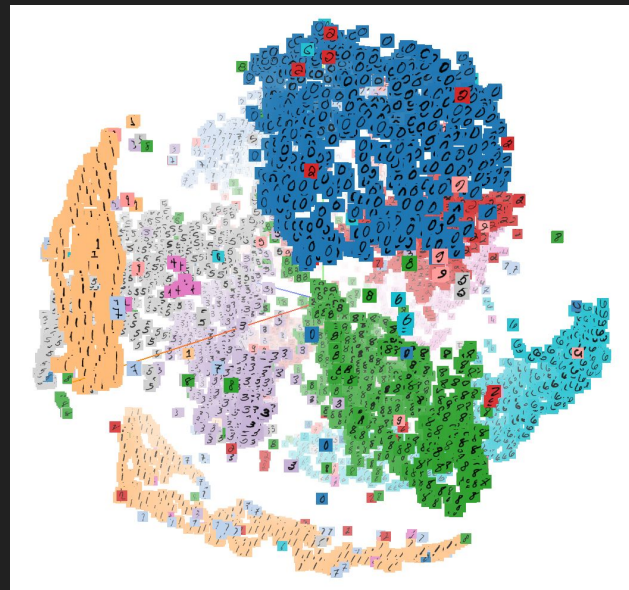
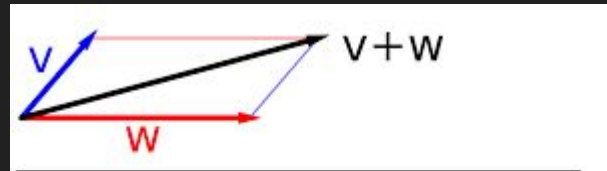
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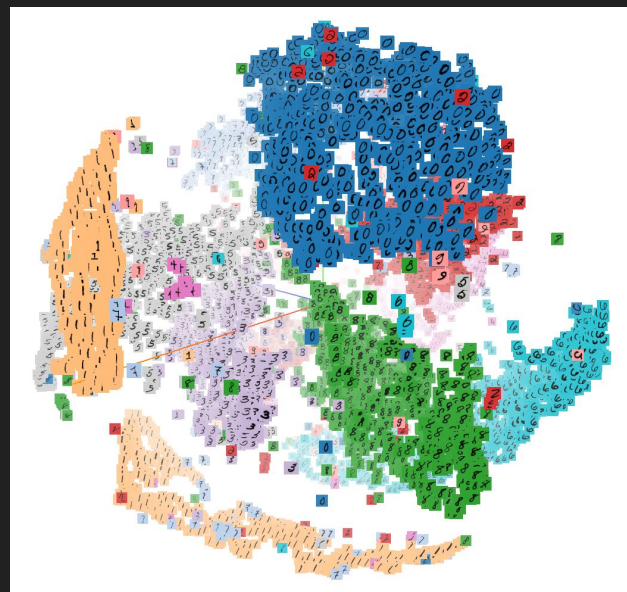
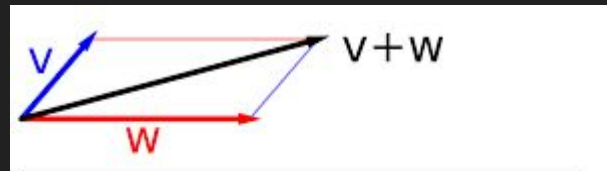
# Intersectionality using Word Embeddings

