Estimating the conditional variance by local linear regression

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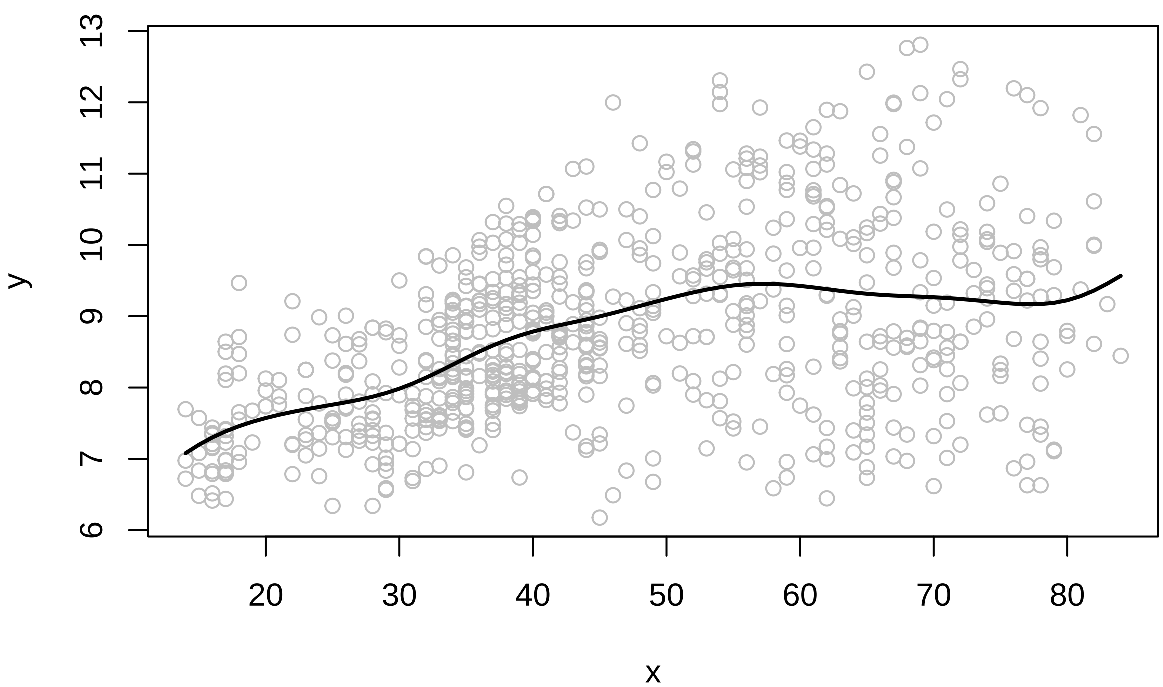
```
x <- Yr
y <- lg_weight
n <- length(x)
```

Estimating the conditional variance (Using loc.pol.reg)

1.Fit a nonparametric regression to data (x_i, y_i) and save the estimated values $\hat{m}(x_i)$.

```
fit.lpr <- fit.loc_pol_reg(x, y)
```



```r
fit_y <- fit.lpr$lpr
mtgr <- fit_y$mtgr # \hat_{m}(x_i)
```

