Risk Reporting and Risk Monitoring during the Zombie Apocalypse

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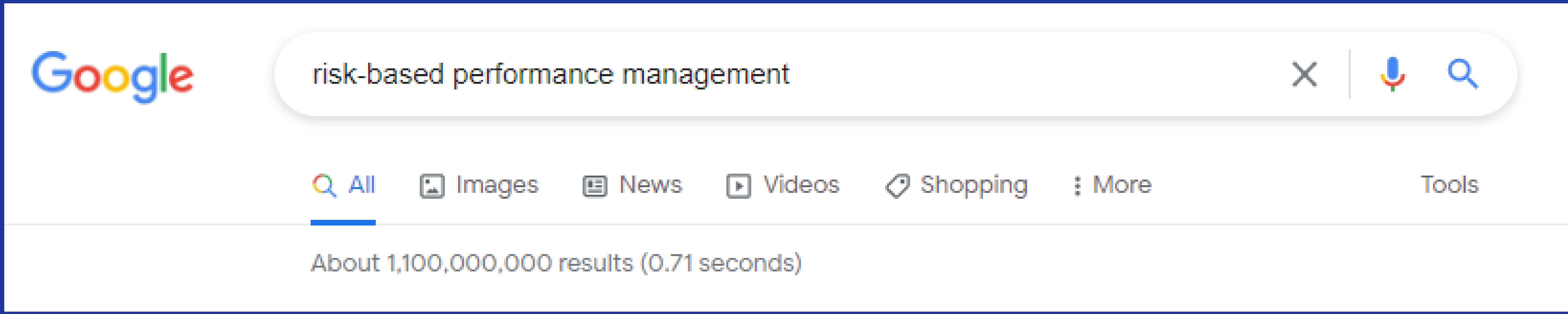
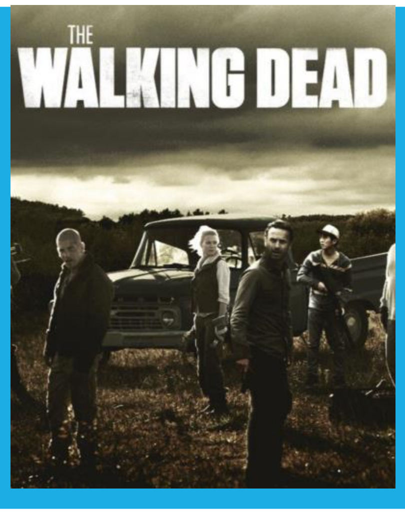
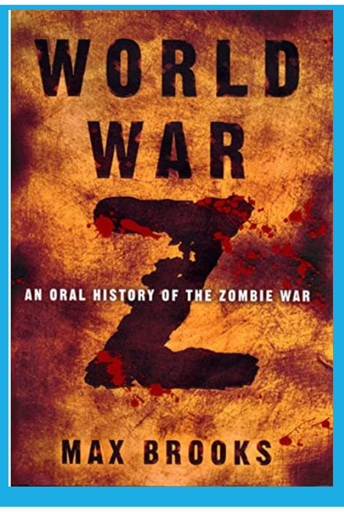
RISK AWARENESS WEEK 2022

UQÀM
Université du Québec à Montréal



Presentation structure

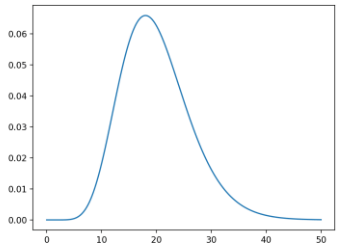
You are the Zombie!			
Heat maps	• Easy, conceptual and no fancy tricks	• There may be some statistical concepts	• Some coding and statistics may be involved

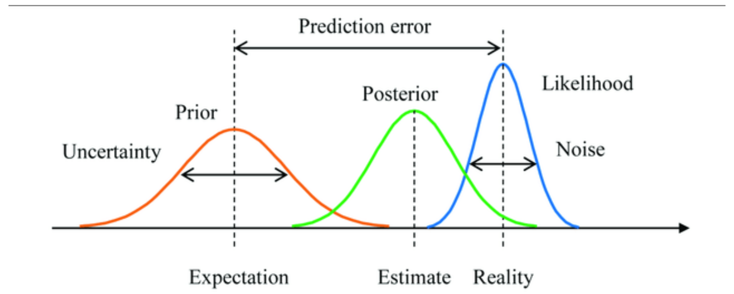
Medium Risk of dying due to famine

We can sustain 5 to 45 colonists

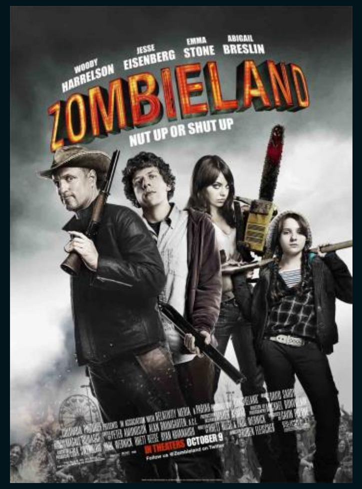
We have 90% chance of sustaining between 10 and 35 colonists

Updated with today's data, we have a 90% chance of sustaining between 12 and 37, with potable water being the key factor