white women  $\rightarrow$  dainty = 0.40

Black women  $\rightarrow$  dainty = 0.26

white men  $\rightarrow$  dainty = 0.25

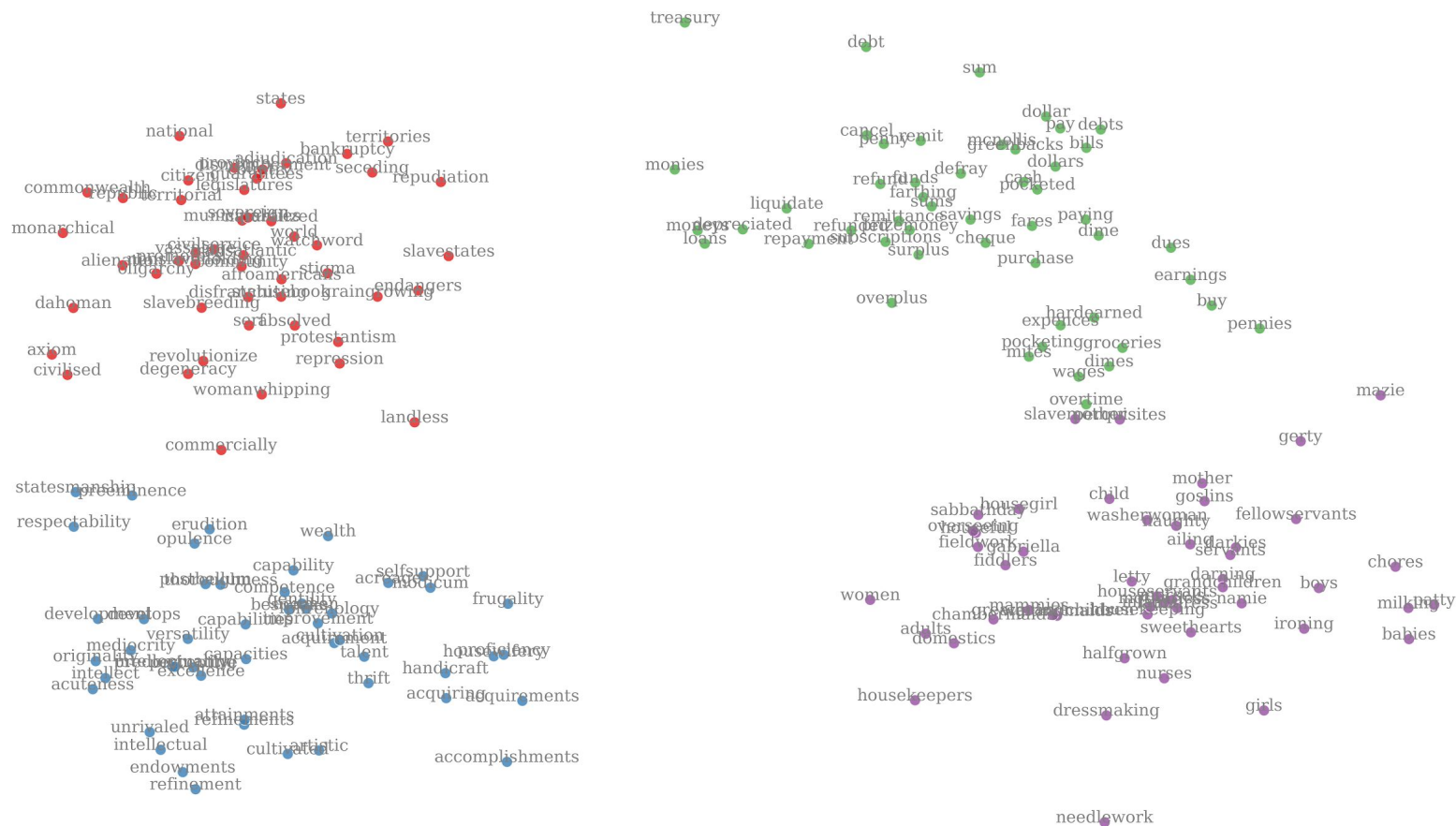
Black men  $\rightarrow$  dainty = 0.11



Polity	Economy	Culture	Domestic
country	cash	endowments	babies
vassalage	sum	refinement	girls
commonwealth	debts	thrift	houseservants
municipalities	refund	acquirement	houseful
nonslaveholding	greenbacks	intellectual	fellowservants
graingrowing	defray	competence	waitingmaids
afroamericans	funds	refinements	milking
civilised	pay	attainments	washerwoman
adjudication	dues	mediocrity	sabbathday
bankruptcy	savings	talent	fieldwork



