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natural language processing  
browser plug-in

enabling aging workers to  
take control of their futures

“

I often feel worried that **the pace** it takes me to complete a task makes me look **weak or incompetent**.

When I am at the grocery store trying to self-checkout, I can feel the eyes on me wishing I'd hurry up. I **feel self-conscious all the time...whatever I do.**”

Interviewee, 72 year old,  
OLLI Vital Aging Group



## One in four

U.S. workers is expected to be 55 or older by 2030.



Over the past 20 years, average retirement age went from

**62 to 66**



As of 2020, workers 50 and older made up over

**one-third**

of the U.S. workforce.



**78%** of older workers have seen/experienced ageism in the workplace.



**20.2%** of Americans age 65 and older (5.9M men, 4.8M women) were working or actively seeking work in 2019

**18x**

Since the Workforce Investment Act of 1998, the annual ageism complaints has jumped from

**1000 to 18000.**

# Existing solutions

The screenshot shows the Datapeople job draft interface. On the left, there is a sidebar with a red circle containing the number 53 and the text "Your job is very likely to underperform". Below this, there are several bullet points: "State if this job is remote-friendly in the description", "This job has a small candidate pool", "Missing an Equal Employment Opportunity statement", "Your job length is just right", and "Benefits included". The main content area shows a job description for a recruiting professional with 35 years of experience. It includes sections for "About Role", "Responsibilities", and "Qualifications". The "Responsibilities" section lists: "Report to the Sr. Director, Talent Acquisition and lead all aspects of the full-lifecycle recruiting process", "Be a partner to our department leaders to help define our talent needs and recruiting strategies needed to fill roles", and "Define, track and analyze talent acquisition metrics and develop practical tracking and reporting methods to".

The screenshot shows a LinkedIn job listing for a software engineer. The title is "(99+) software engineer Jobs | LinkedIn". Under "About the job", there is a "Description" section that reads: "Duties: Design, develop and implement software solutions. Solve business problems through innovation and engineering practices. Involved in all aspects of the Software Development Lifecycle (SDLC) including analyzing requirements, incorporating architectural standards into application design specifications, documenting application specifications, translating technical requirements into programmed application modules, and developing or enhancing software application modules. Support IRS tax reporting internal systems (NRTX). Qualifications: Minimum education and experience required: Bachelor's Degree in Computer Engineering, Computer Science, Information Technology, or related field of study plus 5 (five) years in job offered or as Software Engineer, Associate, Program Analyst, or related occupation (Skills Required): Requires experience in the following: Cloud Services such as AWS or Azure; IBMstrat; Java; JS/ON; Maven; Oracle; React; SVN; UNIX; Bootstrap; DB2; COBOL; Dynatrace; JavaScript; Microservices; Performance Testing; REST; Splunk; VSAM; GIT; Jenkins; Python; SOAP and REST web services; Spring Framework; J2EE; NodeJS; Software Development; SQL; XML; Wolters Kluwer's; GainsKeeper; Broadridge's Tax Managed Services".

The screenshot shows the Textio job analysis interface for a "Customer Service Manager" job post in Chicago. The interface includes a "Textio Score" of 37, labeled "Below Average". On the right, there are two charts: "Slightly masculine tone" and "Appeals to older people". Below these charts, there are three bullet points: "Contains too many questions", "Sentences are too long", and "Uses fixed mindset language". The main text area shows a job description with several phrases highlighted in yellow and purple. A tooltip is visible over the phrase "inspired by", suggesting a different phrase that would tend to resonate more with women. The text in the job description includes: "Our passionate team is hiring a competitive and results-driven customer service manager. We're a fun, fast-paced company, but we always work hard. As our team is rapidly expanding, we are looking for a customer service manager who is also a forward-thinking leader. This role is more than just a cog in the system. We are looking for a phenomenal customer rep, a proven team player, and someone who would be a huge plus. Do you have a great sense of humor? Are you driven by the ability to set and exceed results-oriented goals? Do you do your best under pressure with tight deadlines? When you see something that's a problem, do you make a change or just complain? If so, this might be the place for you."

The screenshot shows the Chrome Color Enhancer extension interface. The interface is titled "Color Enhancer" and has a "Setup" section. Under "Setup", there is a "Step 1: Select the row with the faintest stars:" section. This section contains a grid of 12 stars in two rows and six columns. The first row has stars in shades of purple, blue, and green. The second row has stars in shades of purple, blue, and green. A box is drawn around the first row of stars. Below the grid, there is a "Step 2: Adjust the slider until all of the stars are visible in the selected row" section. At the bottom, there are "Reset", "OK", and "Cancel" buttons.

“

Job post assessment tools **do not protect me** from ageist language.

