

# Modernizing Our Profession: Innovation Through Collaboration #CASSpring



Kevin Kuo (@kevinykuo)  
RStudio

**Actuaries should embrace  
AI through collaboration**

**Rule #1 of Artificial Intelligence:**  
*If people talk to you about AI with  
a straight face, they're trying to  
hustle you*

(except for when I'm doing it)

1. ~~Big data Blockchain AI~~
2. ???
3. Profit!

**Let's see how we can figure this  
“AI” stuff out together and apply it  
to our jobs**

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“AI” stuff out together and apply it  
to our jobs

# Artificial Intelligence?

*(insert stock photo with android pointing at touchscreen wall with a bunch of numbers)*



# Artificial Intelligence?



# Artificial Intelligence?



Plz define AI...



**AI can help us do our jobs  
better?**

**Is screen scraping and  
simulating mouse clicks  
AI?**

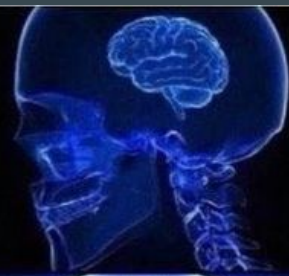
No AI



Much AI

**A continuum?**

**Copy prior template  
and manually select  
factors**



**Automated workflow  
with R**



**Bayesian MCMC / other  
cool stuff**



**Individual claims  
forecasting with  
Bayesian neural  
networks**



AI in reserving  
(an example view)

# AI is...

- Net-net, a good thing
- Software, mostly\*
- Not just deep learning

\*For our purposes

Let's see how **we** can figure this  
“AI” stuff out together and apply it  
to our jobs



# The Actuary

# About me (for context)

- Fun
- Interesting
- Cool
- Serial Career Hopper

## Licenses & Certifications



### Associate, Casualty Actuarial Society (ACAS)

Casualty Actuarial Society

Issued Oct 2016 · Expired Dec 2017



### Member, American Academy of Actuaries (MAAA)

American Academy of Actuaries

Issued Oct 2016 · Expired Dec 2017

## Experience



### Software Engineer

RStudio, Inc.

Jul 2017 – Present · 1 yr 11 mos

Greater Seattle Area



### Principal Data Scientist

Honeywell

Feb 2017 – Jul 2017 · 6 mos

Greater Atlanta Area



### Senior Associate

KPMG US

Oct 2015 – Jan 2017 · 1 yr 4 mos

Greater Atlanta Area



### VP, Decision Management

Citi

Jun 2015 – Oct 2015 · 5 mos

Greater Atlanta Area

A close-up photograph of Gene Wilder, dressed as Gene Wilder. He is wearing a brown top hat, a purple velvet jacket, a white shirt, and a brown bow tie. He has a slight, knowing smile and is resting his head on his right hand. The background is slightly blurred, showing what appears to be an indoor setting with a yellow wall.

