

Fair lending review consists of four steps, all of which require knowledge of an applicant's protected status



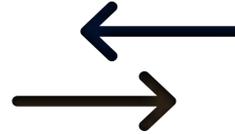
Disparate Treatment Assessment

Evaluate whether demographic characteristics are used directly when assessing an applicant's creditworthiness



Disparate Impact Analysis

Assess the degree to which approval outcomes differ between protected and non-protected classes



Feature Attribution

If disparate impact exists, identify and quantify the factors most responsible for driving the disparity



LDA Search

Search for less discriminatory alternatives that mitigate disparate impact while preserving underwriting accuracy

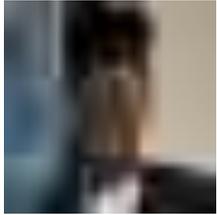
Unfortunately, protected status (gender and race/ethnicity) is not usually collected when a borrower applies for a loan – instead, lenders must estimate it.

BISG is the status quo race/ethnicity estimation method

- **BISG = Bayesian Improved Surname Geocoding**
- **BISG was developed by RAND in 2008 to study health care records:**
 - It predicts race and ethnicity based on **last name and address**
 - It's based on Bayesian statistics developed in the 1800s
- **BISG is widely accepted as the standard for estimating race and ethnicity in fair lending analysis**
 - Affirmed by CFPB in it's [2014 report](#)
 - Based on census data, usually at the ZIP Code™ level
- RAND released BISG with an open-source license so everyone could use
 - **making it possible to uncover unfair practices in consumer lending**

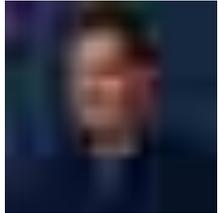


The only problem: BISG is often wrong!



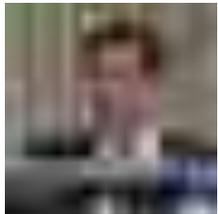
White **X**

Surname	Matthews
ZIP code	91207
BISG Race/Ethnicity	White
Actual Race/Ethnicity	African American



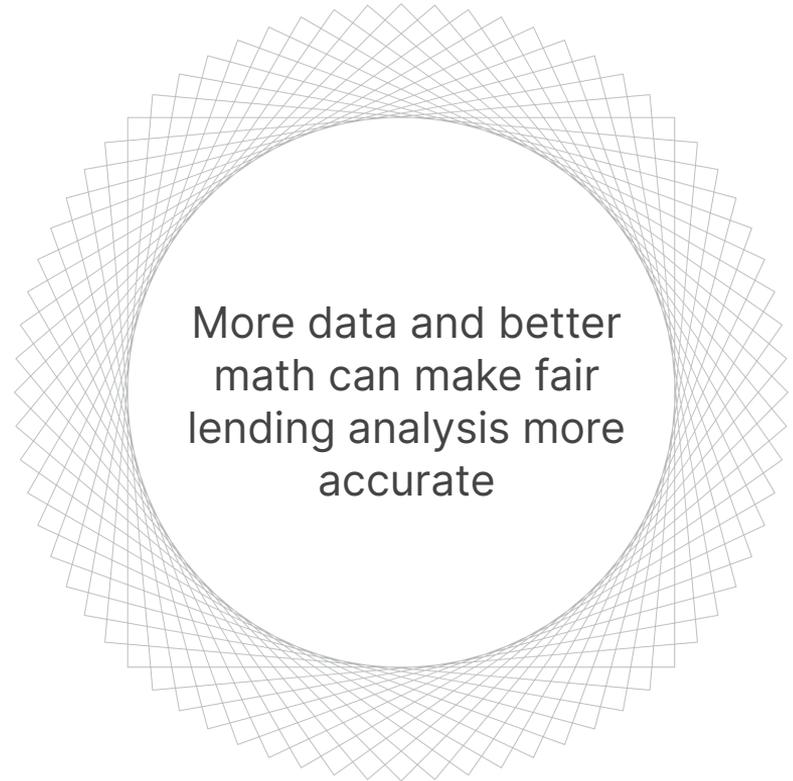
White **X**

Surname	Flo
ZIP code	91362
BISG Race/Ethnicity	White
Actual Race/Ethnicity	Hispanic



??? **X**

Surname	Upbin
ZIP code	91506
BISG Race/Ethnicity	???
Actual Race/Ethnicity	White



We built a machine learning alternative to BISG, the Zest Race Predictor (ZRP), to see if we could do better

