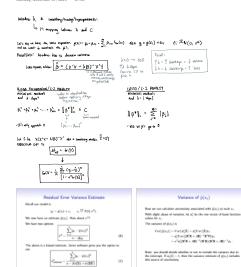
## Penalized Splines and GAMs Summary



Confidence interval and prediction interval

Obtain point wise confidence interval derived from previous expression to plugging in  $\partial^{+}$  for  $\partial^{+}$ . If  $\lambda = 0$  the previous equation reduces to the CLS scalance. Similarly the variance for an unclearned point  $g_{ij}^{+}$  with covariate  $g_{ij}^{+}$  has settince.

 $V_{\rm HP}(\omega^*) = \sigma^2 + \sigma^2 \sigma^2 (\mathbf{X}^*\mathbf{X} + \lambda \mathbf{R})^{-1} (\mathbf{X}^*\mathbf{X}) (\mathbf{X}^*\mathbf{X} + \lambda \mathbf{R})^{-1} \sigma^2$ .



For the deviance residuals plot, the data fits well and does not deviate too much from the straight line. This suggests that our normality assumption is of violated.

The summary of the summary of the summary of the production of the summary of the summary of the production of the summary of the summary of the deepaste for capturing the underlying electrohysis for utilities. For the response w. Fitted values plot, it should look linear if it is sufficient, in which it does.

Finally, the histogram of residuals appears to be normal. Visually, it appears that there may be no dissues. Checking gam The default is 0 = 10, such that highest possible EDF is 9 (because of identifiability coestoint).

> em checkent) -> Guillet up -> 4 pri disputable. By your "" " said is " wais," pay than eif a light here down unwnortation. Using mathematical notation, with  $g_j(x_{ij})$  for smooth terms, write out a statistical model with normal errors for the cross-sectional data with  $y_i$  denoting hippocampus volume in orm? and the convariates ox, prosisces, aroxi, (treating APOE4 as a factor with reference level 0), a smooth  $x_i$  are a smooth for pressure. Include distributional assumptions, (You do not need to write the basis functions used for the smooth terms  $g_j(x_{ij})$ , or the penaltiest objective functions.) where the product of  $y_i \stackrel{iid}{\sim} N(\mu_i, \sigma^2)$ where y<sub>i</sub> is hippocampus volume in cm\*3 for individual i,  $y_i = \beta_0 + \beta_1 DX_i + \beta_2 PTGENDER_i + \beta_2 APOE4_{1i} + \beta_2 APOE4_{2i} + g_1(AGEVISIT_i) + g_2(PTEDUCAT_i) + \epsilon$  $\beta_0$  is the baseline hippocampal volume without considering other covariates:  $\beta_1$  is the estimated effect for diagnosis, with 0 as the reference level,  $\beta_1$  is the estimated effect for gender, with female as the reference level,  $\beta_1$  is the estimated effect for APOE4 with 1 copy of the allele, with the reference group being 0,  $\beta_4$  is the estimated effect for APOE4 with 2 copies or the allele, with the reference group being 0,  $\beta_4$  is the estimated effect for APOE4 with 2 copies or the allele, with the reference group being 0,  $\beta_4$  (AEVISIT) is the smoothing term for age\_volit,  $g_2$ (PTEDUCAT), is the smoothing term State the null hypothesis for each p-value in the spline basis dimension diagnostics in  $_{gam.check}()$  . Then state whether it is acc at  $\alpha=0.05$ . \* ||Y-XA-20||2+=10|2 of the so werd tendent possibly → strains under tennede D H0: The basis dimension for PTEDUCAT is adequate Extracting Effects from a Smooth Function
We want to edinate the effect of a 10 pg/m² because in PM<sub>2.0</sub> levels
from 40 to 50 pg/m² behavior to respect to the control of the control
10 minutes from terroscopic layer 10 minutes from 10 pg/m² specially.
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10 minutes from terroscopic layer 10 minutes from 10 pg/m² specially. Interpretation of model Daily counts of non-accidental mortality were positively a with provious-day PM<sub>3.5</sub> level among those 65 or above. In linear regression  $\hat{y}_i = \hat{\beta}_0 + \hat{\beta}_1 x_i$ . In GAMs, we have  $\hat{y}_i = \hat{\beta}_0 + \hat{g}(x_i),$  and slope changes with  $x_i.$ Approximately Secar on log scale. > need <= beside(), 1 # greb ear rev > secoligate() and <= 1 - 1 = 0.0 # subtract none small number > 31 <= predict(fits, need) > 32 <= predict(fits, need) > 32 <= predict(fits, need) > (pr = 21)/20=0. 

> \* We estimated a 0.00105 increase in log death count per unit  $(\mu_0/m^2)$  increase in PM  $_{2.5}$  level in the previous day. \* 10 unit increase in PM $_{2.5}$  level from the previous day increased daily death-counts by 100 \* ( $e^{(0.00000\times10)}-1)\%=1.09\%$ .

s a.consens. So our entireste in 8.032 (95%C1 8.001, 8.044). The same effects of a 10 anis increase in PM $_{3,3}$  levels from 20 to 30  $\mu_{\rm R}/\nu^4$  in 8.030 (96%C1 8.004, 8.816). These the estimates are very similar because the PM $_{3,3}$  effect appears to