**Oh so you're not  
even an actuary**

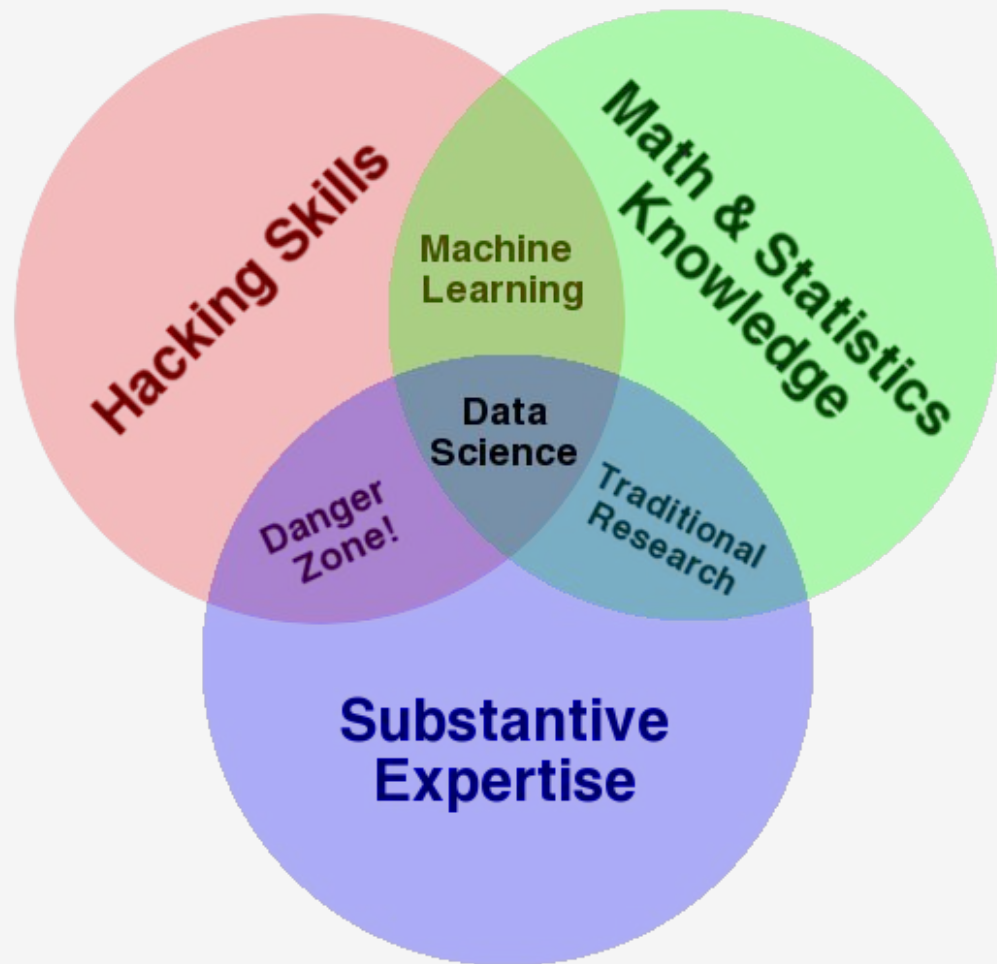
**Please continue to tell  
me about actuaries**