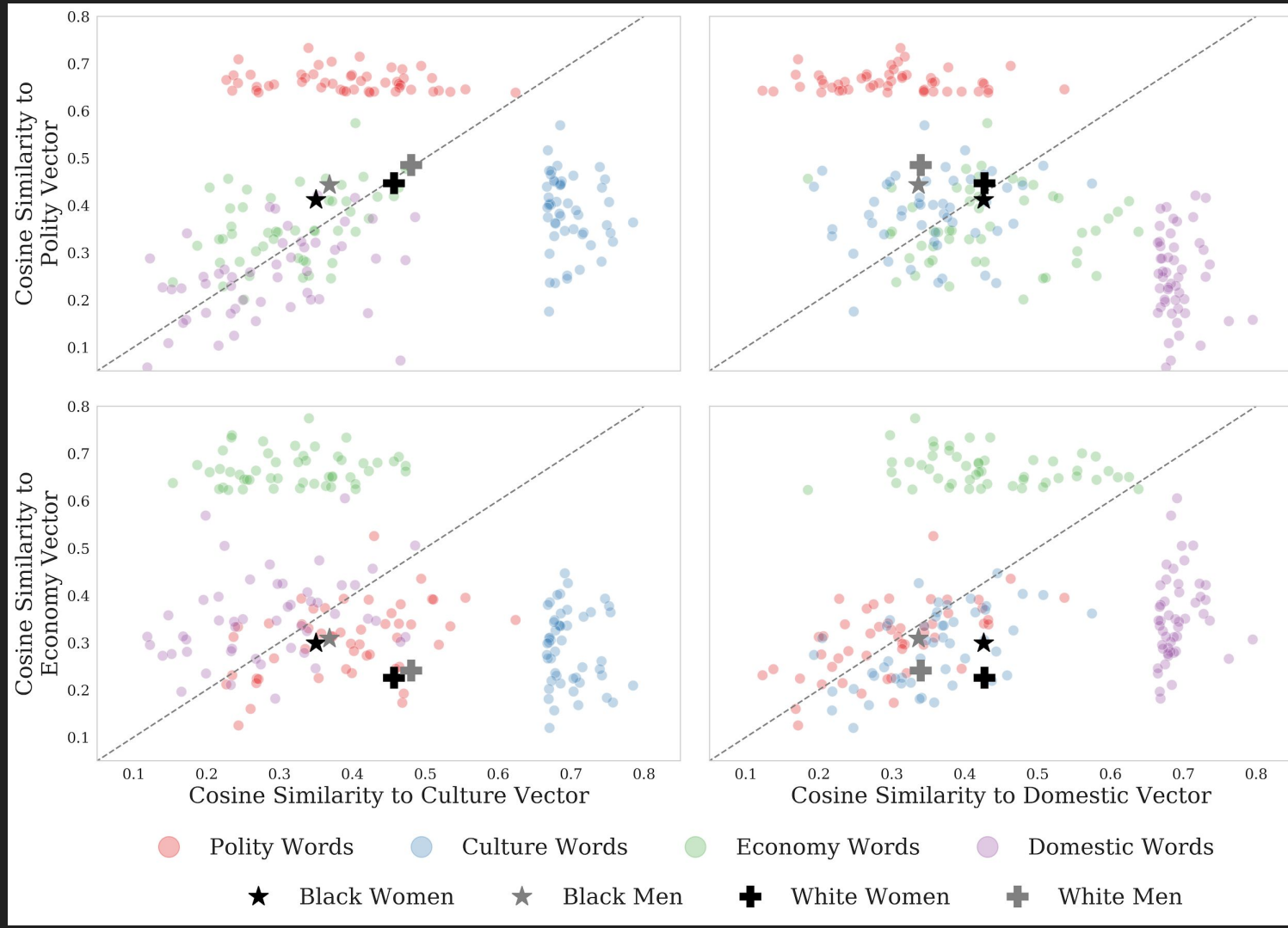
# Individual



## Practical



## Domestic Words



# White Culture

“So far as regards myself, I should consider it a great trial to be obliged to live in this city under the present régime, for, according to my peculiar political ideas, all the refinement, all the intellect, which once constituted the charm of Washington society, has departed with my brethren of the South ... ” (white woman, 1863)

“... erudite without pedantry, charitable without parade, soft of speech but duly assertive, stickler for the social proprieties but void of prudery, ever genial but never frivolous.” (white man, 1906)

# White Culture

“The field hands, and such of them as have generally been excluded from the dwelling of their owners, look to the house servant as a pattern of politeness and gentility. And indeed, it is often the only method of obtaining any knowledge of the manners of what is called “genteel society;” hence, they are ever regarded as a privileged class; and are sometimes greatly envied, while others are bitterly hated.” (Black man, 1857)

“The great strides made by the Negro in these first fifty years, has opened his eyes to the possibilities of advancement and convinced him that merit can and will compel its reward. ... They have taught him self-reliance and a desire for team work. They have taught him thrift. They have given lessons in integrity and high moral purpose. (Black man, 1917)

# Black Economy

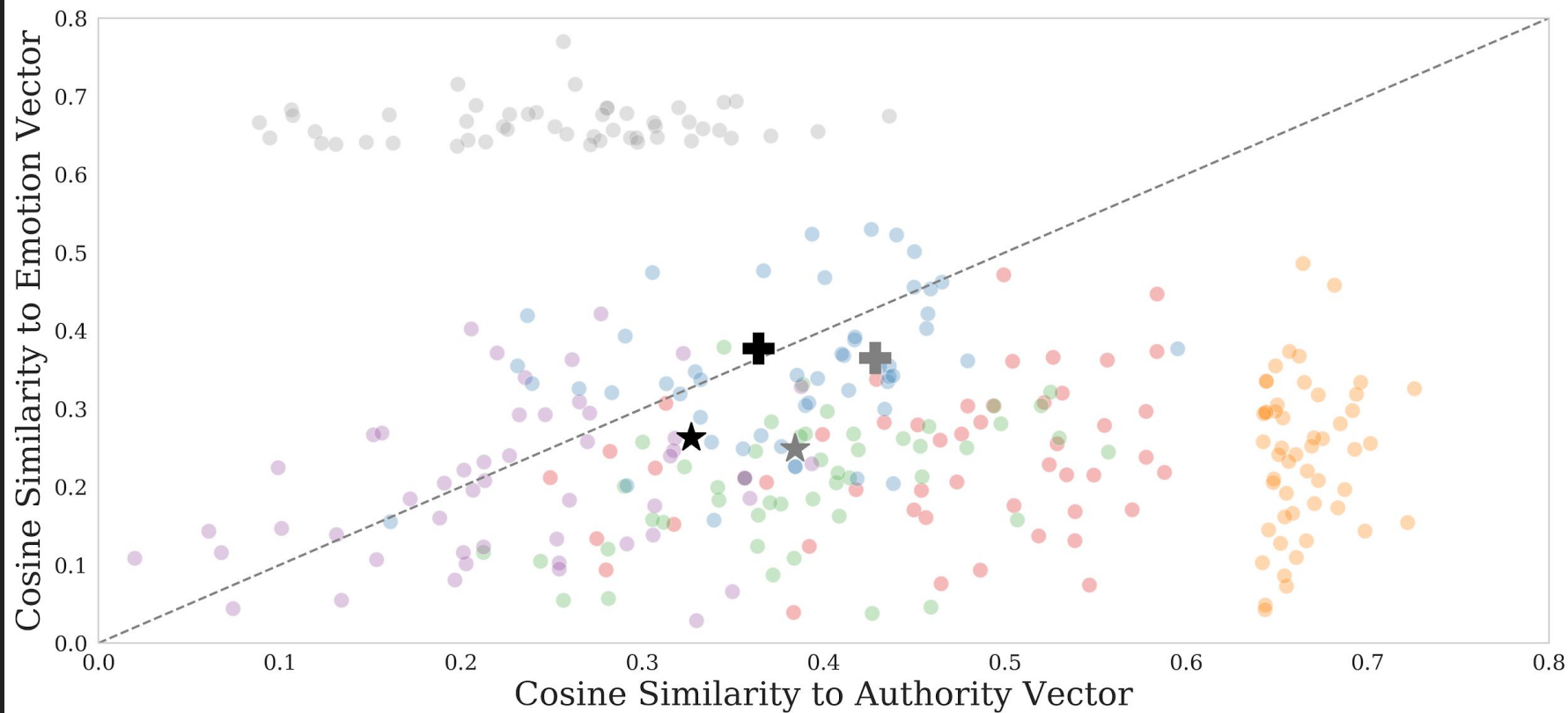
“At the time of her death, **she had acquired, by her industry and care, more than four hundred dollars**, the whole of which, after paying the expences of her last sickness and funeral, she left by will, to charitable purposes.” (describing a Black woman, 1826)