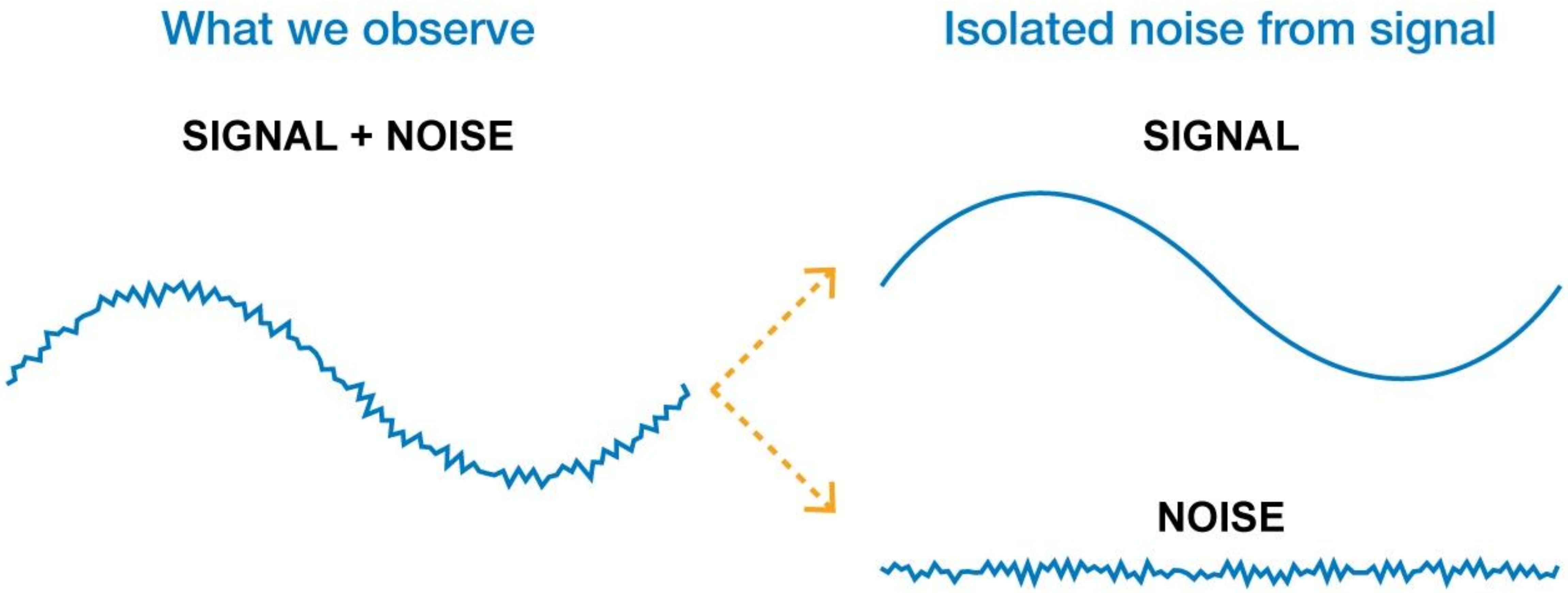


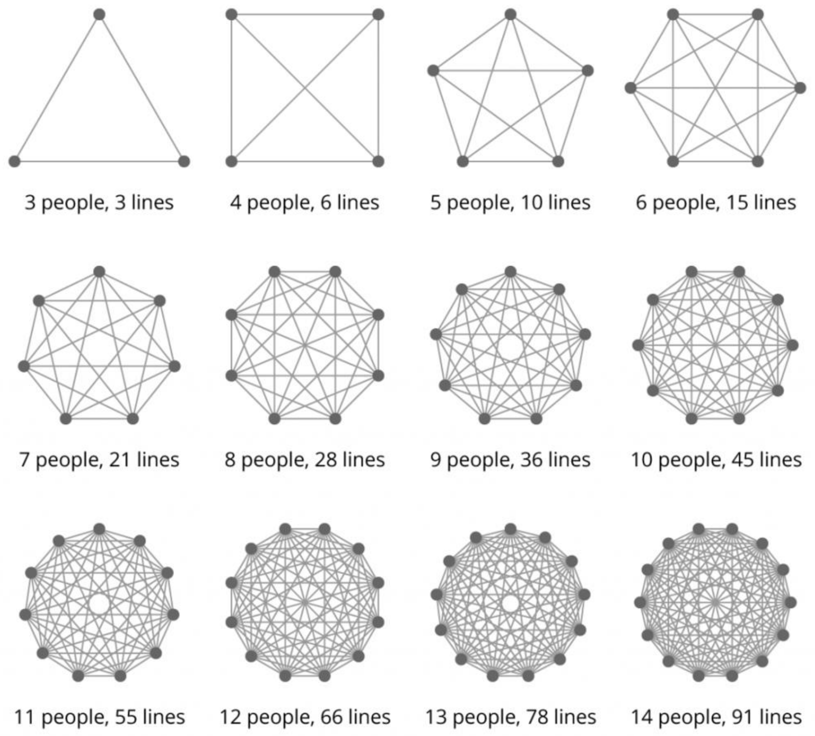


Signal and Noise



- Sometime, simple methods may work.
- But complexity is a…





Preparedness

Robust

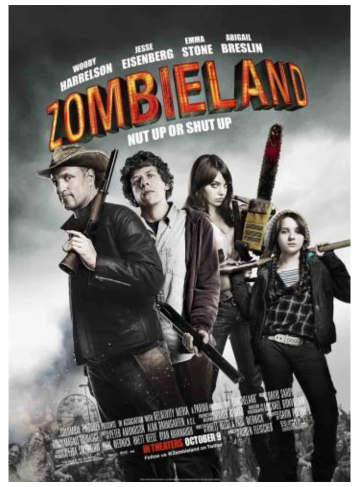
Resilient

Warned

Talking about risks and trends

- Cut the jargon and take the time to explain principles.