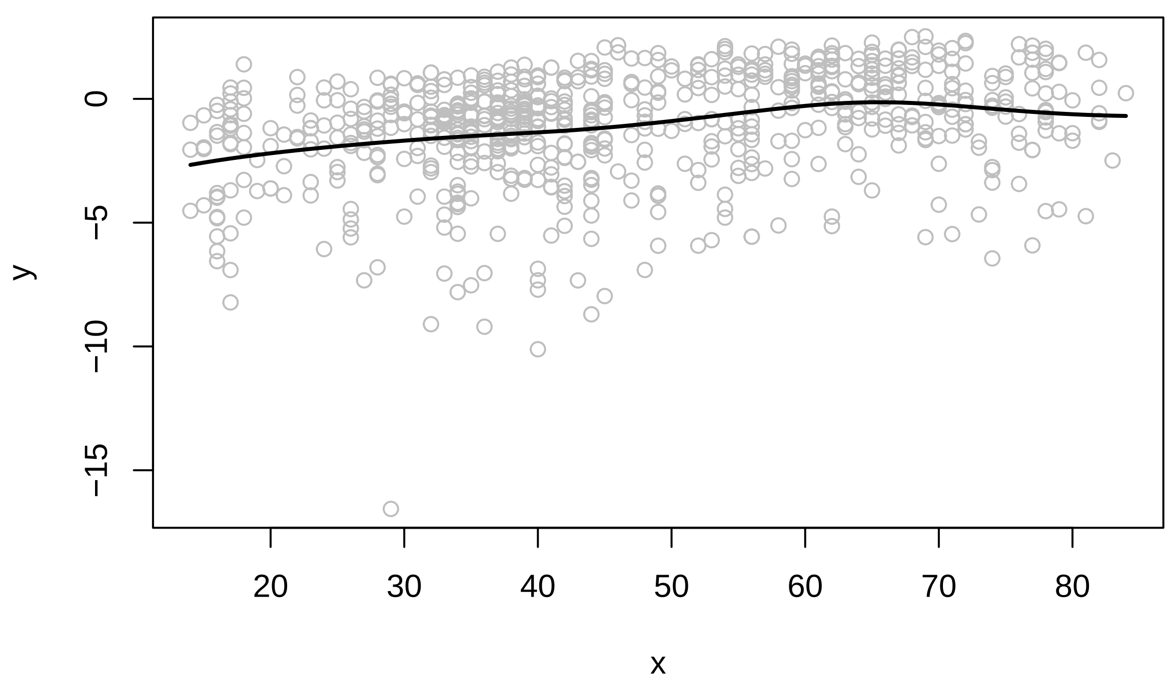
2.Transform the estimated residuals $\hat{\epsilon} = y_i - \hat{m}(x_i)$

$$z_i = \log \epsilon_i^2 = log((y_i - \hat{x_i}))^2)$$

```r
hat_e <- y - mtgr
z <- log((hat_e)^2)
```

3. Fit a nonparametric regression to data (x_i, z_i) and call the estimated function $\hat{q}(x)$. Observe that $\hat{q}(x)$ is an estimate of log $\sigma^2(x)$.

```r
fit_z <- fit.loc_pol_reg(x, z)$lpr
```




```r
qtgr <- fit_z$mtgr
```