“**I thought I would work and put some money in a savings bank.** Well, I lived with the best people in the city; and though I was only careful of my earnings, it came to me that I had robbed the poor. **My industry** had doubtless kept some poor wretches from paying work. I felt it, and I said, ‘Lord, I will give all back that ever I have taken away.’” (Black woman)



# Black Economy

“The mother of eleven children, all reaching maturity, except two that lived to eleven and twelve years, **her industry, her management and her executive ability** in caring for and carrying on her household affairs are still wonderful memories, and have continually lingered with me as examples in the progress of my own extended life.” (describing a white woman, 1919)



# White men's emotions

General Rodes was not only a comrade whom I greatly admired, but a friend whom I loved. To ride away without even expressing to him my deep grief was sorely trying to my feelings; but I had to go. His fall had left both divisions to my immediate control for the moment, and under the most perplexing and desperate conditions.”

“But, reader, the death of a dear one in war does not bring with it the chastened sorrow of a peaceful death. It inflames and infuriates the passion for blood; it intensifies the thirst for another opportunity to see it flow.”

(white man, 1904)

# White men's emotions

“I rambled on through the woods, wrapped in the shadows of gloom and misanthropy. “Why,” I asked myself, “can’t I be a hog or dog to come at the call of my owner? **Would it not be better for me if I could repress all the lofty emotions and generous impulses of my soul, and become a spiritless thing?**”  
(white woman posing as a Black woman, 1857)

# In sum

- Culture distinguished the races
- Domestic words distinguished by gender
- The economy had an interesting intersectional dynamic
- White men were closest to authority, Black women furthest, with white women and Black men an uneasy in-between
- White men had emotions

# In sum

- Culture distinguished the races
- Domestic words distinguished by gender
- The economy had an interesting intersectional dynamic
- White men were closest to authority, Black women furthest, with white women and Black men an uneasy in-between
- White men had emotions

White identities were afforded a social status via culture and a humanity via emotions not allowed Black identities, establishing a deep yet subtle discursive canyon between the races.

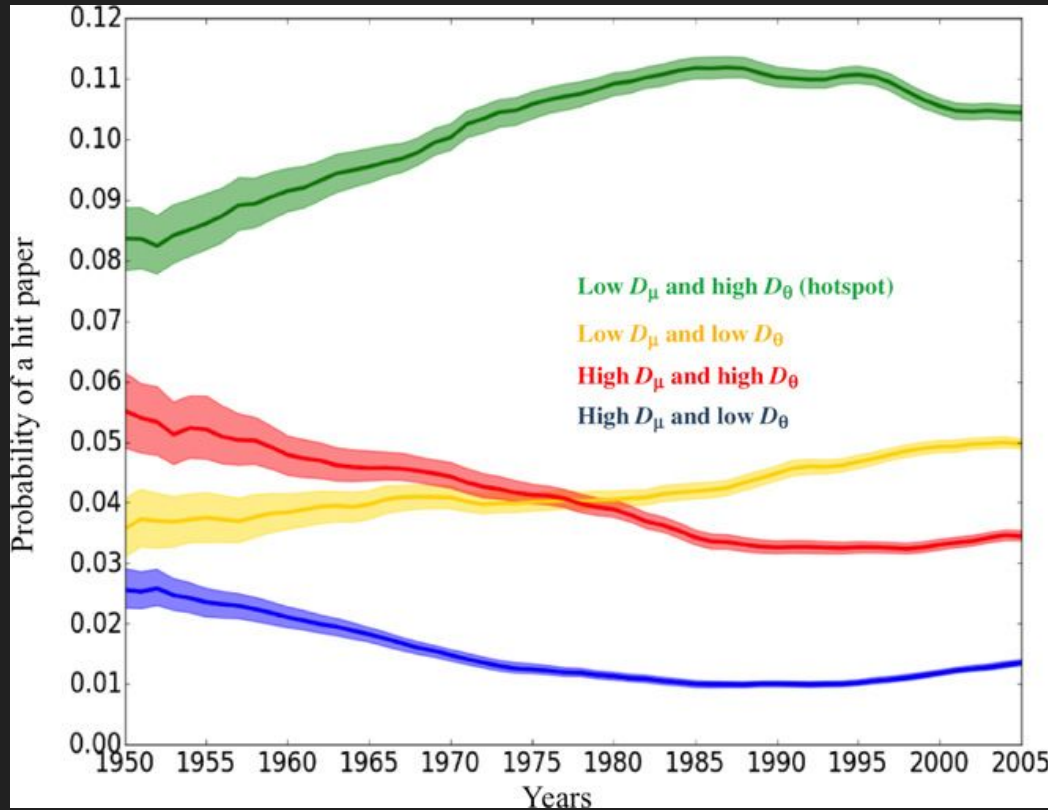
## **Part III: Machine Learning is Intersectional**