- **ZRP is trained on voter registration data for millions of Americans**
 - The models are trained using XGBoost, a popular machine learning method
- **The inputs to the method are the same as BISG: name and address**
 - The models uses both first name and last name
 - The address is used to look up ACS demographic attributes of the area, which are used in combination with the name to train and predict
- **ACS demographic attributes allow the method to make use of granular data and generalize nationwide**
 - Each address is used to index into detailed block group or tract demographics
 - This mapping allows the model to generalize from people in neighborhoods in one state to other states, taking local demographics into account
- **We've released the model and development notebooks as open source for everyone to use and improve**

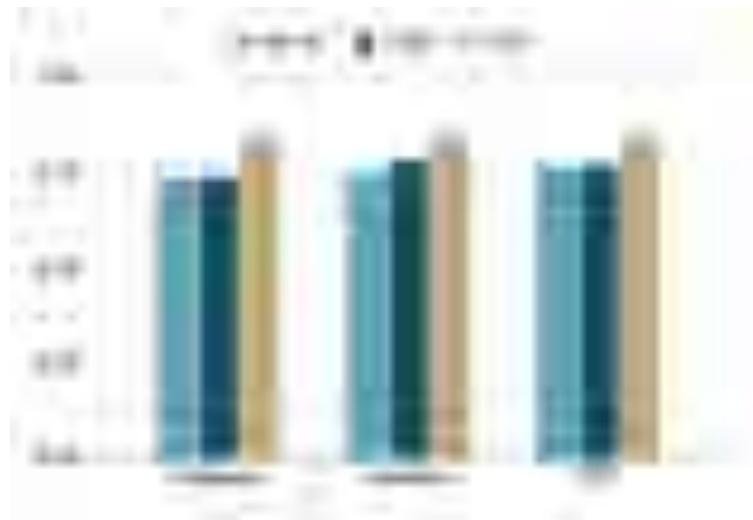
Zest Race
Predictor (ZRP)



Tests show ZRP is better at predicting race and ethnicity than BISG and its close cousin BIFSG

Predictive Accuracy (AUC) by Race/Ethnicity Proxy Method and Validation Dataset

Validation Dataset*	BIFSG	BISG	ZRP
Random sample of Alabama registered voters (n=229,644)	0.74	0.74	0.85
Random sample of Louisiana registered voters (n=680,320)	0.75	0.78	0.85
Small business owners who applied for PPP forgiveness (n=100,173)	0.77	0.77	0.85



* Model was not trained on these datasets, the validation datasets were only used for validation purposes.

ZRP provides a more accurate count of protected individuals than the other methods

Total counts by method for the PPP loan forgiveness dataset

	BISG-80	BIFSG-Max	BISG-Max	ZRP	Self-Reported
Total Protected	29,649	25,865	45,598	61,224	67,200
White	25,864	39,726	41,203	38,803	32,547
Missing	44,660	39,726	13,701	146	426

ZRP protected count was closer to the self-reported truth and 34% higher than BISG-Max, 100% higher than BISG-80

Will millions of Black Americans be counted?

Switching from BISG to ZRP could ensure everyone is counted more accurately

Statewide (FL) Impact



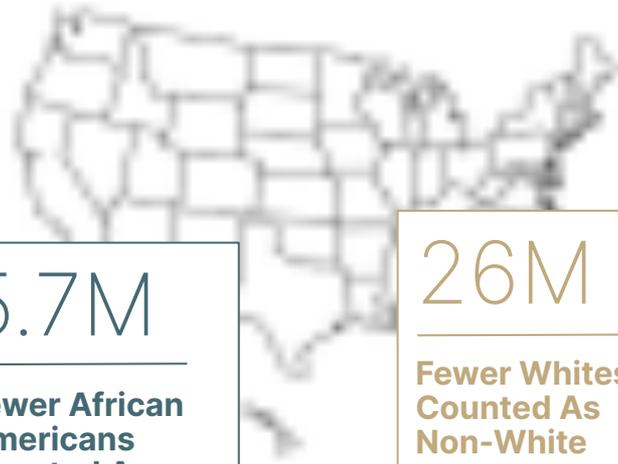
420K

Fewer African Americans Counted As Whites

2M

Fewer Whites Counted As Non-White

Nationwide Impact (Est.)