**The Data Scientist?**

**SHOW ME THAT VENN DIAGRAM**



**ONE MORE TIME**



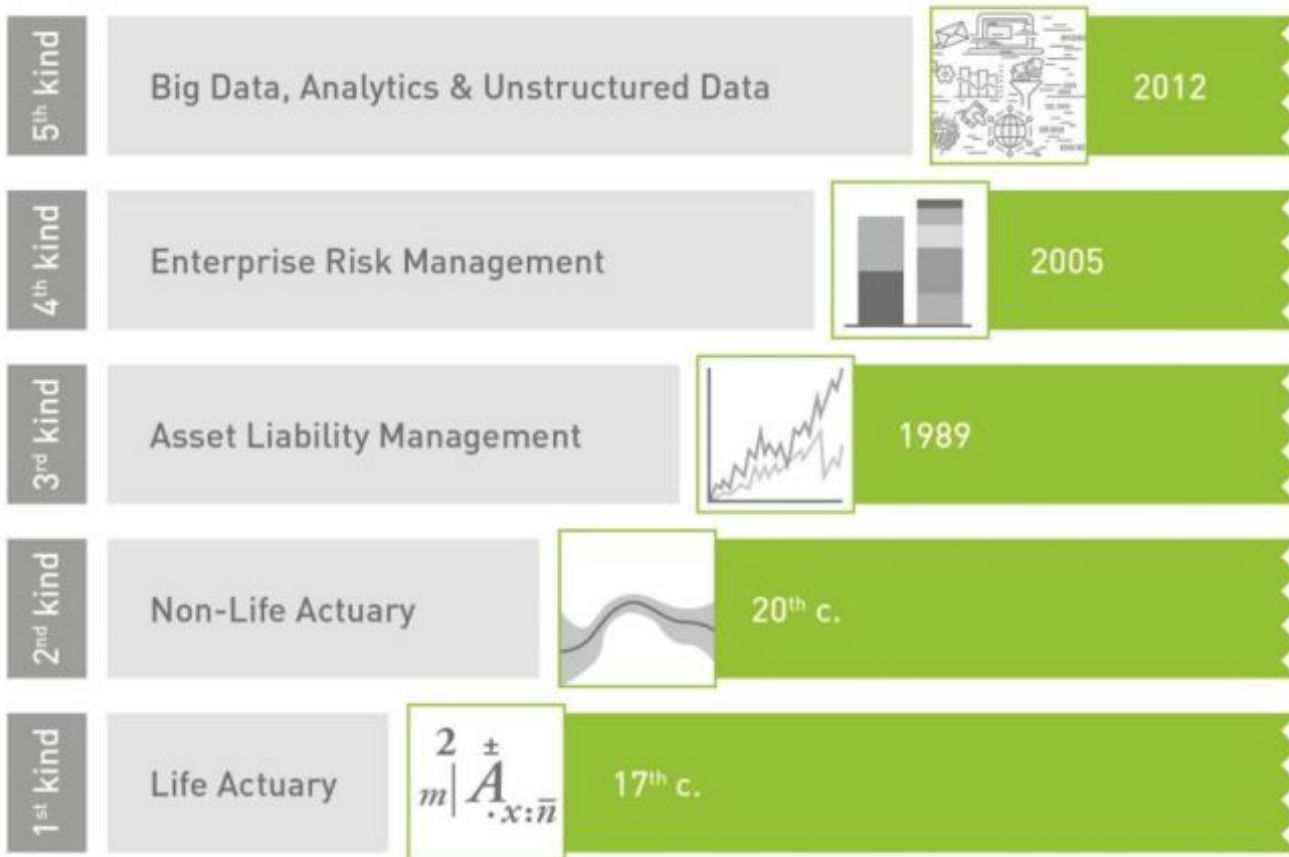
## How to spot a data scientist (somewhat opinionated)

1. Bad at software engineering
2. Knows some stats and math
3. Thinks they're good at explaining technical concepts to "business" audience
4. Has enough domain expertise to pull 3 off.
5. A good data scientist also knows how to makes good slides

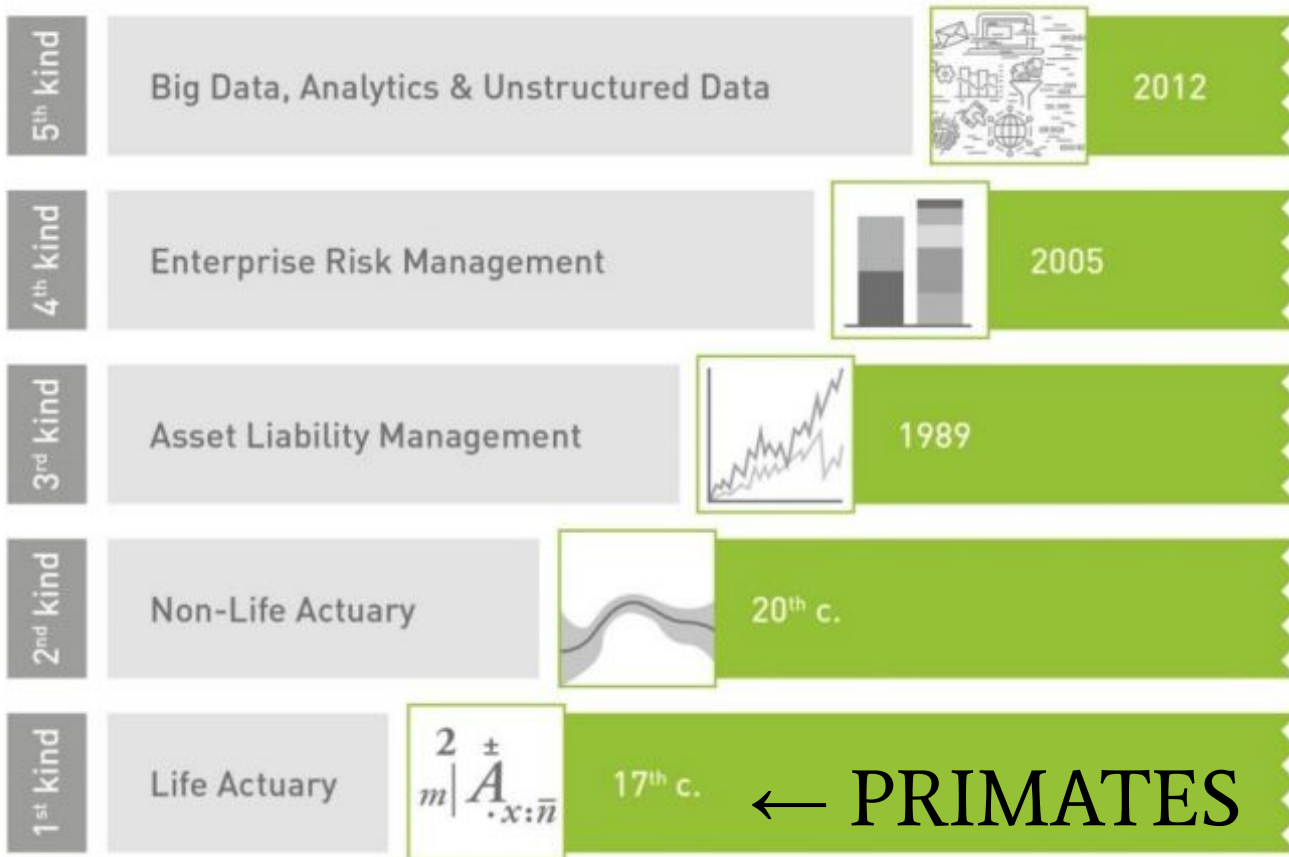
**Actuaries are the OG data  
scientists!**