# Quantitative Method Qualitative Epistemology



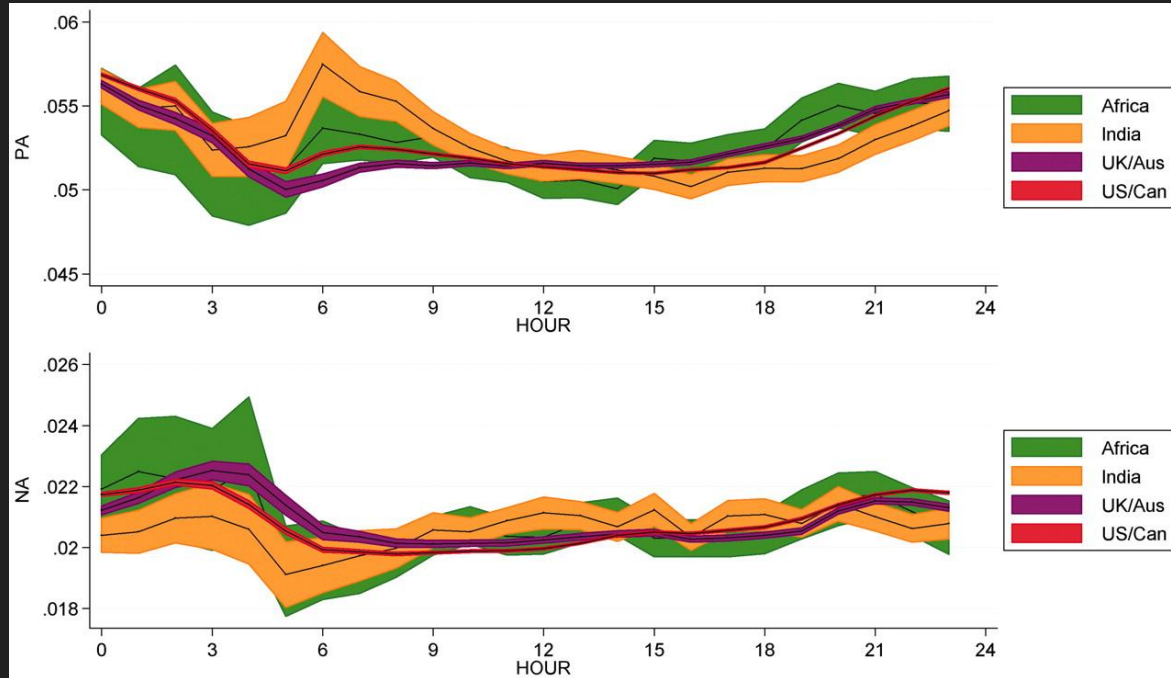
# **A missed opportunity**

# A missed opportunity

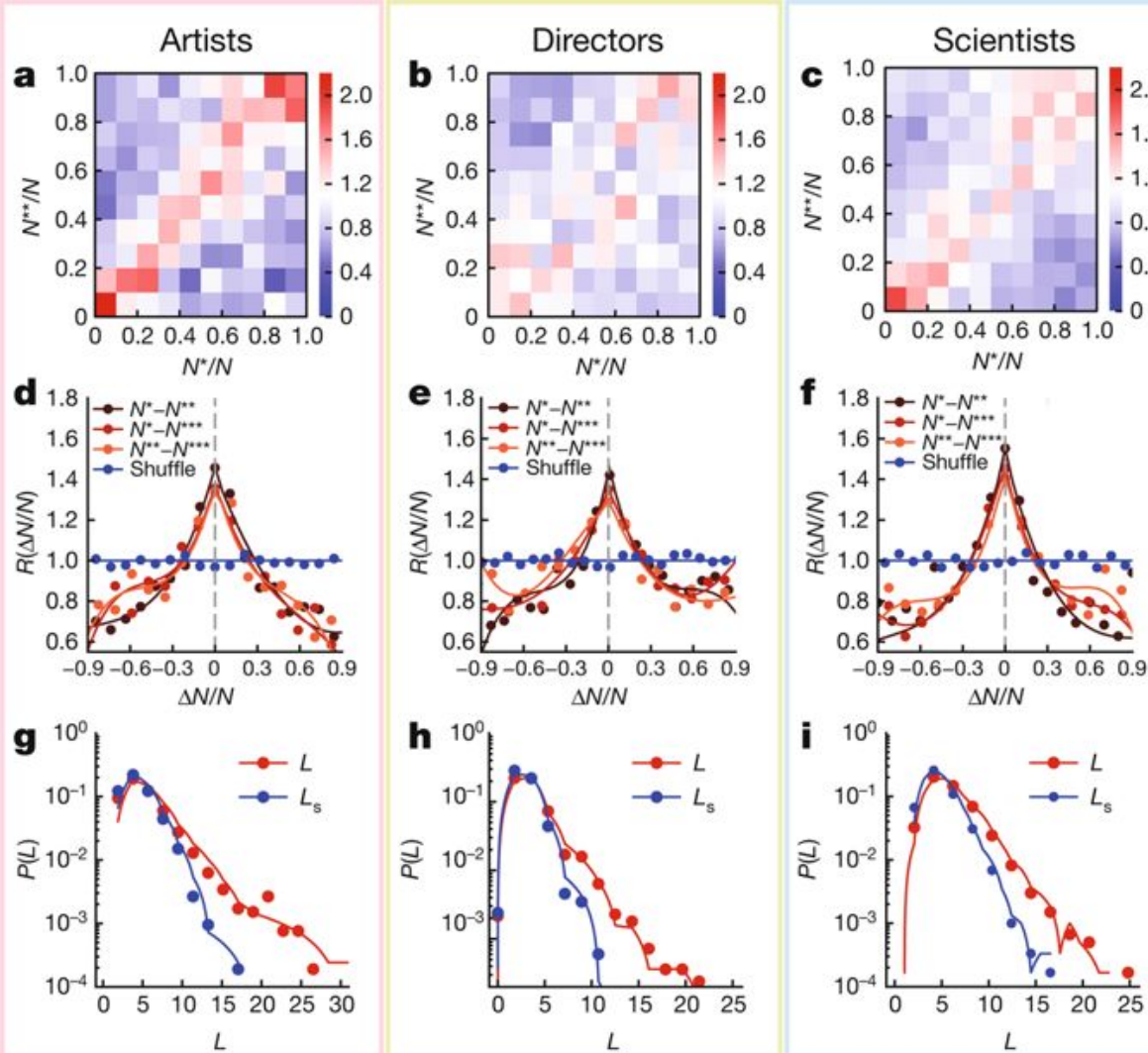


Mukherjee S, Romero DM, Jones B, Uzzi B (2017). “The **nearly universal** link between the age of past knowledge and tomorrow’s breakthroughs in science and technology: The hotspot.” *Science Advances* 3(4).