I would like to **avoid applying to jobs** which may be harmful for **someone like me.**”

Interviewee, 58 year old statistician,  
recently rejected for a senior data  
scientist position

# What we do differently

Sage aims to **reduce the information asymmetry** around age-bias in job descriptions; providing applicants with more information while applying for jobs

Sage not only detects & flags harmful age-unfriendly language but also provides tools that are designed to make the entire job application process easier - all within the same browser plugin

- Age-bias tracker
- Declutter page
- Speech-to-text for application forms
- Read-page aloud
- Adjust display settings

The screenshot shows a LinkedIn job listing for 'Sr Data Scientist' at Safeway. The job details include a salary range of \$130,400/yr - \$190,160/yr, 10,001+ employees, and skills in Predictive Modeling and A/B Testing. The 'About the job' section describes the role as a senior data scientist for a cutting-edge analytics team. An 'Age bias tracker' overlay is visible on the right, identifying 6 age-unfriendly terms: 'energetic', 'new grad', 'tech-savvy', and 'cutting-edge'. The tracker also shows a 'Tools' section with options like 'Declutter page', 'Speak to fill out form', 'Read page text out loud', and 'Adjust text display', all currently turned off.

**Jobs based on your Profile**

- Sr Data Scientist**  
Safeway  
Pleasanton, CA (Hybrid)  
\$130.4K/yr - \$190.2K/yr (from job description)
- Data Scientist - Clearance Required**  
Deloitte  
Albany, NY (Hybrid)
- Data Scientist at Sports Startup**  
Predictive Sports Science, LLC  
Louisville, KY (Hybrid)
- Data Scientist, Mid**  
Booz Allen Hamilton  
Columbia, MD  
\$73.1K/yr - \$166K/yr (from job description), 401(k), +1 benefit
- Senior Data Scientist**  
Digitas North America  
New York, NY  
\$70K/yr - \$105K/yr (from job description)

### Sr Data Scientist

Safeway, Pleasanton, CA (Hybrid) **2 minute**

\$130,400/yr - \$190,160/yr (from job description)

10,001+ employees · Retail

Skills: Predictive Modeling, A/B Testing,

[Apply](#) [Save](#)

#### About the job

We are seeking an **energetic** and **tech-savvy** senior data scientist to join our cutting-edge data analytics team. The ideal candidate will be a **recent graduate** with a **youthful** spirit and an active approach to problem-solving. As a Senior Data Scientist, you will work on developing and implementing data models, algorithms, and statistical analyses to help our team gain insights into complex data sets.

**Responsibilities:**

- Design and develop predictive models, machine learning algorithms, and statistical analyses to uncover insights and trends in large and complex data sets.
- Collaborate with cross-functional teams, including software engineers, product managers, and other data scientists to develop data-driven solutions that can be used to make informed business decisions.
- Communicate findings and insights effectively to both technical and non-technical stakeholders, including presenting data and results in a clear and understandable manner.
- Continuously stay up-to-date with the latest advancements and technologies in the field of data science. and apply this knowledge to improve our data analytics

Watch a demo of the age bias tracker interactions here: <https://youtu.be/uzap0WQ9GYI>

The image shows a browser window displaying a LinkedIn job posting for a "Sr Data Scientist" at Safeway. The job details include a salary range of \$130,400/yr to \$190,160/yr, a full-time mid-senior level position, and 10,001+ employees in the retail sector. Skills listed include Predictive Modeling, A/B Testing, and 8 more. There are "Apply" and "Save" buttons. The "About the job" section describes the role as seeking an energetic and tech-savvy senior data scientist to join a cutting-edge data analytics team. Responsibilities include designing predictive models, collaborating with cross-functional teams, and communicating findings. Qualifications require a recent graduate degree in computer science, statistics, or mathematics, and at least 5 years of experience in data science.

Overlaid on the right side of the page is the Sage accessibility menu. It features a "Sage" logo, a close button (X), and a title "Age bias tracker" with thumbs up/down icons. Below this, it states "6 age-unfriendly terms found on this page" and lists the terms: energetic, new grad, tech-savvy, and cutting-edge. A "Tools" section includes "Declutter page" (set to "on"), "Speak to fill out form" (Open), "Read page out loud" (Open), and "Adjust text display" (Open). A "Help Center" link with a question mark icon is at the bottom.