- *Actuary of the first kind*: the life actuary since the 17th century. Uses deterministic methods.
- *Actuary of the second kind*: the non-life actuary in the 20th century. Uses probabilistic modelling.
- *Actuary of the third kind (1989)*: the job description expands the actuary's focus from a narrow consideration of liabilities to both sides of the balance sheet and their interaction (ALM). The actuary uses stochastic processes to calculate the value of liabilities against assets and align both sides of the balance sheet.
- *Actuary of the fourth kind (2005)*: the job description is expanded again to include risk management (or enterprise risk management, ERM), as reflected notably in revised and risk-based solvency rules (SST, Solvency II). Corresponds to ERM or risk actuary.
- *Actuary of the fifth kind (2012)*: the job description is expanded further to include statistical and computer-science methods and know-how so as to answer actuarial problems in non-life, life and health insurance and also reinsurance.



$${}^2_m|A_{\cdot x:\bar{n}}$$



Business

# Unsexy Actuaries Are 97.28892% Certain They Need Stronger Brand

By [Michael Sasso](#)

November 30, 2018, 2:00 AM PST

- ▶ Number crunchers want peppier image amid AI, data threat
- ▶ More ads marketing actuarial services to hedge funds



**Blasphemous!**

精算師

Exquisite Calculation Master



**STEM Grad**

**Actuary**

**ML/AI/DS**

Perceptions

**Let's play “college career counselor”**



# Gross generalizations

## “Actuarial”

- **Utilize math/stats/coding skills and business acumen**
- Many exams
- On average, more bureaucratic organizations
- Work with outdated proprietary technology and manual processes

## “Data science/ML engineering”

- **Utilize math/stats/coding skills and business acumen**
- No exams
- On average, more agile companies
- Work with and sometimes contribute to the cutting edge of technology

# Money isn't everything!

Let's talk about it real quick to get it out of the way..