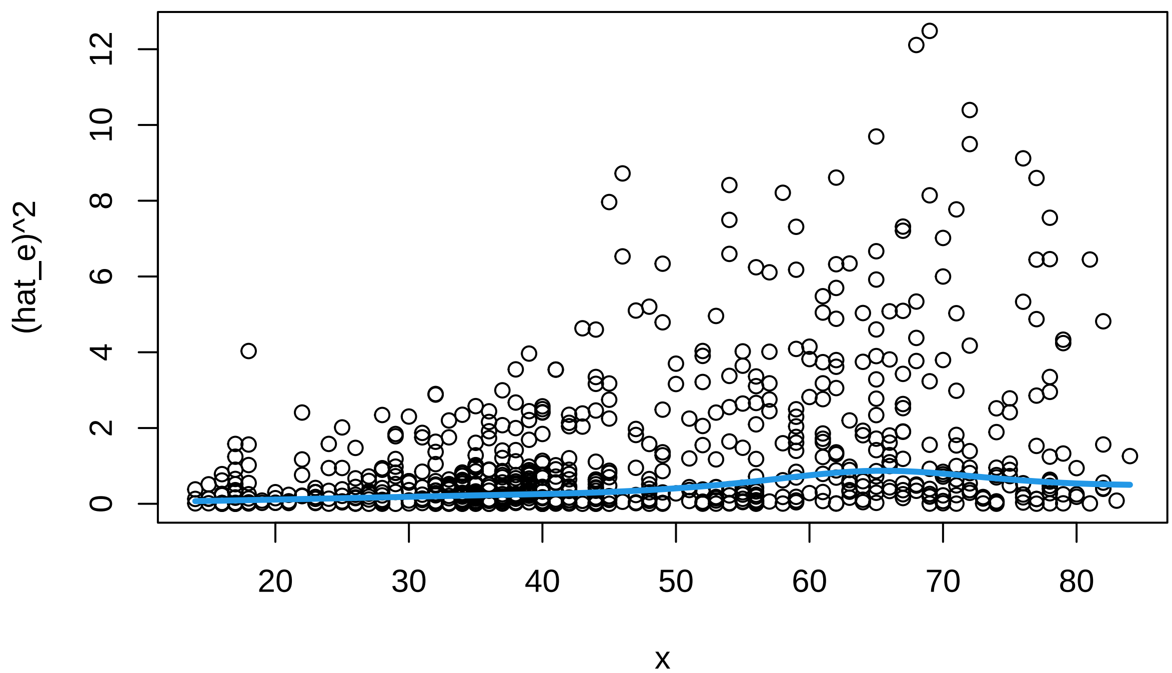
4. Estimate $\sigma^2(x)$ by

$$\hat{\sigma}^2(x) = e^{\hat{q}(x)}$$

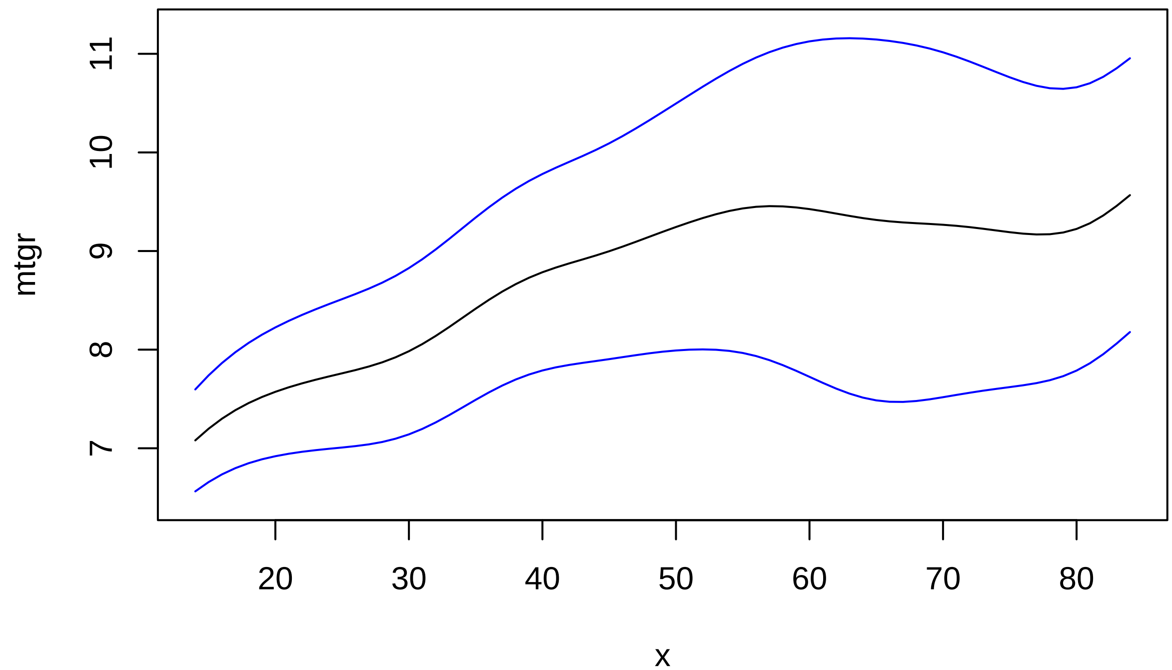
```r
sig.sqr <- exp(qtgr)
```

plots

```r
plot(x, (hat_e)^2)
lines(x, sig.sqr, col=4, lwd=3)
```



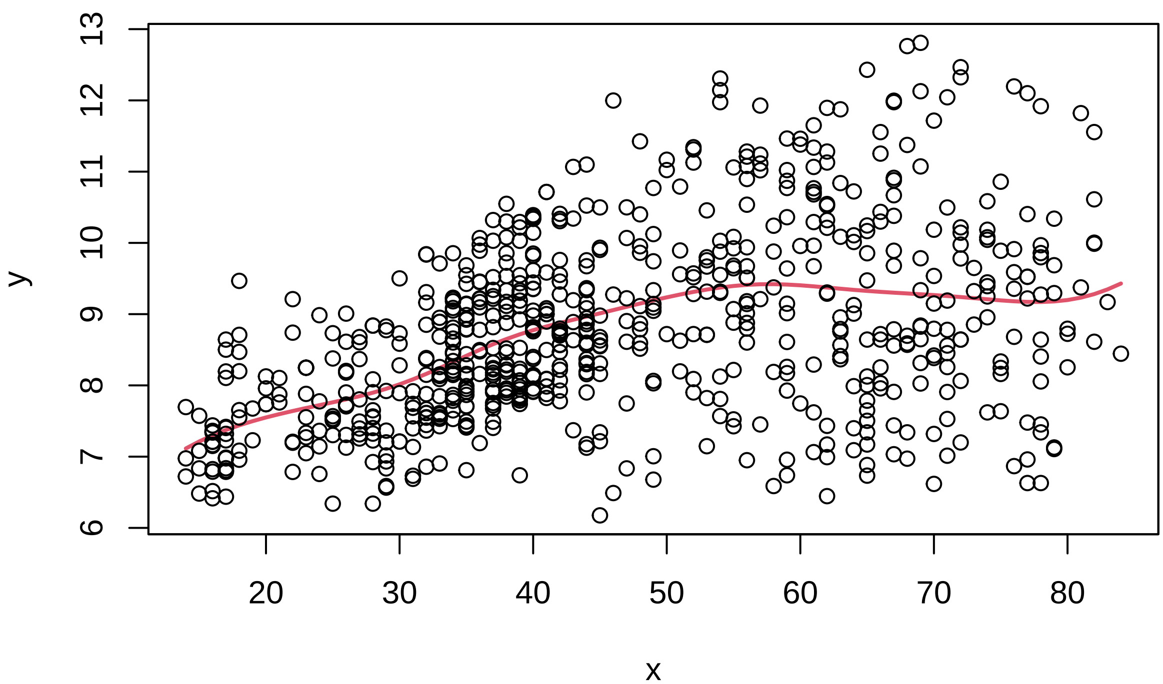

```r
y.min <- min(mtgr - 1.96 * sqrt(sig.sqr)) - 0.1
y.max <- max(mtgr + 1.96 * sqrt(sig.sqr)) + 0.1
plot(x,mtgr, type = 'l', ylim=c(y.min, y.max))
lines(x,mtgr + 1.96 * sqrt(sig.sqr), col="blue")
lines(x,mtgr - 1.96 * sqrt(sig.sqr), col="blue")
```



Estimating the conditional variance (Using sm.regression)

1.Fit a nonparametric regression to data (x_i, y_i) and save the estimated values $\hat{m}(x_i)$.

```
h.dpi <- dpill(x=x, y=y, range.x=range(x))
sm_regression <- sm.regression(x=x, y=y, eval.points=x, h=h.dpi, pch=1, cex=1, col=2, lwd=2)
```




```
mtgr_sm <- sm_regression$estimate
```