Watch a demo of the declutter interaction here: [https://www.youtube.com/watch?v=F4unAQR\\_GPk](https://www.youtube.com/watch?v=F4unAQR_GPk)



Google

google.com/search

← → ↻ 🏠 🔒

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**SUBMIT YOUR APPLICATION**

Resume/CV\*

Full name\*

Email\*

Phone\*


Current company

**LINKS**

LinkedIn URL

←

×



Click the text box you want to fill out and speak

Watch a demo of the speak to fill form interaction here: <https://youtu.be/OlkRjRsU7EM>

Google x +

google.com/search

in Search by title, skill, or com... City, state, or zip code Search

Jobs based on your Profile

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- Senior Data Scientist**  
Digitas North America  
New York, NY  
\$70K/yr - \$105K/yr (from job description)

### Sr Data Scientist

Safeway, Pleasanton, CA (Hybrid) 2 minutes ago

\$130,400/yr - \$190,160/yr (from job description) · Full-time · Mid-Senior level

10,001+ employees · Retail

Skills: Predictive Modeling, A/B Testing, +8 more

Apply Save

#### About the job

We are seeking an energetic and tech-savvy Senior Data Scientist to join our cutting-edge data analytics team. The ideal candidate will be a recent graduate with a youthful spirit and an active approach to problem-solving. As a Senior Data Scientist, you will work on developing and implementing data models, algorithms, and statistical analyses to help our team gain insights into complex data sets.

Responsibilities:

- Design and develop predictive models, machine learning algorithms, and statistical analyses to uncover insights and trends in large and complex data sets.
- Collaborate with cross-functional teams, including software engineers, product managers, and other data scientists to develop data-driven solutions that can be used to make informed business decisions.
- Communicate findings and insights effectively to both technical and non-technical stakeholders, including presenting data and results in a clear and understandable manner.
- Continuously stay up-to-date with the latest advancements and technologies in the field of data science, and apply this knowledge to improve our data analytics.

Watch a demo of the read page text out loud interaction here: <https://youtu.be/qdd6tp80FWk>

The image shows a LinkedIn job listing for a Senior Data Scientist position at Safeway. The listing includes the job title, location (Pleasanton, CA), salary range (\$130.4K/yr - \$190.2K/yr), and company information (10,001+ employees). A sidebar on the left shows other job recommendations from Deloitte and Odds-R. An accessibility overlay menu is open on the right, showing options for font size (Small, Medium, Large), color contrast (White background/Black text, Black background/White text), and a sample text area. The 'Large' font size option is selected, and the 'Black background/White text' contrast option is also selected. The 'Applied' button is visible below the sample text.

Jobs based on your Profile

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Safeway  
Pleasanton, CA (Hybrid)  
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**Sr Data Scientist**  
Safeway, Pleasanton, CA (Hybrid)  
\$130,400/yr - \$190,160/yr  
· Mid-Senior level  
10,001+ employees · Retail  
Skills: Predictive Modeling

Apply Save

**About the job**  
We are seeking an energetic and tech-savvy Senior Data Scientist to join our cutting-edge data analytics team. The ideal candidate will be a recent graduate with a youthful spirit and an active approach to problem-solving. As a Senior Data Scientist, you will work on developing and implementing data models, algorithms, and statistical analyses to help our team gain insights into complex data sets.

Font size: Small Medium Large  
Color contrast: White background Black text Black background White text  
Sample: Lorem ipsum dolor sit amet.  
Applied  
Help Center

Watch a demo of the adjust text display interaction here: <https://youtu.be/S8km8WctWZ0>

“

This is good! **Simplified** for people like us who are not able to keep up with the **pace of tech advancements**. It is **user friendly**, and I believe I can now apply easily.

Usability tester, Professor of  
Pharmacology, Age 52

# Helping users find age-friendly jobs (w/ NLP)

Job sites are littered with ageist language discriminating older candidates' personality, lifestyle preferences, skills, and age. A few examples...



You're a **digital native** with a **keen interest in pop culture**

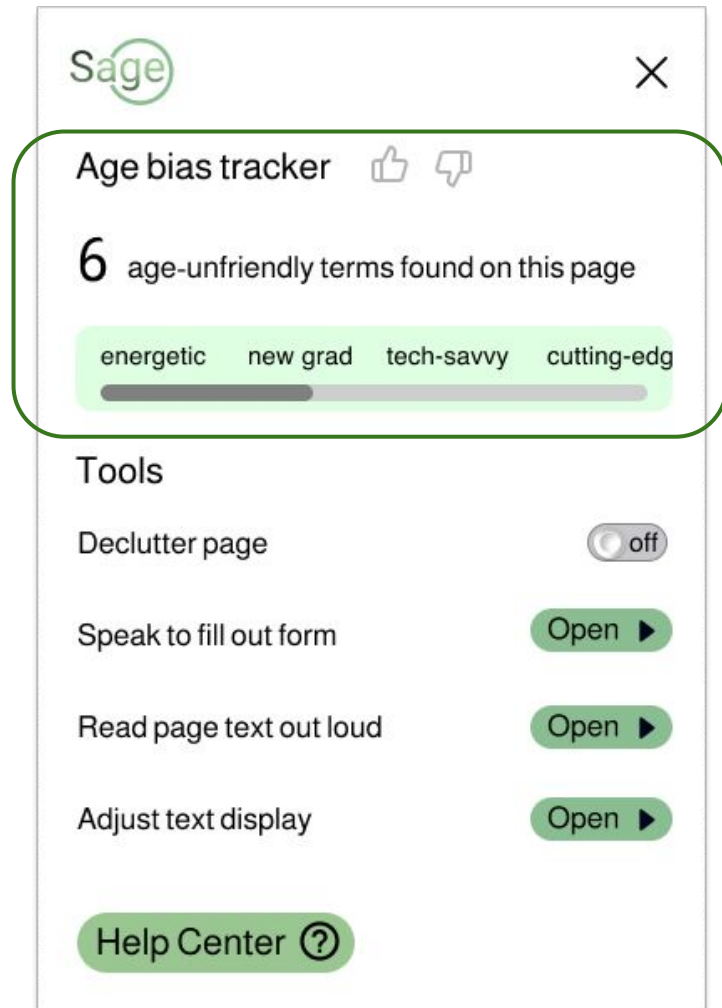
You are a team player with an **absolute winning mentality**