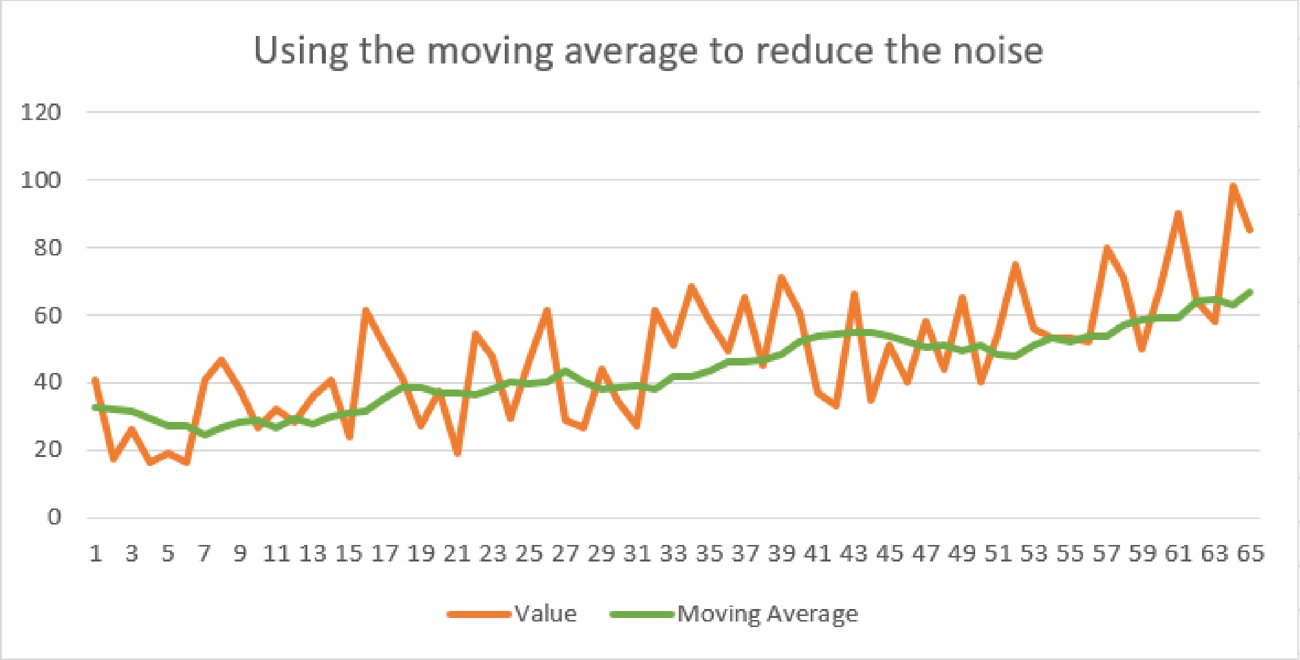
- Talking in ranges and presenting assumptions.



$$\bar{a}_{SM} = \bar{a}_{SM\_prev} + \frac{1}{n}\left(x_M - x_{M-n}\right)$$

C14 | fx =AVERAGE(A3:A13)

	A	C	D
1	Daily data	Rolling average	
13	41	32.8	=AVERAGE(A2:A12)
14	17.5	32.1	=AVERAGE(A3:A13)
15	26	31.4	
16	16.5	29.1	
17	19	27.1	
18	16.5	27.2	
19	41	24.5	
20	46.5	26.8	
21	38	28.3	
22	26.5	29.0	
23	32	26.9	
24	28.5	29.1	
25	36	28.0	
26	40.5	29.7	
27	24	31.0	
28	61.5	31.7	
29	51	35.5	
30	41.5	38.7	
31	27	38.7	
32	37.5	37.0	
33	19	36.9	



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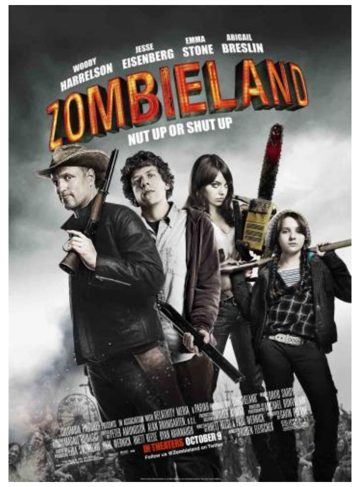
Causality

- Some qualitative methods are useful, even when trying to establish causality.

