Professor Morris's 1-D Smoothing Example (Using the \texttt{gam} Package)

\begin{verbatim}
> x <- c(0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 1)
> y <- c(1.0030100, 0.8069872, 0.6690364, 0.6281389, 0.5542417, 0.5105527, 0.5306341, 0.5023322, 0.6103748, 0.7008915, 0.9422990)
> fitsmspline <- gam(y ~ s(x))
> fit1.1 <- gam(y ~ s(x, 1.1))
> fit1.5 <- gam(y ~ s(x, 1.5))
> fit2 <- gam(y ~ s(x, 2))
> fit3 <- gam(y ~ s(x, 3))
> fit4 <- gam(y ~ s(x, 4))
> fit5 <- gam(y ~ s(x, 5))
> fit6 <- gam(y ~ s(x, 6))
> yandfits <- cbind(y, fitted.values(fitsmspline), fitted.values(fit1.1), fitted.values(fit1.5), fitted.values(fit2), fitted.values(fit3), fitted.values(fit4), fitted.values(fit5), fitted.values(fit6))
> matplot(x, yandfits)
> matlines(x, yandfits)
\end{verbatim}
> plot(fitsmspline, se=TRUE, col="blue")

> summary(fitsmspline)

Call: gam(formula = y ~ s(x))
Deviance Residuals:
    Min        1Q    Median        3Q       Max
  -0.035126 -0.021672  0.002452  0.020933  0.038000

(Dispersion Parameter for gaussian family taken to be 0.001)

    Null Deviance: 0.2957 on 10 degrees of freedom
Residual Deviance: 0.0061 on 6.0001 degrees of freedom
AIC: -39.1886

Number of Local Scoring Iterations: 2

Anova for Parametric Effects
  Df  Sum Sq Mean Sq F value Pr(>F)
  s(x) 1.0000 0.0126402 0.0126402 12.359 0.01259 *
Residuals 6.0001 0.0061366 0.0010228
...
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Anova for Nonparametric Effects

<table>
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<tr>
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<th>Npar</th>
<th>Df</th>
<th>Npar F</th>
<th>Pr(F)</th>
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<td>(Intercept)</td>
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<td>s(x)</td>
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<td>0.263</td>
<td>2.21e-05</td>
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</table>

Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

> plot(fitted.values(fitsmspline), fitted.values(fit4))
```r
> fitlinsmooth <- gam(y ~ lo(x))
> plot(fitlinsmooth)
> fitl.9 <- gam(y ~ lo(x, span = .9))
> fitl.8 <- gam(y ~ lo(x, span = .8))
> fitl.7 <- gam(y ~ lo(x, span = .7))
> fitl.6 <- gam(y ~ lo(x, span = .6))
> fitl.5 <- gam(y ~ lo(x, span = .5))
> fitl.4 <- gam(y ~ lo(x, span = .4))
> yandlfits <- cbind(y, fitted.values(fitlinsmooth), fitted.values(fitl.9), fitted.values(fitl.8), fitted.values(fitl.7), fitted.values(fitl.6), fitted.values(fitl.5), fitted.values(fitl.4))
> matplot(x, yandlfits)
> matlines(x, yandlfits)
```
```r
> plot(fitlinsmooth, se=TRUE, col="blue")
```

![Plot of a smooth fit with confidence intervals](image)

The plot shows a smooth curve fit to the data with confidence intervals indicated. The curve is smooth and the confidence intervals are represented by dotted lines. The x-axis is labeled as 'x' and the y-axis is labeled as 'lo(x)'. The curve appears to be a parabolic shape with a minimum point near the center of the x-axis.
> summary(fitlinsmooth)

Call: gam(formula = y ~ lo(x))
Deviance Residuals:
Min     1Q    Median     3Q    Max
-0.0441666 -0.0201828 -0.0003914  0.0200613  0.0412689

(Dispersion Parameter for gaussian family taken to be 0.0013)

    Null Deviance: 0.2957 on 10 degrees of freedom
Residual Deviance: 0.0073 on 5.7736 degrees of freedom
AIC: -36.822

Number of Local Scoring Iterations: 2

Anova for Parametric Effects
Df Sum Sq Mean Sq F value  Pr(>F)
lo(x) 1.0000 0.0126402 0.0126402  9.9935 0.02058 *
Residuals 5.7736 0.0073027 0.0012648
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Anova for Nonparametric Effects
Npar Df Npar F Pr(F)
(Intercept)
lo(x) 3.2 67.578 6.397e-05 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

> summary(fitl.5)

Call: gam(formula = y ~ lo(x, span = 0.5))
Deviance Residuals:
Min     1Q    Median     3Q    Max
-0.0441666 -0.0201828 -0.0003914  0.0200613  0.0412689

(Dispersion Parameter for gaussian family taken to be 0.0013)

    Null Deviance: 0.2957 on 10 degrees of freedom
Residual Deviance: 0.0073 on 5.7736 degrees of freedom
AIC: -36.822

Number of Local Scoring Iterations: 2

Anova for Parametric Effects
Df Sum Sq Mean Sq F value  Pr(>F)
lo(x, span = 0.5) 1.0000 0.0126402 0.0126402  9.9935 0.02058 *
Residuals 5.7736 0.0073027 0.0012648
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Anova for Nonparametric Effects
Npar Df Npar F Pr(F)
(Intercept)
lo(x, span = 0.5) 3.2 67.578 6.397e-05 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
> plot(fitted.values(fitlinsmooth), fitted.values(fitl.5))

> plot(fitted.values(fitlinsmooth), fitted.values(fitsmspline))