5.7M

Fewer African Americans Counted As Whites

26M

Fewer Whites Counted As Non-White

ZRP is now available for anyone to use, analyze, and improve:

<https://github.com/zestai/zrp>

Once you can accurately determine the protected status of your borrowers, you can use it to analyze your lending programs for discriminatory practices



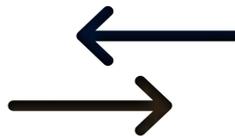
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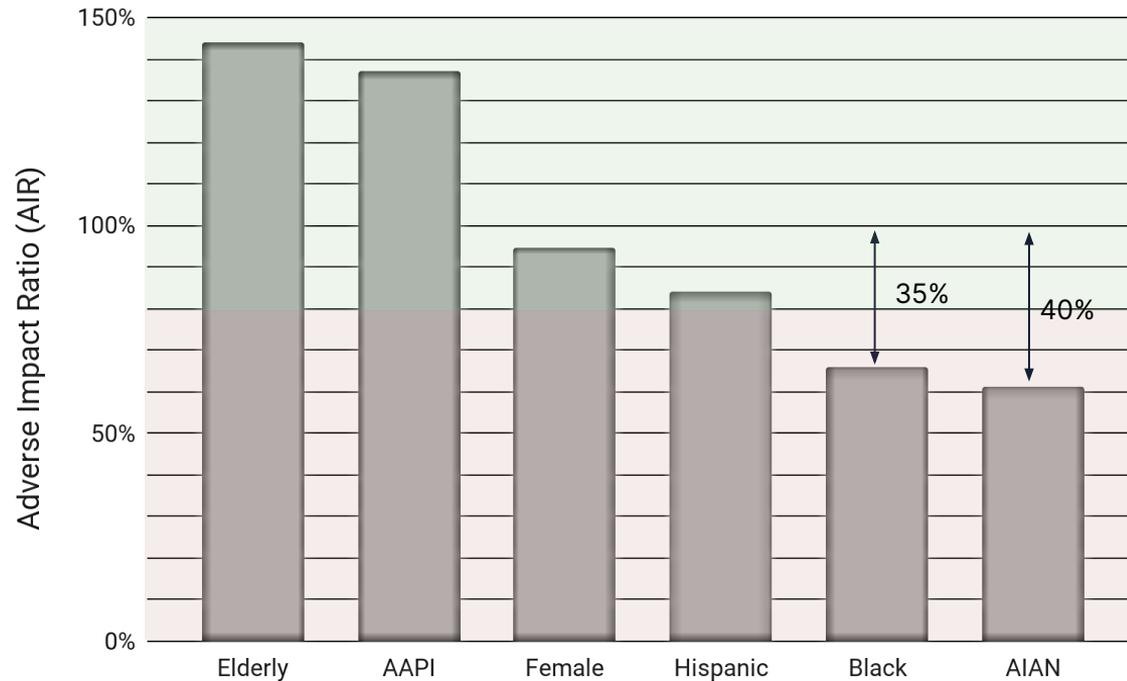
LDA Search

Search for less discriminatory practices that mitigate disparate impact while preserving model accuracy

The Equal Credit Opportunity Act of 1974 provides the legal framework for government agencies to take action against lenders who discriminate, even when unintentional.

The ratio of approval rates quantifies the extent to which a lending practice discriminates against protected borrowers

An AIR of 100% means the practice has perfect demographic parity (equal approval rates between protected and unprotected). Here, we see significant disparity for Black and American Indian borrowers.