# A missed opportunity

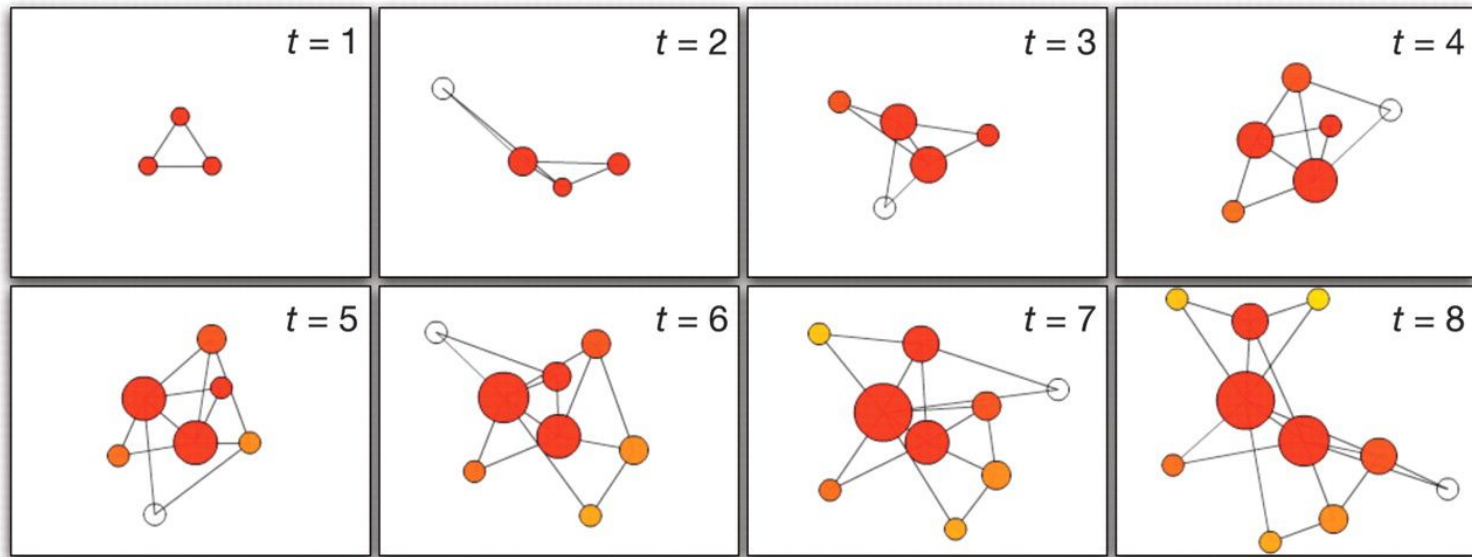


Golder, Scott A. and Michael Macy. 2011. “Diurnal and Seasonal Mood Vary with Work, Sleep, and Daylength Across Diverse Cultures.” *Science* 333(6051): 1878-1881.

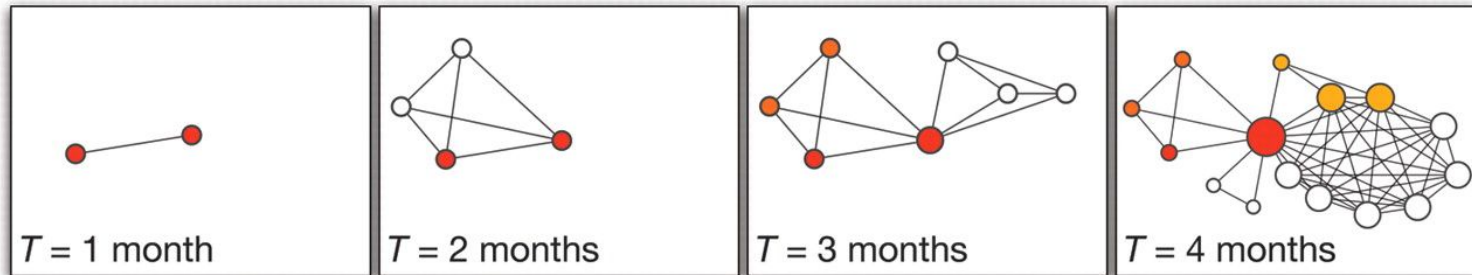


Liu L, Wang Y, Sinatra R, Giles CL, Song C, and Wang D (2018). "Hot streaks in artistic, cultural, and scientific careers." *Nature* 559: 396-399.