# Straight outta college

Preparing grade for exams 1,

<i>Casualty</i>	< 1 yr	1-3 yrs	3-5 yrs
<b>1 Exam</b>	48 - 65	54 - 72	55 - 80
<b>2 Exams</b>	50 - 71	57 - 81	58 - 83
<b>3 Exams</b>	54 - 77	62 - 87	66 - 100
<b>4 Exams</b>	58 - 82	63 - 91	71 - 107
<b>5 Exams</b>		65 - 95	73 - 111
<b>6 Exams</b>		70 - 97	76 - 116
<b>7 Exams</b>		72 - 99	85 - 118
<b>ACAS</b>		85 - 112	90 - 138
<b>FCAS</b>			114 - 166

P&C salaries, DW Simpson

Date Timestamp	Location seattle	Total Comp (Yr) Salary   Stock Grant Bonus	Experience (yrs) At-Company / Total = 0 <input type="radio"/> At-Company <input checked="" type="radio"/> Total
Add Your Compensation!			
4/9/2019	Seattle	\$144,000	0 / 0
4/8/2019	Seattle, WA	\$145,000 108k   27k 10k	0 / 0
4/2/2019	Seattle, WA	\$162,000 112k   16k 34k	1 / 0
3/31/2019	Seattle, WA	\$135,000 108k   3k 24k	0 / 0
3/29/2019	Seattle, WA	\$136,000 108k   17k 11k	0 / 0
3/23/2019	Seattle, WA	\$145,000 108k   20k 14k	0 / 0
3/16/2019	Seattle, WA	\$135,000 108k   3k 24k	0 / 0
3/7/2019	Seattle, WA	\$136,000 108k   17k 11k	0 / 0
3/4/2019	Seattle, WA	\$135,000 108k	0 / 0
3/1/2019	Seattle, WA	\$150,000 108k   17k 24k	0 / 0

Amazon SDE I (entry level) salaries, level.fyi

# 5 years in

## Qualifications:

- Bachelor's degree required; Masters degree preferred.
- Fellowship in the Casualty Actuarial Society (FCAS) or in Society of Actuaries (FSA) designation preferred or comparable education/designation with relevant experience. Attaining Associateship alone is not a sufficient criteria to operate at this level, especially if exams have been passed very rapidly.
- Minimum 5-7 years relevant experience required.
- Sound knowledge of actuarial techniques and standards, as well as other business operations including financial, underwriting, legal, statistics, claims, sales, etc.
- Advanced communication and social skills and ability to build relationships and interact effectively with others within and outside the organization.
- Ability to motivate and mentor peers and motivate and train subordinates.
- Advanced computing skills (MS Office Excel, SAS, etc.); experience building complex models.

Salary: \$132,300-\$173,200

Education Level: Bachelor's Degree (±16 years)

Shift: Day Job

Travel: Yes, 10 % of the Time

“Assistant Actuary” job description,  
large insurer, Seattle

Date Timestamp	Location	Total Comp (/yr) Salary   Stock Grant Bonus	Experience (yrs) At-Company / Total
	<input type="text" value="seattle"/>		<input type="text" value="5"/> <input type="radio"/> At-Company <input checked="" type="radio"/> Total
Add Your Compensation!			
4/27/2019	Seattle, WA	\$200,000 155k   45k	2 / 2
4/27/2019	Seattle	\$205,000	3 / 3
4/18/2019	Seattle, WA	\$200,000 145k   50k 5k	3 / 4
4/18/2019	Seattle, WA	\$237,000 139k   98k	5 / 5
4/17/2019	Seattle	\$160,000 123k   32k 5k	1.5 / 5
4/17/2019	Seattle	\$186,000 134,900   50,819	3 / 3
4/15/2019	Seattle, WA	\$205,000 141k   64k	3 / 4
4/14/2019	Seattle, WA	\$198,000 138k   60k	3 / 3
4/14/2019	Seattle, WA	\$200,000 143k   57k	3 / 4
4/11/2019	seattle	\$246,000 151k   50k 38k	1 / 2
4/10/2019	Seattle, WA	\$260,000 155k   64k 41k	0 / 4

Amazon SDE II (one promotion from entry level),  
max 5 years experience, level.fyi

Mo' money mo' problemz!