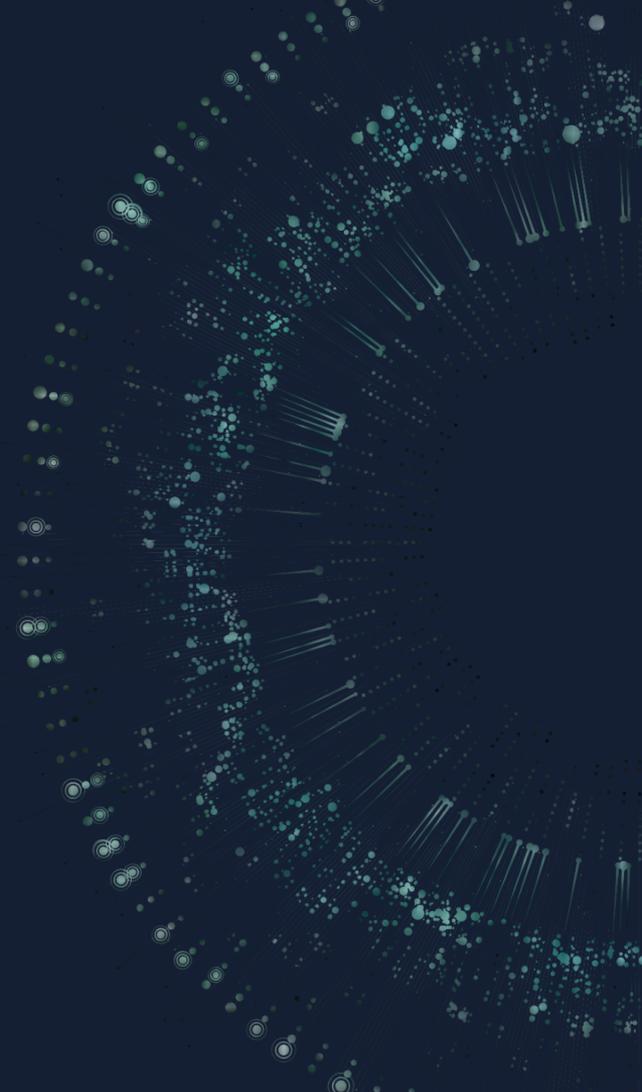
■ Traditional Credit Score

Significant Disparate Impact:

AIR below 80% indicates significant disparity and comes with increased fair lending enforcement risk

Less discriminatory credit scores

**ML helps you ensure your lending
programs are more inclusive**



Analysis can determine which variables are contributing the most to the accuracy of the score – and to disparity in outcomes

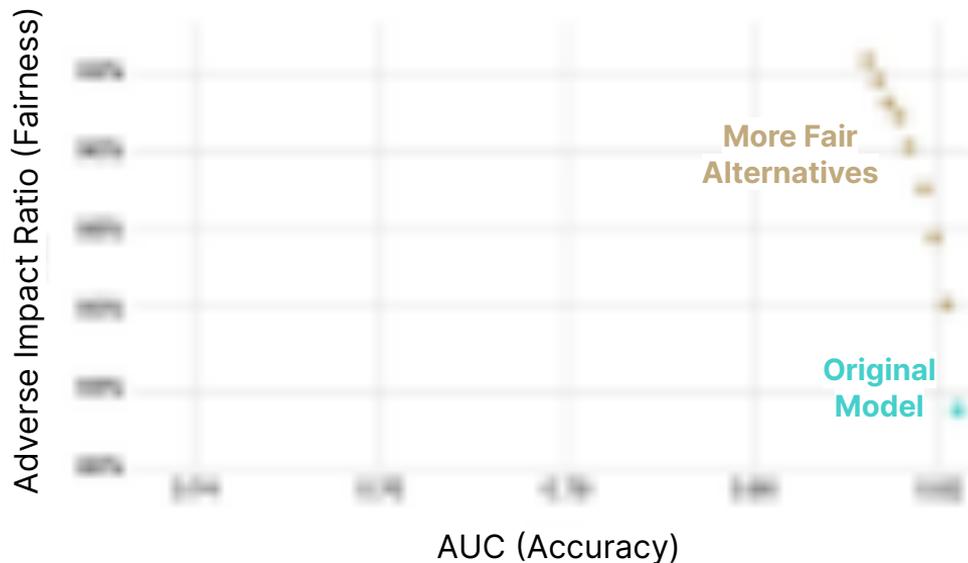
Credit Scoring Model Variable	Contribution to Score Accuracy	Contribution to Disparate Impact
Credit Score	32%	28%
Loan To Value	21%	17%
Down Payment Amount	11%	14%
Monthly Income	8%	12%
Count of Bankruptcies	6%	2%
Delinquencies	4%	2%

But which variable should you cut?

Factors that lead to discrimination also improve accuracy!

