

# THE LINE

*Lyrics by Kyle White*

<http://www.youtube.com/watch?v=zdhqQGrCITl>

Data, a scattered  $n$  by  $p$  set.

It's only in your points you feel spread out, and without trend.

You want to test if your set's a scam  
and you worry when they tell your points, "you're unexplained!"

It just takes a line,

$X$  prime  $X$  beta equals  $X$  prime  $Y$ !

Everything, everything will fit just fine.

Everything everything will fit alright, alright.

Beta, you define that plane.

That hat you're wearing makes you look pretty BLUE, but no, not sad.

You fit great, the data need a friend.

It doesn't matter if it's up or down, go find some trends!

It just takes a line,

$X$  prime  $X$  beta equals  $X$  prime  $Y$ !

Everything, everything will fit just fine.

Everything everything will fit alright, alright.

It just takes a line,

Gauss and Markov they were pretty fly guys!

Everything, everything will fit just fine.

Everything everything will fit alright, alright.

Data, a scattered  $n$  by  $p$  set.

It's only in your points; they feel spread out, and without trend.

Just do your test, with beta hat's great plane,  
and hope that every  $x$  in your set... remains!

It just takes a line,

$X$  prime  $X$  beta equals  $X$  prime  $Y$ !

Everything, everything will fit just fine.

Everything, everything will fit alright, alright.

It just takes a line,

minimize the sum of squares and it's a sign!

Everything, everything will fit just fine.

Everything, everything will fit alright, alright.

## THE CRLB

*Lyrics by Kyle White and Bradley Turnbull*

<http://www.youtube.com/watch?v=pXXb595yOyI>

Theta one, theta two, which estimator do I choose?

Both of them unbiased, what now? I'm still so  
confused.

I need a better measure than just looking at means.

Calculating variance is smart, it seems.  
So here we go!

'Cause it's easy when you know how it's done.  
Invert the information when the bias is none.  
Can't beat it, bounded from below!  
C-R lower bound!

Too bad my stat is lacking some efficiency.  
Why can't someone out there tell how  
to fix this please?  
Sufficient estimators will do the trick --  
condition on them, that will be my fix!  
So thank you Rao!

'Cause it's easy when you know how it's done.  
Improve an estimator with a sufficient one.  
Just try it, you've got nothing to lose!  
Rao-Blackwell improves!

'Cause it's easy when you know how it's done.  
Invert the information when the bias is none.  
Can't beat it, bounded from below!  
C-R lower bound!

# ADVISE ME MAYBE

*Lyrics by Kristin Linn*

[http://www.youtube.com/watch?v=tQd\\_D7Tlj\\_U](http://www.youtube.com/watch?v=tQd_D7Tlj_U)

I passed the prelim, hooray!  
Now 3 more years I can stay,  
collecting books and low pay,  
and drowning in R files.  
I'd trade my soul for a dis-  
sertation topic and miss  
the days when measure just meant  
inches, feet, yards, and miles.

Looking at their photos.  
Yes, yes, oh goodness no!  
Must be a professor!  
Who'll help me get my PhD?

Hey, you don't know me,  
I only made Bs  
in your classes.  
Advise me maybe?  
And yes, I promise  
I'm not Bayesian!  
(But I'm taking 740 next fall.)  
Advise me maybe?

Hey, you don't know me,  
but I need funding.  
I hear you have some;  
advise me maybe?  
What? You're too busy?  
Advising twenty?  
Don't matter to me!  
Advise me maybe?

Sit, wait, while you end your call,  
like Laber's chalk down the hall,  
my heart is pounding but all  
I have is one question.  
I like your research a lot.  
What hinge-loss means I know not.  
But those are really cool plots.  
Oh yeah, did I mention?

I'm looking for  
someone with an open door,  
minimal emails ignored.  
No, don't say it, SABBATICAL?!?!

Hey, you're my third choice,  
don't take it personally.

*P*-value 0.1,  
please don't reject me!  
'Cause all the other guys  
made Type 1s quickly.  
Just think it through and  
advise me maybe?

Hey, you don't know me  
but I need funding.

I hear you have some;  
advise me maybe?

What? You're too busy?  
Advising twenty?

Just think it through and  
advise me maybe?

Before you came into my life I just took classes  
and hoped for passes  
on all my exams.

Before you came into my life I just took classes  
and you should know that...  
(I have no research experience.)

Hey, you're my fourth choice.  
I hear you're crazy.  
But you're all I have left, so,  
advise me maybe?!