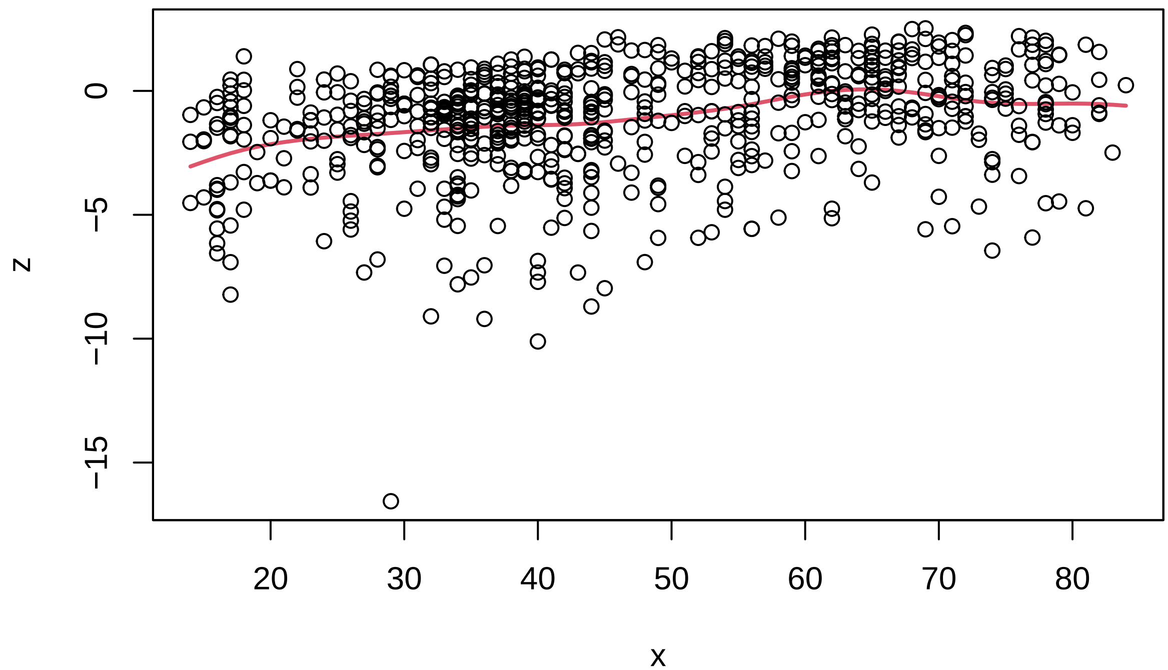
2.Transform the estimated residuals $\hat{\epsilon} = y_i - \hat{m}(x_i)$

$$z_i = \log \epsilon_i^2 = log((y_i - \hat{x}_i))^2)$$

```
hat_e_sm <- y - mtgr_sm
z_sm <- log((hat_e_sm)^2)
```

3. Fit a nonparametric regression to data (x_i, z_i) and call the estimated function $\hat{q}(x)$. Observe that $\hat{q}(x)$ is an estimate of log $\sigma^2(x)$.

```
sm_regression_z <- sm.regression(x=x, y=z, pch=1, cex=1, col=2, lwd=2,
                                 eval.points=x,
                                 h=dpill(x=x, y=z, range.x=range(x)))
```




```r
qtgr_sm <- sm_regression_z$estimate
```