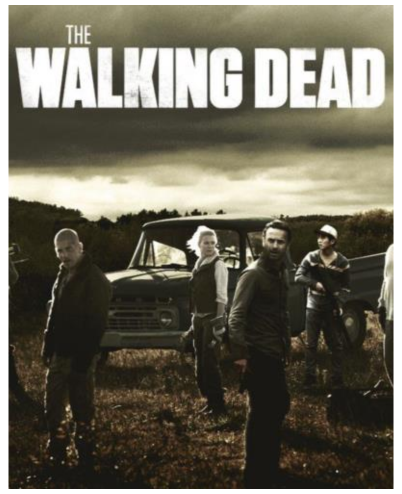


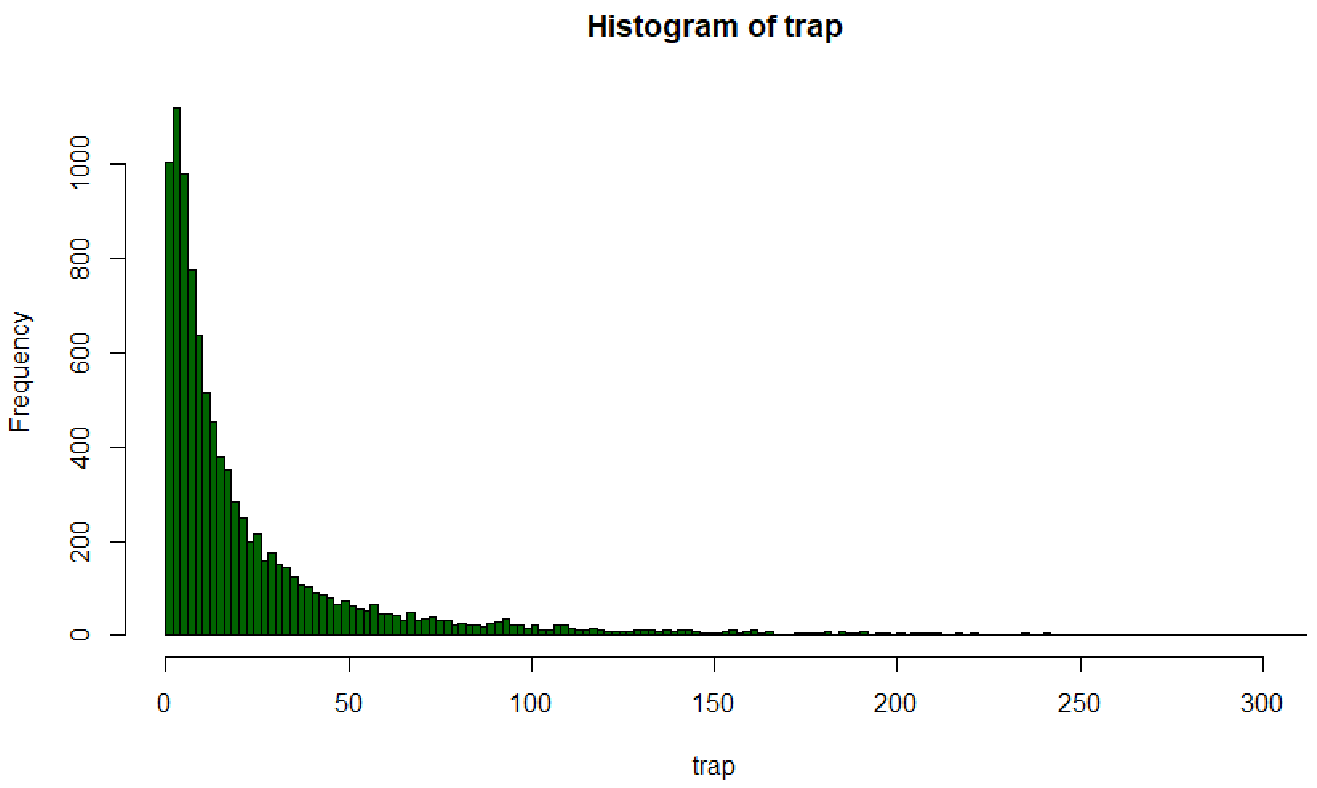
Sufficient for affirming causal inference