# Why Data Science Teams Need Generalists, Not Specialists

by [Eric Colson](#)

MARCH 08, 2019

## Tl;dr (quotes from article)

*...But when the product is still evolving and the goal is to learn, specialization hinders our goals in several ways:*

- 1. It increases coordination costs...*
- 2. It exacerbates wait time...*
- 3. It narrows context...*



### 3.4 RELIANCE ON EXPERTS

The actuary may rely on experts in the fields of knowledge used in the development of the model. In determining the appropriate level of reliance, the actuary may consider the following:

- a. whether the individual or individuals upon whom the actuary is relying are experts in the applicable field;
- b. the extent to which the model has been reviewed or validated by experts in the applicable field, including any known significant differences of opinion among experts concerning aspects of the model that could be material to the actuary's use of the model;
- c. whether there are industry or regulatory standards that apply to the model or to the testing or validation of the model, and whether the model has been certified as having met such standards; and
- d. whether the science underlying the expertise is likely to produce useful models for the intended purpose.

The actuary should disclose the extent of any such reliance.



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## MODELING (Fourth exposure draft)

<http://www.actuarialstandardsboard.org/asops/modeling-fourth-exposure-draft/>

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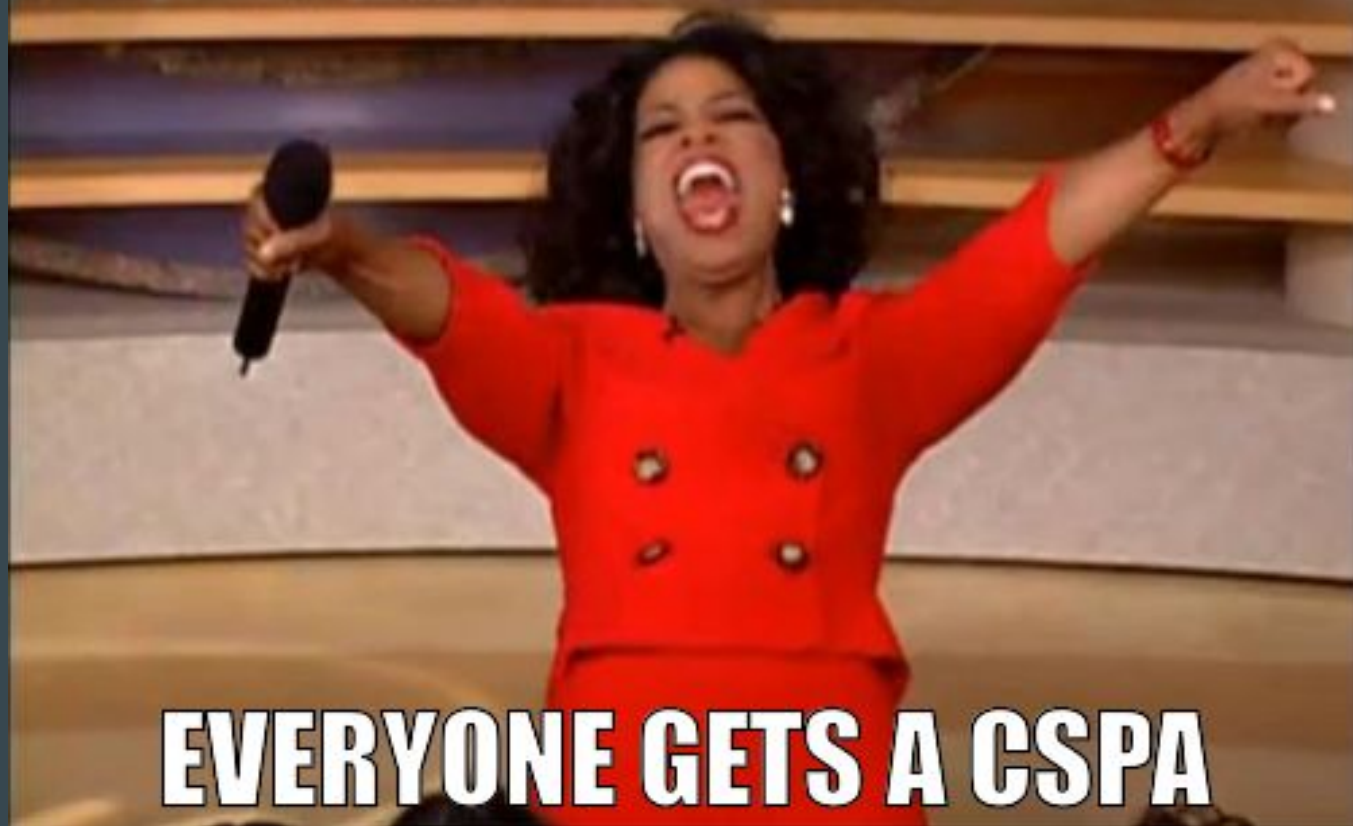
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## MODELING (Fourth exposure draft)

