9/2

**Want**

**a**

Mean Squared

**@mor**

=

ŵ ML

← Max likelihood**.**

**Wx**+6

N (Wx, C)

WEIR

way to

216

(xx)2xy1

~(0,1)

A ERd

**ML**

understand

estimating w

E - **WI**

[124] =

ML

**over randomness**

**in y**

xy randum

{(x,y)....

(an, Yn)

**Wx, +E,**

how good ŵML is **in**

**2**

6. trace

= ((xx)')

↑

**i=1**

i

ith Eigenvalue

A =

al

d

**02**

tr(A) = Σa; =

**trace**

· ((xx)'*)*

**Let**

of **A**

of (xx)

Eigenvalues of *(xx)*"

Mean **squeror** (WHL)

**be**

**Eigen** values

bure

{=/>

6

I Me

-12

to}

}

Consider the

**following**

ŵnew

**3**

**new**

Some

**matrix**

estimator :

(xx

x2 + λI**)** xy

**EIR+**

یال

**\_dxd**

EIR

**Am** = (xx2) xy

let Eigen **values** be {x,,···, λd}

Eigenvalues of

What

**are**

trace ((xx + *x2)")*

=

A**+2I**?

(無)

**i= 2; +2**

?

ر

{ditas

**7**

Av1 =2,~ (A+21) √, = **A√, +2√,** =2,**√,+221** = (+2**)√,**

For

EXISTENCE Thm: (Informal)

FRER St

Wnew = (xx2 + 2I) xy

**than WME**

ML

has

lesser mean sq. **enor**

In practice,

find a

**by**

CROSS

VALIDATION

TRAIN **SET**

**VALIDATION**

SET

**80**%

**20%**-

**Train**

**on**

**the** training set

and

Check for

emor

**on** validation

**Spy.**

Pick that **λ**

gives

least

**emor**.

**K-**FOLD

CROSS VALIDATION

**Fi**

**F2**

**Fk**

**Train on** Fords

{F1,... **Firty** Fit Fil*}*

Validate on **Fi**

Pick A **that gives**

**least** average error-

**LEAVE ONE**

**OUT**

CROSS VALIDATION

ŵnew = (**xx2 +22)** Xy

Is there

**an**

alternate

**way**

to

BAYESIAN MODELING

under **stand**

**WML?**

NEED A **PRIOR on** ω

i.e.,

P)

**PC.**

LIKELIHOOD

Y/r

**~**

N(WI)

**For** Simplicity. Can use & as

**well**.

A

CHOICE

FOR

PRIOR

As usual,

**3**

**~**

d

EIRO

N(ŏ, 21)

〆

COVARIANCE

**212**

MATRIX

R

dxd.

P(w)

P(~/ 1607 (908) a P(280) Day)-(~)

له

又

**i=**1

*(*Yi**-**wxj)

2

-

Пе

**izl**

2

2

**-(w;-(** Te 232

izl

2

@

e

MR

Hull

272

How will the

MAP **estimate**

**arg**

**estimate** look like?

.wxi) =

Ŝ - (y; **- W x;)**

W

**max**

MAP

**w**

i**=1**

ŵ

**MAP**

[

**ang**

mìn s

W dist

2

|| will**?**

272

**Wxi**

+ 1 ||wl*|* 2

**Take** gradient**, Set**

it

to

0

**2212**

**f**(w)

to solve for ŵ MAP.

МАР

(F(w)

=

(xx2)w

Xy +

**HAP**

**3/d**

**22**

**T**

(xx + 1 ) x y

**22**

[verify]

**CONCLUSION**

**MAP**

ESTIMATION

**for**

**with**

**a**

CROSS **VALIDATE in**

**linear**

Gaussian priot (N(0, 31)

PRACTICE

regression

for is

له

equivalent

**to**

"NEW" **estimator**

We

**used** Earlier

LINEAR

REGRESSION

=

**ang min**

**(wz**; -y;)2

RIDGE REGRESSION

**WML**

ML

"

**arg min**

**W**

Σ (wxi-y;)2

i=1

+

REGULARIZER

RIDGE

Loss

label

**fi**

fz

£3

height

**Weight**

**2 height + 3** weight

**3** height #4 **weght**

T

O

C1

C2

**3**

4

**O**