Looking for an **passionate, energetic, ambitious self starter** who's **not afraid to question the status quo**

# How it's done

Our model works across different job search platforms to flag ageist language across **personality, lifestyle preferences, skills** and most importantly, the **age** factor.

- Show the age-friendliness status of the job posting
- Calls out ageist language and the intensity of ageism
- Works concurrently with the age-friendly design features of the plugin



# What is age discriminatory language?

## Literature Review

### **Personality**

- Energetic, vibrant, high-performer, witty, ambitious, adaptable

### **Skills**

- Tech-savvy, quick-learner, fast-learner, sharp

### **Age**

- recent college graduate/Youthful/GPA

## Human Judgement

### **Personality**

- Not looking for someone who is looking to maintain status quo
- An absolute winning mentality

### **Skills**

- Ability to work and deliver results under tight deadlines and with limited oversight while managing across multiple functions

### **Age**

- Excellent degree from a top university with strong A-levels (ideal 300+ UCAS points)

# Data Source, Data Science Approach, and Evaluation

## Data Sources

- The Employment Scam Aegean Dataset (EMSCAD)
- 10,000 data science job postings in the US from Data.world

## Annotations

- 788 annotations (Inter annotator agreement 0.896)
- 60% training, 20% validation, 20% testing

## Model

BERT embeddings + Logistic regression

## Evaluation

Our baseline model was a Linear regression model yielded a F1 of 0.47. Our best model yielded a F1 score of 0.7.

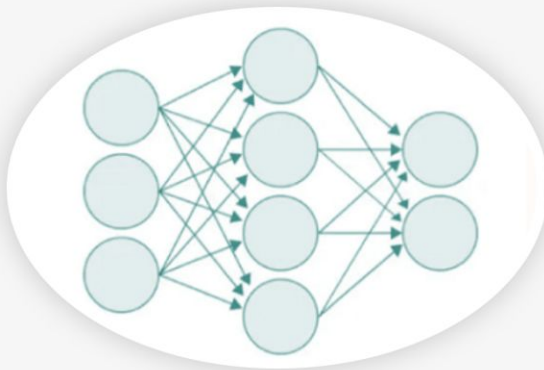


## Input Text

(From Job Post)

The role requires a friendly, energetic, tech enthusiast who understands our values and can make sure they are shining in every interaction with our potential clients. In other words, an absolute winning mentality. You're also a digital native with a keen interest in pop culture.

## Modeling



## Output: Flagged Text

The role requires a friendly, energetic, tech enthusiast who understands our values and can make sure they are shining in every interaction with our potential clients. In other words, an absolute winning mentality. You're also a digital native with a keen interest in pop culture.

# Looking to the future!

By 2050, the population over 60 will be **20%** of total population (2 billion people)!

We need to do better to remove age discrimination in applying to jobs and staying in jobs for older individuals.

Next steps:

- Initiate broader generative research and improve the plugin accessibility features for job search and application
- Introduce real life validation of our NLP model incorporating real time feedback from our users
- Make it easier to find age-friendly jobs in addition to avoiding age-discriminatory jobs



## **Team**

Meera Vinod, Kedari Lahari Narra, Shai Dhaliwal, Catherine Yu, Eileen Cahill

## **Professors**

Annalee Saxenian, David Bamman

## **Students**

Filipe Santos



**Thank you !**

“Longevity economy” is burgeoning - A booming user group with internet connectivity and unmet needs. Over 50 age group spent \$7.6 trillion in goods and services in 2018.

Many applications have sprung up to aid this population, age-tech market worth \$10 billion in 2022

# Timeline

