

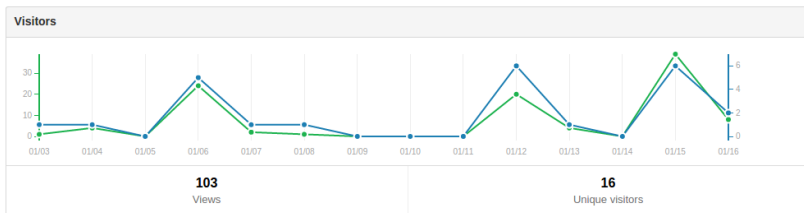
Week 2: likelihood, earthquakes, and more

Quick poll



Help outside of class?

- ▶ open lab hours
- ▶ message board

Access to the course notes last week



Referring sites		
Site	Views	Unique visitors
 github.com	68	8

Popular content		
Content	Views	Unique visitors
 hmods/notes: Course notes for hierarch...	29	9
 notes/main.pdf at master	10	7

Solutions to last week's problems

Posted on GitHub course site at end of class

Likelihood

The joint conditional probability of observations y_1, y_2, \dots, y_n :

$$\mathcal{L}(\theta|y) = \prod_{i=1}^n p(y_i|\theta)$$

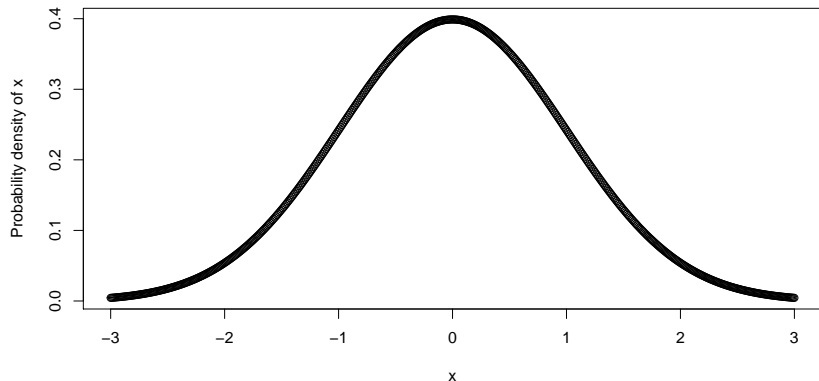
Maximum likelihood estimation

normal model, known standard deviation

$$y \sim N(\mu, 1)$$

Normal probability density

```
x <- seq(-3, 3, .01)  
fx <- dnorm(x, 0, 1)  
plot(x, fx, ylab = 'Probability density of x')
```



Maximum likelihood estimation

$$\mathcal{L}(\theta|y) = \prod_{i=1}^n p(y_i|\theta)$$

What values of θ maximize $\mathcal{L}(\theta|y)$?

Maximum likelihood estimation

$$\mathcal{L}(\theta|y) = \prod_{i=1}^n p(y_i|\theta)$$

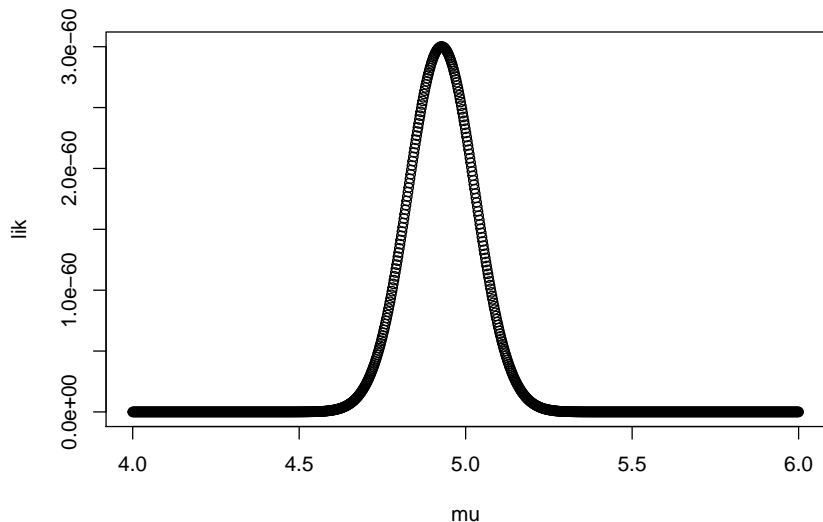
```
calc_lik <- function(y, mu) {  
  likelihood <- prod(dnorm(y, mu, sd = 1))  
  return(likelihood)  
}
```