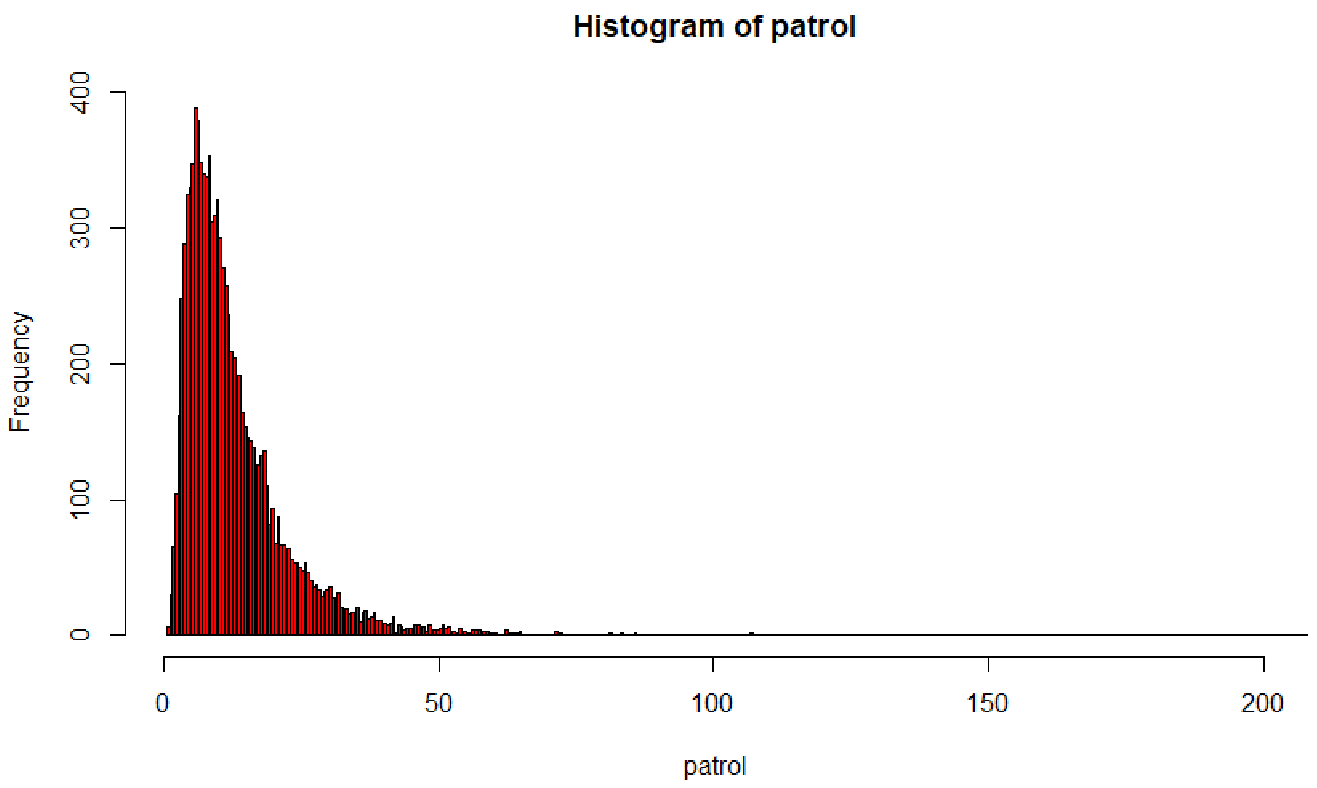
Necessary for affirming causal inference	No	Yes
No	**1. Straw-in-the-Wind** **a. Passing:** Affirm relevance of hypothesis, but does not confirm it. **b. Failing:** Hypothesis is not eliminated, but is slightly weakened.	**3. Smoking-Gun** **a. Passing:** Confirm hypothesis. **b. Failing:** Hypothesis is not eliminated, but is somewhat weakened.
Yes	**2. Hoop** **a. Passing:** Affirm relevance of hypothesis, but does not confirm it. **b. Failing:** Eliminates hypothesis.	**4. Double Decisive** **a. Passing:** Confirm hypothesis and eliminates others. **b. Failing:** Eliminates hypothesis.

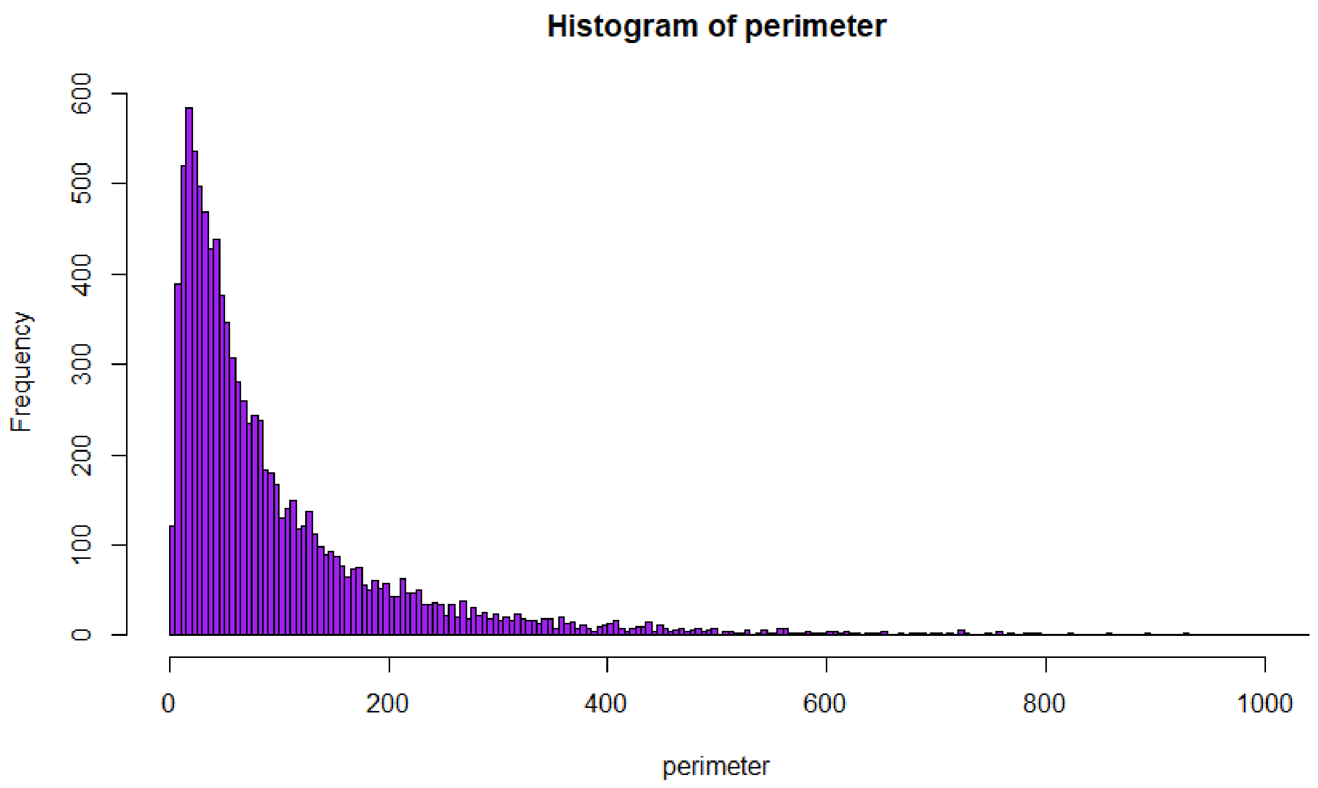
Lintelo, D. & Munslow, T. & Pittore, Katherine & Lakshman, Rajith. (2019).