<http://www.actuarialstandardsboard.org/asops/modeling-fourth-exposure-draft/>

The actuary should disclose the extent of any such reliance.

**YOU GET A CSPA**



**EVERYONE GETS A CSPA**

**Actuaries as full stack data  
scientists?**

Let's see how we can figure this  
“AI” stuff out **together** and apply it  
to our jobs

**Collaboration**

**Solve common problems  
together so we can focus  
on our own problems**

# I've got 99 problems...

- Individual claims reserving
- Convincing the regulator to approve your rate filing backed by ML models (or just adding a regularization term to your GLM)
- Training materials for newcomers to predictive modeling
- Deploying U/W models to production



# Introducing Kasa AI

Accelerating innovation in insurance analytics through open collaboration.

AUTHOR

Kevin Kuo

AFFILIATION

RStudio

PUBLISHED

March 31, 2019

CITATION

Kuo, 2019

Kasa AI is a not-for-profit community-driven initiative for insurance analytics research. Our goal is to improve workflows and advance applied artificial intelligence in the insurance industry through open collaboration.

<https://blog.kasa.ai/posts/intro/>

<https://github.com/kasaai>

tl;dr

- A **GitHub** org, projects organized as repos
- Depends on **volunteers**
- **Anyone can contribute** and provide feedback
- Everything is **open source**
- Outputs
  - **Research**
  - **Software**
  - **Educational material**

Commits on Feb 6, 2019

Added init documentation for download functions



actuarialvoodoo committed on Feb 6 ✓



e394275



Moved download functionality to a function in the pricing tutorial package ...



actuarialvoodoo committed on Feb 6



6468476



Updated download\_file to check for presence of download folder before ...



actuarialvoodoo committed on Feb 6



eac9244



Commits on Feb 2, 2019

Added script to fetch data from web and add to external\_data folder. ...



actuarialvoodoo committed on Feb 2 ✓



bd77b33



Every version is tracked

Commits on Jan 3, 2019

Merge pull request #72 from kasaai/bugfix/update-distill ...



kevinykuo committed on Jan 3 ✓

Verified



7530f09



rebuild blog post



kevinykuo committed on Jan 3 ✗



6ecfb88



add a couple library() calls to prevent cached content from breaking ...



kevinykuo committed on Jan 3



8df716d



fix citation for naic whitepaper



kevinykuo committed on Jan 3



9067c39



# Decide on model type #45

Open

kevinykuo opened this issue on Dec 14, 2018 · 7 comments



kevinykuo commented on Dec 14, 2018

Member



Let's keep it simple with GLM.

- Regularization?
- Frequency/severity vs pure premium
- By-peril or not
  - Whether to account for dependency if by-peril



kevinykuo added the **modeling** label on Dec 16, 2018



RonRichman commented on Dec 18, 2018



My thoughts would be that it makes sense to start of with GLM, ideally freq/sev for all perils together. With that baseline, it then becomes easier to show the benefits of regularization, or ML/DL methods.



EKtheSage commented on Jan 16



What if you have little to no loss history and you want to use industry loss cost to supplement your analysis?

In our company we used ISO rating structure as the starting point and built a residual model off of that. The model was a LR model since our exposure was not reliable.