Making a likelihood profile

```
l <- 1000
mu <- seq(4, 6, length.out = 1)
lik <- rep(NA, 1)
for (i in 1:l){
  lik[i] <- calc_lik(y, mu[i])
}
```

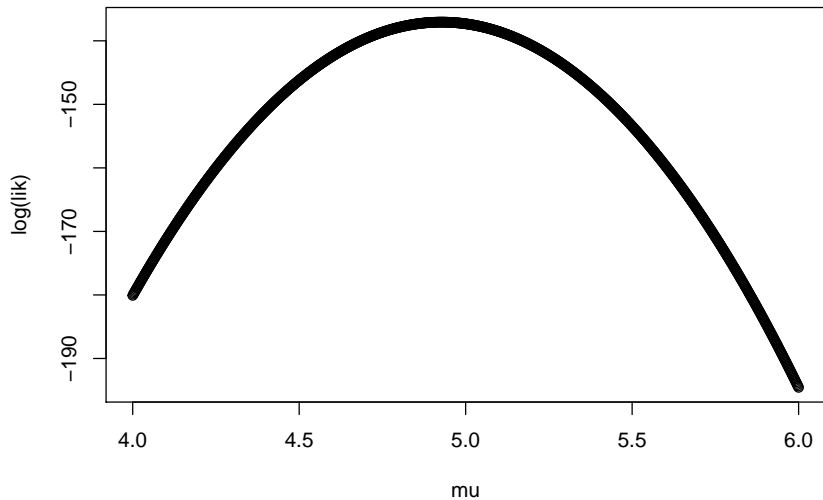
Making a likelihood profile

```
plot(mu, lik)
```



Log-likelihood profile

```
plot(mu, log(lik))
```

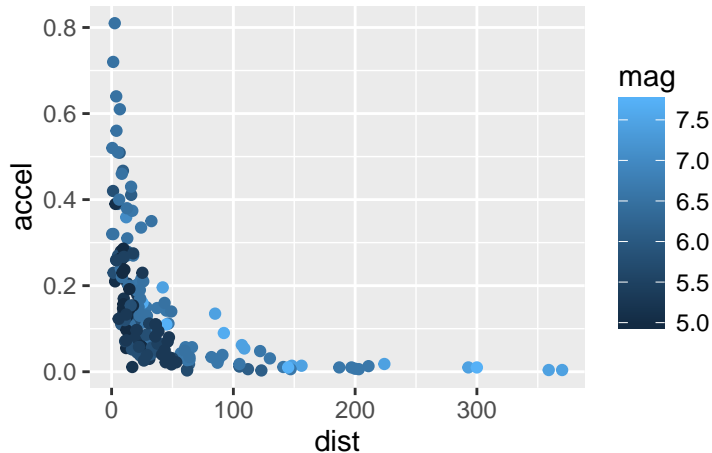


Today's class: earthquakes & optimization



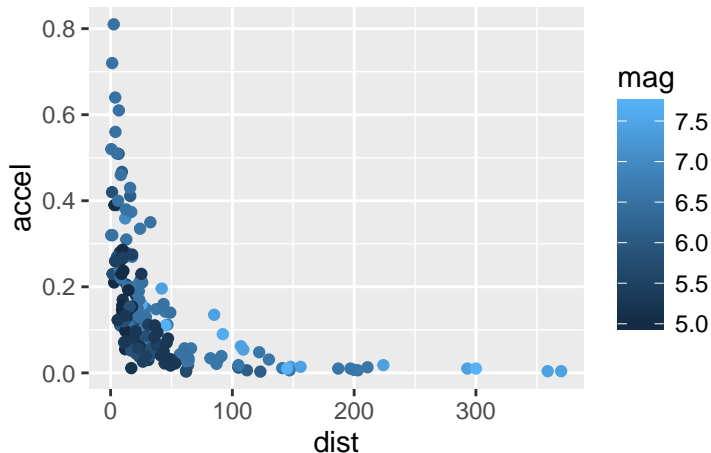
The data

```
ggplot(attenu, aes(x = dist, y = accel, col = mag)) +  
  geom_point()
```



Your task

1. Predict peak ground acceleration at epicenter
2. Predict attenuation curve



A quick primer on \LaTeX math equations

Demo in Atom