## Scale-Free Model



## Scientific Collaboration Network



**A missed opportunity**

# **A missed opportunity**

**Better leverage the breakthrough alignment between  
machine learning and intersectionality.**

# Leverage the Alignment

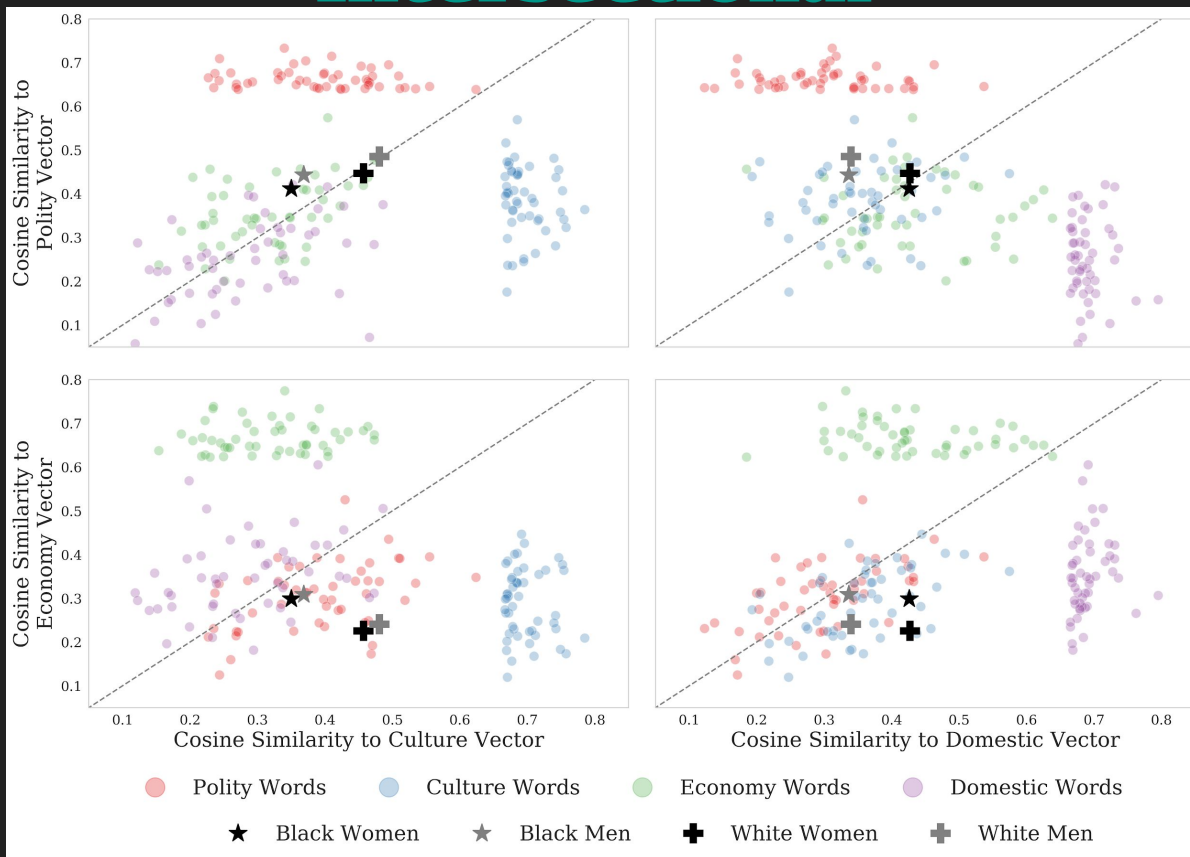
- **What are we studying? With what data?**
  - Web of Science, patents, IMDB, Yelp
  - Call in populations (with care) that have been left out
  - Be aware of representation in data
- **Context is critical**
- **Make big data small (e.g., Foucault Wells 2014)**
  - Don't silence intersecting experiences through statistical aggregation
- **Approach it with a qualitative epistemology**
  - Understand your data
  - Qualitative lenses



# Leverage the Alignment

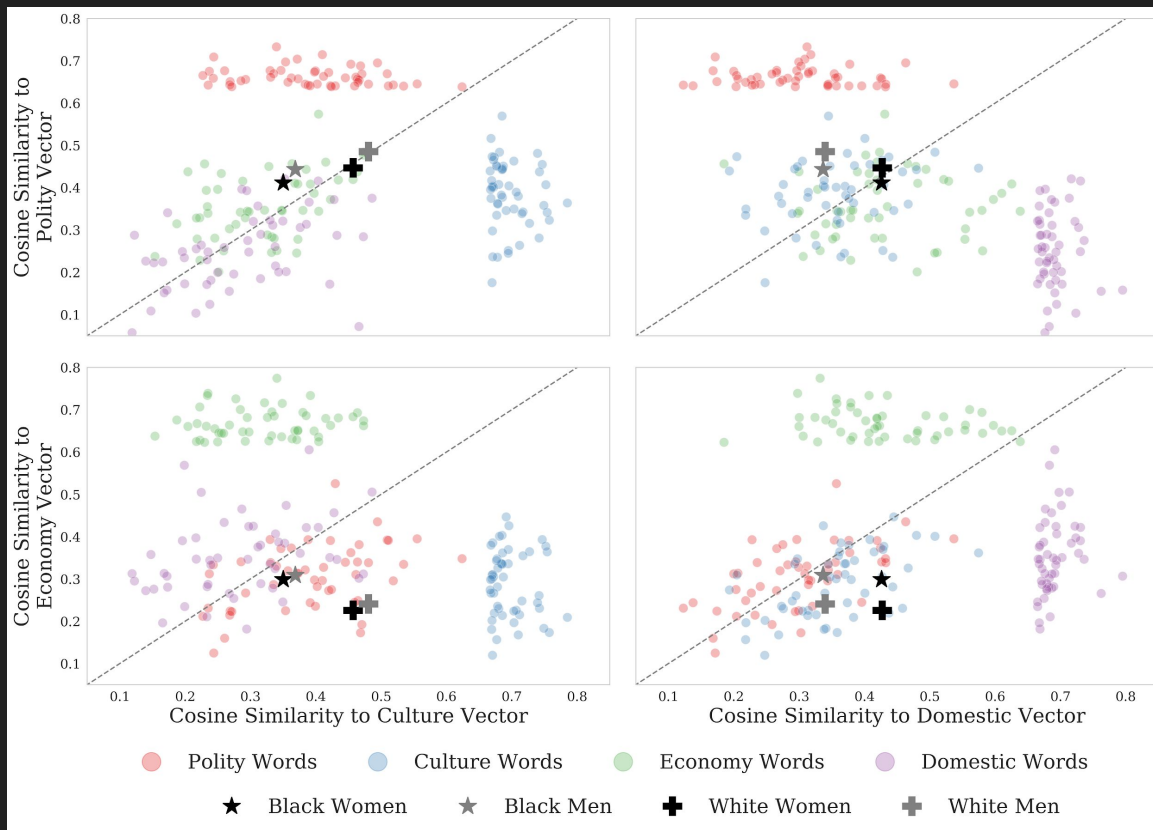
- Develop standards for model sensitivity
- Data accessibility and representation
- Privacy, ethical, human rights, and social justice issues