Objectives level using R





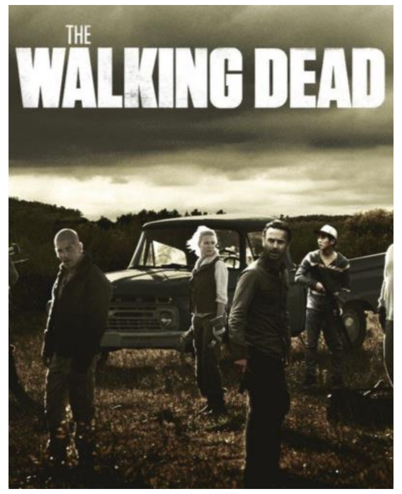




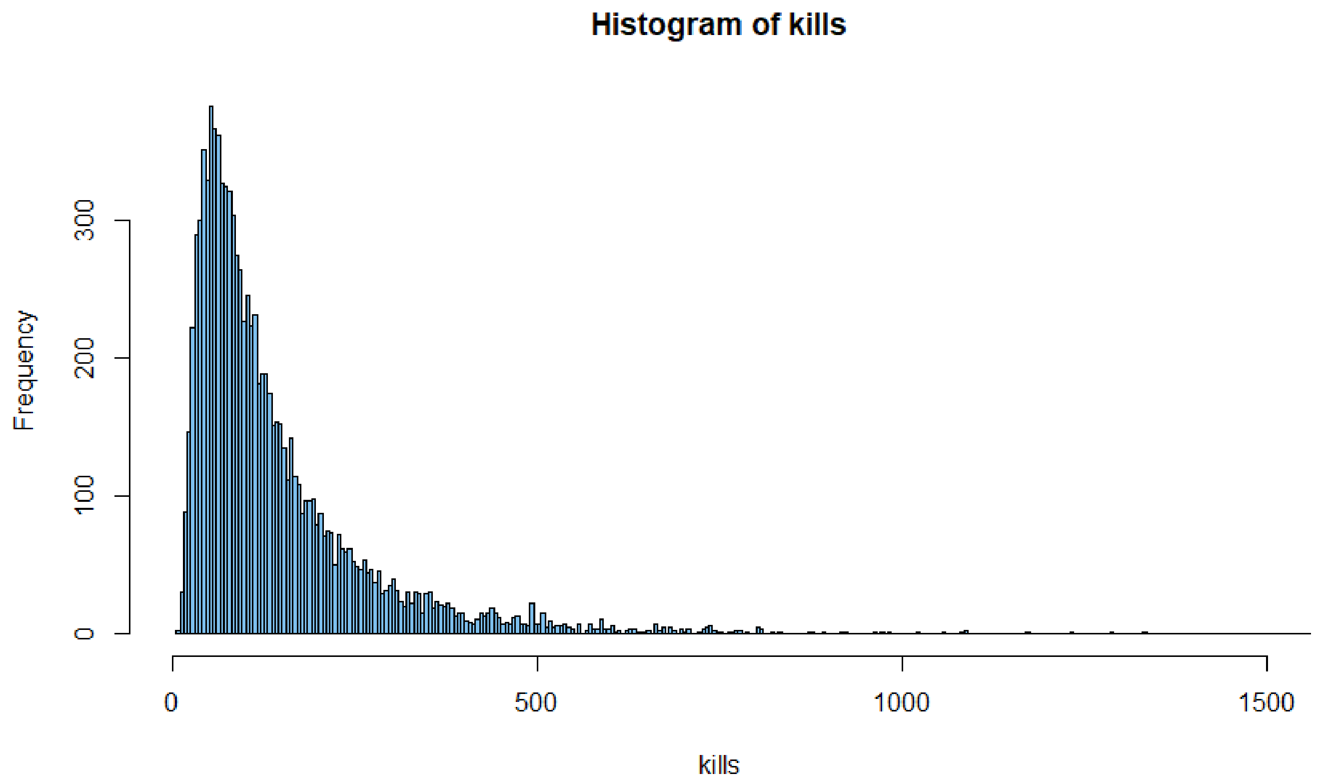

```
trap <- rlnorm(10000, log(12), log(4))
patrol <- rlnorm(10000, log(10), log(2))
perimeter <- rlnorm(10000, log(60), log(3))

p1 <- hist(trap, breaks=1000, xlim=c(1,300), col ="darkgreen")
p2 <- hist(patrol, breaks=500, xlim=c(1,200), col ="red")
p3 <- hist(perimeter, breaks=1000, xlim=c(1,1000), col ="purple")
```