Zest Pioneered powerful mathematics called “adversarial debiasing” that takes unfair discrimination out of credit scores

Debiasing a Credit Risk Model: Fairness vs Accuracy

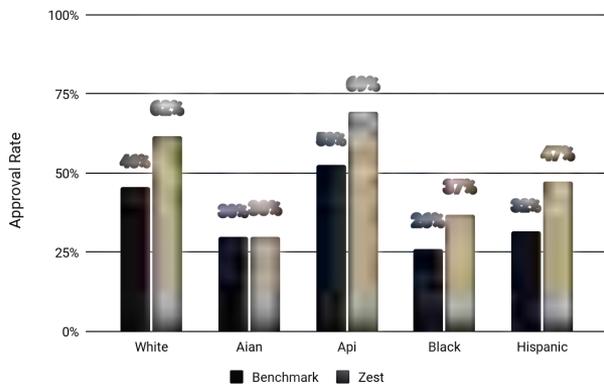


- Works for any product, credit characteristics, applicant demographics, and geography
- **It produces scores that are more fair and just as accurate.**

ML can help you significantly increase approval rates for protected borrowers – with no increase in risk

Zest will increase Hispanic & Black approvals by +40% and Female approvals by 36%

Race/Ethnicity: Approval Comparison

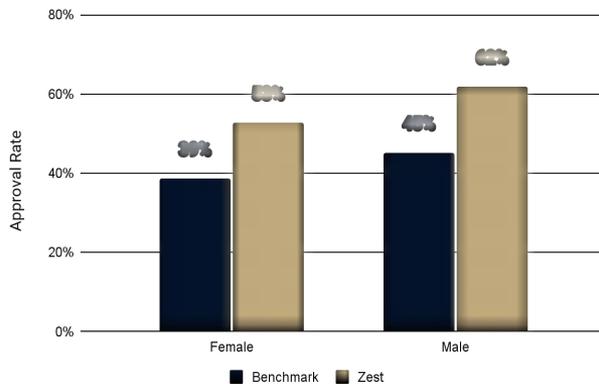


49% Increase in Hispanic approvals

41% Increase in Black approvals

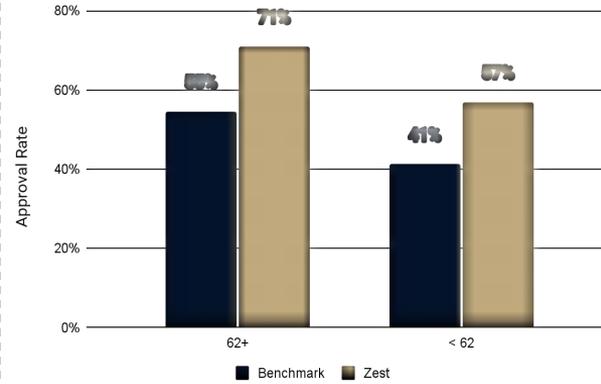
31% Increase in AAPI approvals

Gender: Approval Comparison



36% Increase in female approvals

Age: Approval Comparison



30% Increase in elderly approvals

Safely expand credit access, fast

HawaiiUSA Federal Credit Union was looking to **expand credit access for its more than 132,000 members**. They were able to do this by partnering with Zest.

Using a model built in under a week with 250 variables, Hawaii USA was able to **improve risk assessment accuracy** by gaining deeper insights into potential borrower populations.

HawaiiUSA was able to **increase the amount of borrowers being approved by 21%** without taking on any additional risk.



1 week

Model Build & Analysis
created and delivered

100k+

Borrowers used to train
the model

21%

Increase in
approval rate

"We looked at other lending solutions but Zest offers the best combination of **performance, transparency, and compliance**. Our member data stays right where it lives rather than being sent offshore for modeling."

Greg Young
President & CEO



Drive more inclusive lending

Lending with greater intention to drive growth

With over 350,000 members and 24 office locations, GreenState credit union sought to improve risk assessment across the credit spectrum.

Using a Zest model that leveraged 100s of borrower attributes, this lender was able to **significantly increase approvals for protected borrowers without incremental risk**. The resulting **incremental \$11M annual profit** can now be reinvested in their community.



32%

Increase in approvals for protected borrowers

\$132M

Increase in originations w/ no increased risk

\$11M

Additional profit per year that can be reinvested

“The results with Zest AI are impressive, increasing approvals 26% for low-income designated loans, meaning we could deliver more to GreenState members who deserve better.”

Amy Henderson
Chief Consumer Services Officer



More inclusive underwriting is here.

Jay Budzik, CTO

j@zest.ai

The background features a dark blue gradient with a network of thin, light-colored lines. Scattered throughout are numerous glowing spheres of varying sizes and colors, including teal, light blue, and white, creating a sense of depth and connectivity.