# The Future of Machine Learning is Intersectional



# The Future of Machine Learning is Intersectional

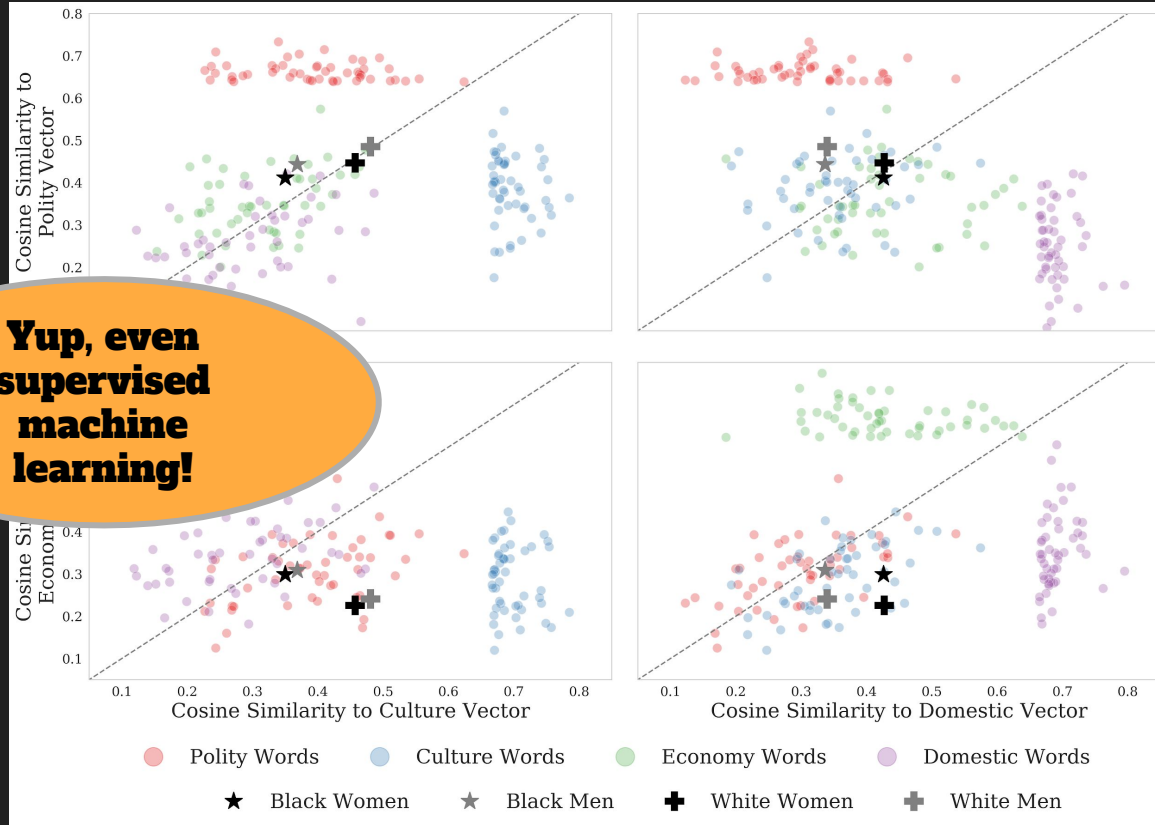
- ✓ Relational
- ✓ Embedded
- ✓ Situational
- ✓ Contextual
- ✓ Constitutive
- ✓ Inductive
- ✓ Data-driven
- ✓ Uncertain
- ✓ Interpretive



# The Future of Machine Learning is Intersectional

- ✓ Relational
- ✓ Embedded
- ✓ Situational
- ✓ Contextual
- ✓ Constitutive
- ✓ Inductive
- ✓ Data-driven
- ✓ Uncertain
- ✓ Interpretive

**Yup, even supervised machine learning!**



# Program for **Interpretive** Data Science

- meaning-making not patterns
- understanding not laws
- contextual not universal



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