Objectives level using R




```
kills <- trap + patrol + perimeter
hist(kills, breaks=1000, xlim=c(1,1500), col ="skyblue2")
```




```
quantile(kills, c(0.05,0.1,0.25,0.5,0.75,0.8,0.9,0.95))
```

5%	10%	25%	50%	75%	80%	90%	95%
30.22833	38.56993	59.87206	101.66292	179.58215	207.69101	303.91936	427.18523

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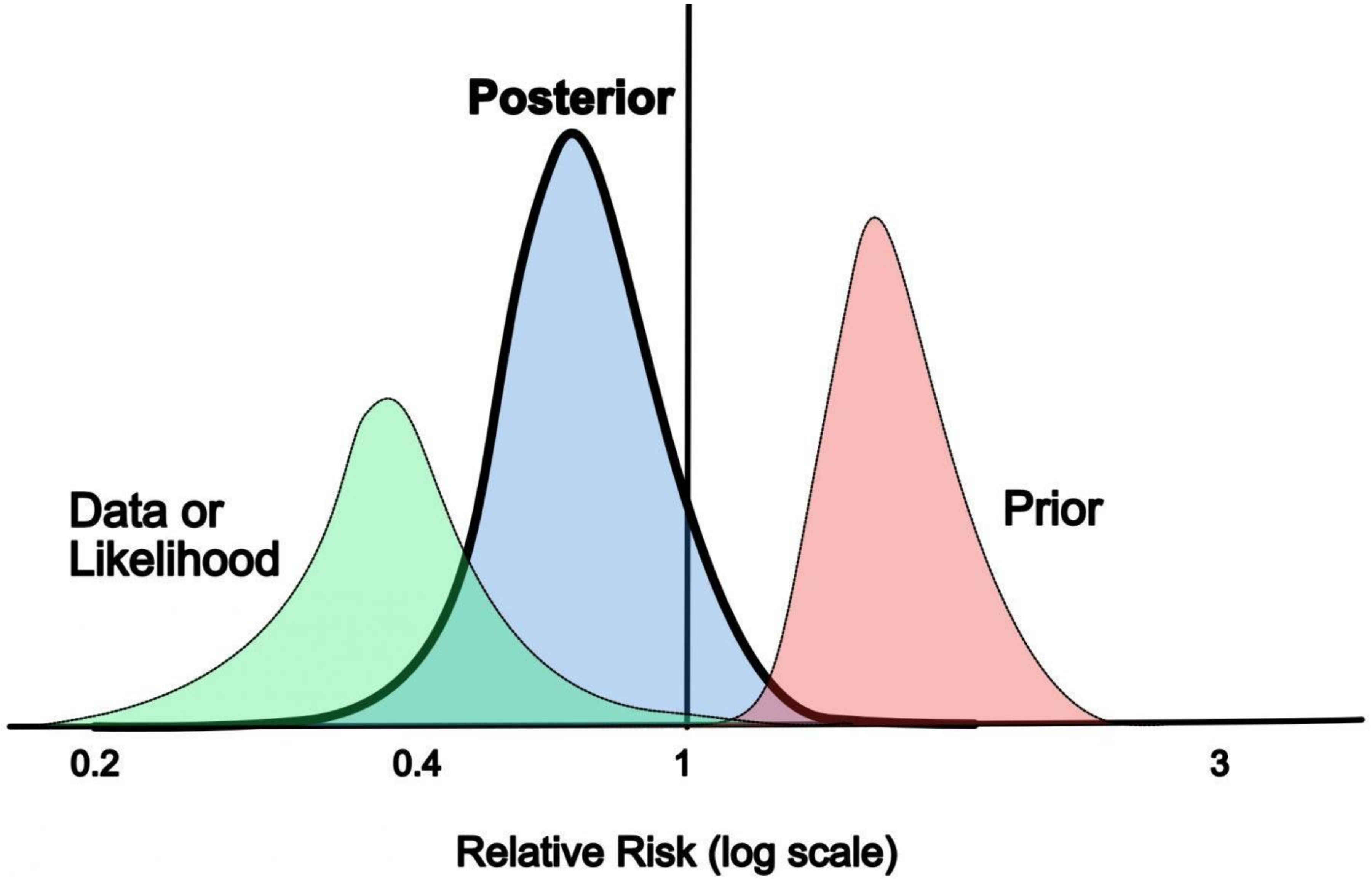
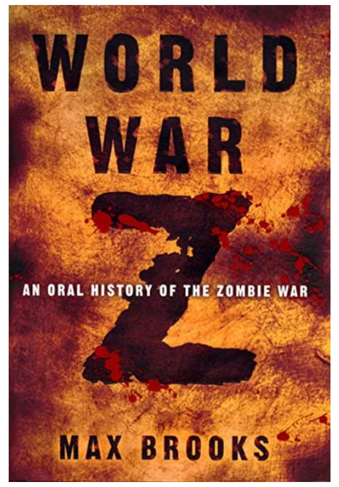
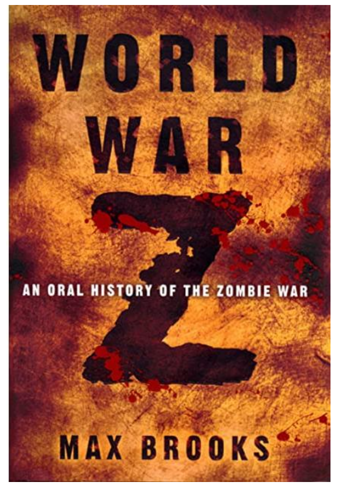
Bayesian updating