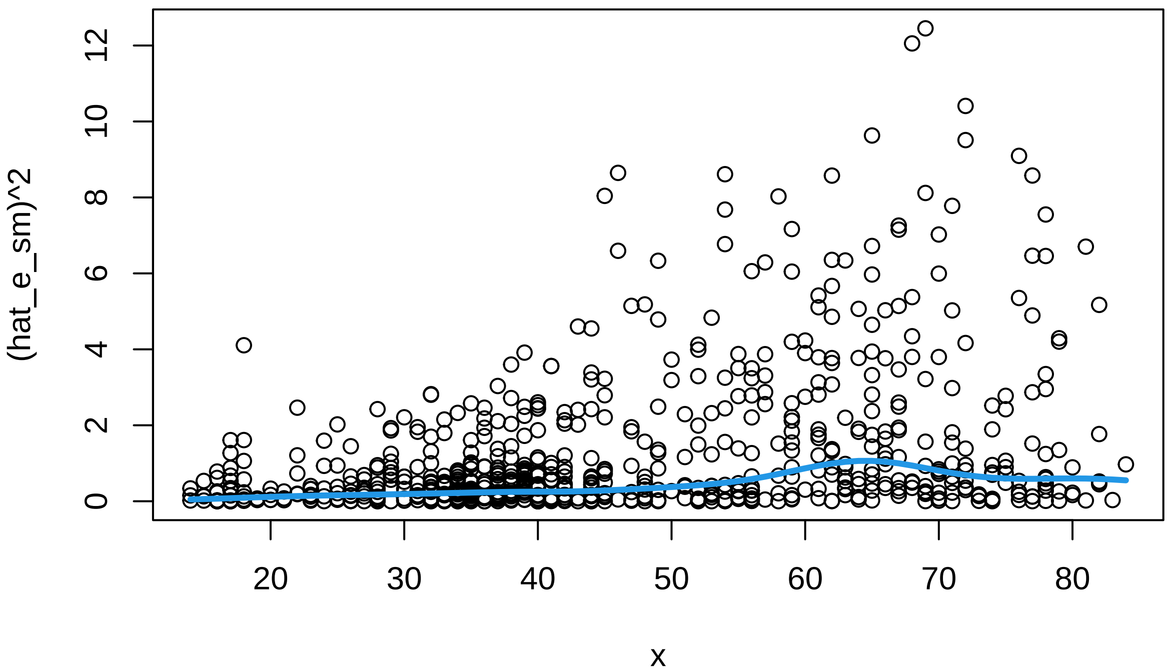
4. Estimate $\sigma^2(x)$ by

$$\hat{\sigma}^2(x) = e^{\hat{q}(x)}$$

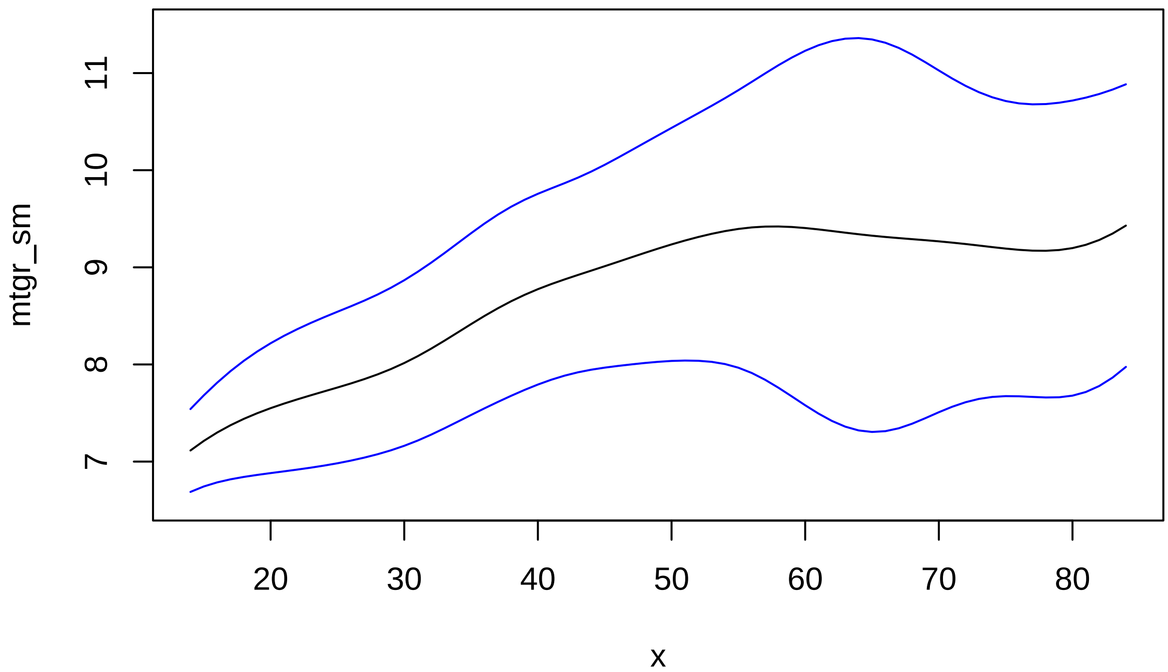
```r
sig.sqr_sm <- exp(qtgr_sm)
```

plots

```r
plot(x, (hat_e_sm)^2)
lines(x, sig.sqr_sm, col=4, lwd=3)
```




```r
y.min_sm <- min(mtgr_sm - 1.96 * sqrt(sig.sqr_sm)) - 0.1
y.max_sm <- max(mtgr_sm + 1.96 * sqrt(sig.sqr_sm)) + 0.1
plot(x,mtgr_sm, type = 'l', ylim=c(y.min_sm, y.max_sm))
lines(x,mtgr_sm + 1.96 * sqrt(sig.sqr_sm), col="blue")
lines(x,mtgr_sm - 1.96 * sqrt(sig.sqr_sm), col="blue")
```



mtgr_sm
11
10
9
8
7
20
30
40
50
60
70
80
x