Hey, you don't know me,  
I only made Bs  
in your classes.

Advise me maybe?  
Next year I'll have to pick  
a whole committee!  
Not leaving 'til you  
advise me maybe?

# SHRINK IT

*Lyrics by Bradley Turnbull, Joe Usset, Sidd Roy, and Kyle White*

[http://www.youtube.com/watch?v=\\_UTJbjBCUQg](http://www.youtube.com/watch?v=_UTJbjBCUQg)

I got a beta hat and great I get a zero score.  
Least squares works, but prediction's so poor.  
And I was thinking of ways that I could penalize.

I need some zero values!  
LASSO is what I choose!

You tune that baby up;  
just the best will come back.  
If prediction's all you want, OLS is on crack.  
Just shrink those betas down,  
then you loop it right back.  
(Thank you,)  
Tib-Tib Tib-Tib-shir-a-ni!!

Your betas tremble because your  $X$ s are collinear,  
and without a lambda you feel so singular.  
So I was thinking of ways that I could penalize.  
Makes no sense to select!  
Ridge regression perfect!

Now you leave one out, then you find a  $Y$ -hat.  
Then you sum them all up, yeah pick lambda like that.

Now beta's pretty small, but you like it like that.  
(Come on!)

Shrink shrink, shrink shrink, shrink it!!

My beta's biased but  
I kissed some variance goodbye.  
My MSE is not so mean,  
I guess this was worth my time?

The path ahead is sparse,  
so I will look up and pray:  
Oracle, please!

I can adapt and you can show me the way (way).

Now we're penalizing beta with a norm in  $L_1$   
and a fan of Thomas Bayes isn't missing any fun  
'cause a double exponential  
and the mode can get it done, c'mon!

Tib-Tib Tib-Tib-shir-a-ni!!  
Shrink shrink, shrink shrink, shrink it!!

# I THINK I'M A BAYESIAN

*Lyrics by Kristin Linn*

<http://www.youtube.com/watch?v=JmSKam4BCvU>

I think I'm Bayesian.  
For all my life taught  
parameters are fixed they don't come from  
distributions.  
Try to imagine:  
experiments repeat forever...  
such a silly notion!  
Propose this: New step.  
What should I do? Accept, reject?  
I feel free in these chains!

I think I'm a Bayesian.  
How did this happen?  
Just yesterday I tested H0s.  
But I just learned Bayes' rule,  
and priors seem cool,  
have no p-value so how do I know?  
If I'm a Bay Bay Bay Bay... Bayesian?  
Am I a Bay Bay Bay Bay... Bayesian?

I don't know if this makes sense but,  
I think I'm a Bayesian.

Give me a sampler:  
I'll go and tune it;  
I'll fly to it; I'll burn it in;  
'cause I love to run chains,  
cut strings,  
a couple things I can't do without Bayes!

Yeah I'm on top of the world,  
when my samplers all converge!  
Used to shrink my coefficients,  
now I use stochastic search!

My advisors be like, "Woah,  
what happened to you?  
Use a prior one more time and  
I'mma banish you to Duke!!"

Accept it, I know you want  
to join my table at the Chinese restaurant.  
My posterior is charming, so why don't you try?  
We're conjugate! Don't be shy!  
Yeah I know, all the frequentists say,  
"Shame on you!"  
But I tell them take a random walk  
'cause I know this is the start of something new!  
I think I'm a Bayesian!

I think I'm a Bayesian.  
How did this happen?  
Just yesterday I tested  $H_0$ s.  
But I just learned Bayes' rule,  
and priors seem cool,  
have no p-value so how do I know?

# SUPER BAYES

*Lyrics by Kristin Linn*

[http://www.youtube.com/watch?v=VY1e\\_vTmZKA](http://www.youtube.com/watch?v=VY1e_vTmZKA)

This one is for the boys with the distributions  
on their parameters, they be prior choosin'  
and over model space, they be samplin' up!  
Markov chains with reversible jump!

And he cool, got tools, he might have a rule  
that minimizes risk and when I see him at school.  
I trip, I flip, wanna kiss him on the lip  
'cause with a Bayes factor, he's so freakin' hip.

Conjugate or not not, do you think I'm hot hot?  
Based on my posterior, do I have a shot? Oh!  
You're the kinda guy I was lookin' for  
'cause your unknowns are random, yo.

I said, excuse me, you're a heck of a guy.  
I mean, my my my my, MCMC is fly.  
I mean, you're not shy 'round empirical types,  
and your estimates perform like a frequentist's  
might, oh!