- Updating you beliefs based on new information.





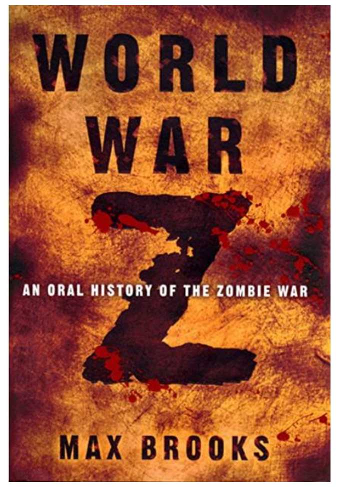
Forecasting



- Seasonal and Trend decomposition using Loess

- ARIMA

Model validation



I am the Chosen One, my models don't need validation

You are kidding, right?

Right?

Thanks for attending, and make sure to avoid the zombification of your Board!

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Picture courtesy of brgfx

Code

- # Risk Awareness Week 2022 - Risk Reporting and Risk Monitoring during the Zombie Apocalypse – R Code
- # Is my assumption (belief) standing the test of time?
- library(bayesrules) #loading packages
- library(tidyverse)
- library(rstan)
- library(bayesplot)
- library(broom.mixed)
- library(janitor)
- library(fpp3)

Code

- # Small Monte Carlo simulation to assess number of zombie kills as part of colony performance review
- trap <- rlnorm(10000, log(12), log(4))
- patrol <- rlnorm(10000, log(10), log(2))
- perimeter <- rlnorm(10000, log(60), log(3))
- kills <- trap + patrol + perimeter
- p1 <- hist(trap, breaks=1000, xlim=c(1,300), col ="darkgreen")
- p2 <- hist(patrol, breaks=500, xlim=c(1,200), col ="red")
- p3 <- hist(perimeter, breaks=1000, xlim=c(1,1000), col ="purple")
- hist(kills, breaks=1000, xlim=c(1,1500), col ="skyblue2")

Code

- quantile(kills, c(0.05,0.1,0.25,0.5,0.75,0.8,0.9,0.95))
- #____
- #Bayesian updating
- p = seq(0,1, length=100)
- #Fast vs Slow Zombies
- plot(p, dbeta(p, 3, 8), type='l') #relatively weak prior
- qbeta(c(0.05,0.95), 3,8)
- plot(p, dbeta(p, 28, 96), type='l')
- qbeta(c(0.05,0.95), 28,96)
- plot_beta_binomial(alpha=3,beta=8, y=28,n=124)

Code

- prior <- pbeta(0.25,3,8)
- prior
- posterior <- pbeta(0.25, 28,96)
- posterior
- posterior/ (1-posterior) #odds

Code

- #Gamma-Poisson Conjugacy using the bayesrule library
- #From a sample calculating the lambda.
- #Trial and errors using Gamma distribution to figure out the lambda from my Poisson
- #I think I have an average 6 zombies per hour, with some zombies every hour and very rarely 12 or more
- plot_gamma(shape=8, rate=3)
- plot_gamma(shape=8, rate=2)
- plot_gamma(shape=8.5, rate=2)
- plot_gamma(shape=9, rate=2)

Code

- plot_gamma(shape=10, rate=2)
- plot_gamma(shape=10, rate=3)
- plot_gamma(shape=12, rate=2)#Decent prior for about 3 to 10 with an average of 6
- summarize_gamma(12,2)
- plot_poisson_likelihood(y=c(3,4,12,2,5,6,7,14,3,6,8), lambda_upper_bound = 50)

- #With new data
- plot_gamma_poisson(shape=12,rate=2,sum_y=70, n=11)
- summarize_gamma_poisson(shape=12,rate=2,sum_y=70, n=11)

Code

- #STL and ARIMA
- us_finance_employment <- us_employment %>% filter(year(Month) >= 1970,
-   Title== "Financial Activities") %>% select(-Series_ID)
- autoplot(us_finance_employment)
- model <- us_finance_employment %>% model(stl = STL(Employed))
- components(model)
- components(model) %>% autoplot()
- model1 <- us_finance_employment %>% model(ARIMA(Employed, stepwise = FALSE, approx = FALSE))
- forecast(model1, h=48) %>% autoplot(us_finance_employment)