# Discuss approaches for task

 35 Open  18 Closed


Author ▾

Labels ▾

Projects ▾

Milestones ▾

Assignees ▾

 **Reg Checklist - Building the Model - "Old Model" Versus "New Model"** regulatory

#27 opened on Dec 14, 2018 by kevinykuo  0 of 5 

 **Reg Checklist - Building the Model - Messaging Data, Model Validation and Goodness-of-Fit Measures** regulatory

#26 opened on Dec 14, 2018 by kevinykuo  0 of 14 

 **Reg Checklist - Building the Model - Predictor Variables** regulatory

#25 opened on Dec 14, 2018 by kevinykuo  0 of 4 

 **Reg Checklist - Building the Model - Medium-Level Narrative for Building the Model** regulatory

#24 opened on Dec 14, 2018 by kevinykuo  0 of 6 

 **Reg Checklist - Building the Model - High-Level Narrative for Building the Model** regulatory

#23 opened on Dec 14, 2018 by kevinykuo  0 of 9 

 **Reg Checklist - Selecting Model Input - Final Data Information** regulatory

#22 opened on Dec 14, 2018 by kevinykuo  0 of 1 

 **Reg Checklist - Selecting Model Input - Data Organization** regulatory

#21 opened on Dec 14, 2018 by kevinykuo  0 of 4 

 **Reg Checklist - Selecting Model Input - Adjustments and Scrubbing** regulatory

#20 opened on Dec 14, 2018 by kevinykuo  0 of 7 

# Issues track tasks

This conversation was marked as resolved by **actuarialvoodoo**

✳ Hide conversation



**kevinykuo** on Feb 5 **Member**

+ 😊 ...

Can we wrap this mechanism into a function that takes the time periods to be downloaded as an argument? I think it can live in the package and we can provide example usage in `README`.



**actuarialvoodoo** on Feb 5 **Author** **Member**

+ 😊 ...

If I were just doing this analysis for myself, I would (ideally) use a makefile to automate/orchestrate the analysis. Is that a direction we want to consider for this project?



**kevinykuo** on Feb 6 **Member**

+ 😊 ...

I think GNU Make is a little too intimidating for newer users. That said, we do need to stay organized as we scale up. Maybe we can look at <https://github.com/ropensci/drake?>



**actuarialvoodoo** on Feb 6 **Author** **Member**

+ 😊 ...

I added an argument to the function `download_data` which will allow users to specify the datasets to download. I will file an issue to use drake tomorrow.



Reply...

Unresolve conversation

# Discuss changes line-by-line

```
2 + library(tidyverse)
```

```
3 + library(fs)
```



**ONE DOES NOT SIMPLY**

**START USING GIT**



**WATCH ME DIFF**  
**WATCH ME REBASE**



<https://happygitwithr.com/>



# Projects

- “Tidy” package for reserving  
(<https://github.com/kasaai/rsvr>)
- Personal Auto pricing tutorial  
(<https://github.com/kasaai/pc-pricing-tutorial>)
- More on the way!

**What about collusion?**

# ANTITRUST COMPLIANCE POLICY

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(As Adopted February 12, 1993)

## **POLICY**

The antitrust laws are among the most important of all federal and state laws affecting associations such as the Casualty Actuarial Society. The purpose of the antitrust laws is to preserve fair and honest competition. It is the longstanding and undeviating policy of the Casualty Actuarial Society to comply in all respects with the letter and spirit of the antitrust laws.

A description of an actuarial methodology or mode of analysis of data and its logical internal consistency and past predictive accuracy is not a violation of the antitrust laws. Such a description, however, must be undertaken with extreme care to avoid being viewed as a means of "signaling" future pricing decisions. Any application or example of the methodology or analysis should be presented using insurance company experience that is generally available to the public or is hypothetical in nature rather than the past or current experience of any actual individual competitor.



**Oh so you read  
a web page**

**Please tell me about your  
expert opinion on antitrust**

**DISCLAIMER:  
IANAL**

**What about protecting IP?**

**Yeah if you could stop divulging trade secrets**



Let's talk about this, too...

**That would be great**

**Let's figure this "AI" stuff out  
together and apply it to our jobs!**