Yes I did, yes I did.

I need an introduction 'cause I aint Sidd  
I am Kristin Linn, I love statistics, I take limits.

Multiply my likelihood by your prior.  
Be my conjugate and I'll take you higher.  
Don't you love those bay bay bay bay bay bay  
bay bay Bayesians, super Bayes,  
bay bay bay bay bay bay bay bay Bayesians,  
super Bayes.

You have an unknown  
you want to find.

Give it a prior,  
and multiply by  
the likelihood  
of the data.

Ignore that constant denominator!



Now you have it,  
a posterior.  
How will you use it?  
The choice is yours.  
Forget your p-values tonight.  
I'm 95% sure you'll be alright!

Bayes rule it will set you free.  
No more p-values and finally,  
don't need that crazy closed form density.  
Sample from it using MCMC!

If objective is the way to go,  
under transformation one can show,  
there's a prior invariant and so,  
thank you Jeffreys, you are my hero, oh!

When I was 22, I had my first love.  
His name was Bayes, no it wasn't just a phase,

and we used to stay up all night  
using WinBUGS.

Sampling with MCMC, oh I was star struck.  
He woke me up daily, don't need no Starbucks!  
We'd go on random walks,  
diagnose all our problems of convergence with  
autocorrelation plots.

He was really good at minimizing his risk.  
He knew he had me dazing  
cause he was so amazing.  
Freq 3:16 is fading  
'cause now I keep on saying...

Bayes rule it will set you free.  
No more p-values and finally,  
don't need that crazy closed form density.  
Sample from it using MCMC, yeah

Bayesians 'round the world agree  
both objective and subjectively.  
it makes sense to update prior beliefs.  
Bayes I love you, you're the one for me, me.

# IT'S THE LAW

*Lyrics by Kyle White*

<http://www.youtube.com/watch?v=2PCldtn7IYs>

What would we do without the CLT?  
What's a quick way to show consistency?  
Your study's budget don't matter to me.  
I am a statistician, I want more data, please!

It's the law, large sample theory,  
averages converge I guarantee.  
Asymptotics leave me in awe!

(It's the law)

You have to think in terms of infinity.  
Confusing at first, almost surely!  
Asymptotics leave me in awe!  
It's. The. Law.

We hope you have a sample that's i.i.d.  
Lindeberg's condition intimidates me!  
If you're feelin' stumped with these tough proofs,  
just be happy for Stefanski and Boos!

It's the law, large sample theory,  
averages converge I guarantee.  
Asymptotics leave me in awe!

(It's the law)

Sometimes you need more than thirty.  
Crazy that strong implies weak.  
Asymptotics leave me in awe!  
It's. The. Law.

A hundred thousand monkeys all typing away  
they go long enough they'll write my thesis someday

It's the law, large sample theory,  
averages converge I guarantee.  
Asymptotics leave me in awe!

(It's the law)

You have to think in terms of infinity  
Confusing at first, almost surely  
Asymptotics leave me in awe  
It's. The. Law.

# THE CURSE OF HIGH DIMENSION

*Lyrics by Kristin Linn and Bradley Turnbull.*

[http://www.youtube.com/watch?v=P-yk\\_EZKAYs](http://www.youtube.com/watch?v=P-yk_EZKAYs)

I'm the king of Monte Carlo  
And numerical methods too  
When the problem is in one dimension  
There's no integral I can't compute

Oh, ah it's integration time  
Oh, ah it's computation time

Gaussian quadrature and Simpson's rule  
they get harder when you move into  
higher dimensions

Gaussian quadrature and Simpson's rule  
they get harder when you move into high into  
higher dimensions

Doctor Monahan tried to warn me  
Things get harder exponentially  
Well, I'm trapped in the fifth dimension  
Will I ever get to Fat City?

Oh, ah, I wanna get to Fat City  
Oh, ah, and sing the Jeopardy Theme

Want my error to be bounded by  
order  $h$  squared but I need a bigger sample  
Want my error to be bounded by  
order  $h$  squared but I need a need a bigger sample

Curse of high dimension!

Doctor Monahan don't have a fit  
I used the solve command to get an inverse quick  
Doctor Monahan don't have a fit  
I used the solve command to get an inverse quick  
Want my error to be bounded by  
order  $h$  squared but I need a bigger sample  
Want my error to be bounded by  
order  $h$  squared but I need a need a bigger sample

Curse of high dimension!