pre_plots

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```
library(tidyverse)
library(here)
library(ggplot2)
library(purrr)
devtools::load_all()
```

Plots to illustrate the effect of the kernel function & bandwidth

```
# data setting
n <- 3000
x <- rnorm(n)
grid <- seq(-4,4, 0.1)
```

Effect of the kernel function

```
kers  <-  c("normal","epanech", "biweight", "triweight")
hs <- 1.06*sd(x)*n^(-0.2)

sim_ker <- as.data.frame(kers) %>% mutate(
  f_est = map(.x=kers,~KDE_est(x,grid,hs,.x)$f_est),
  grid = map(.x=kers,~KDE_est(x,grid,hs,.x)$grid)
)


## plots
sim_ker <- unnest(sim_ker)
```

```
## Warning: `cols` is now required.
## Please use `cols = c(f_est, grid)`
```

```
png(here("plots", "KDE_kernels.png"),width=1200, height=600)
sim_ker %>%
  ggplot()+
  geom_line(aes(x = grid,y = f_est,color = kers), size=1)+
  stat_function(fun = dnorm,
                args = list(mean =0, sd = 1),
                color = "red", linetype = "dashed", size=1) +
```

```
  xlab("x")+
  ylab("density")+
  theme_bw() +
  labs(title = "KDE of N(0,1) sample with different kernel functions",
              subtitle = "The red dash line is the ture N(0,1) density",
       color="Kernel")+
  theme(axis.text.x = element_text( hjust = 1), plot.title = element_text(size=20), plot.subtitle = ele
   theme(legend.position = c(0.8, 0.6),
         legend.title = element_text(size = 20),
          legend.text = element_text(size = 20))

dev.off()
```

```
## pdf
##   2
```

Effect of the bandwidth

```
h <- c(0.05,0.1,0.3)

sim_h <- as.data.frame(h) %>% mutate(
  f_est = map(.x=h,~KDE_est(x,grid,.x,"normal")$f_est),
  grid = map(.x=h,~KDE_est(x,grid,.x,"normal")$grid)
)

## plots
sim_h <- unnest(sim_h)
```

```
## Warning: `cols` is now required.
## Please use `cols = c(f_est, grid)`
```

```
png(here("plots", "KDE_bandwidths.png"),width=1200, height=600)
sim_h %>%
  ggplot()+
  geom_line(aes(x = grid,y = f_est,color = factor(h)), size=1)+
  stat_function(fun = dnorm,
                args = list(mean =0, sd = 1),
                color = "red", linetype = "dashed", size=1) +
  xlab("x")+
  ylab("density")+
  theme_bw() +
  labs(title = "KDE of N(0,1) sample with different bandwidths",
       subtitle = "The red dash line is the ture N(0,1) density",
       color = "Bandwidth")+
  theme(axis.text.x = element_text( hjust = 1), plot.title = element_text(size=20), plot.subtitle = ele
   theme(legend.position = c(0.8, 0.6),
         legend.title = element_text(size = 20),
          legend.text = element_text(size = 20))

dev.off()
```

```
## pdf
##   2
```

Beaver's data

Density plots using the bulit-in density function

```
png(here("plots", "beaver_hist.png"),width=1200, height=600)
hist(beaver1$temp, breaks = 30, main = "Histogram of beaver's body temperature", xlab = "temperature")
dev.off()
```

```
## pdf
##   2
```

```
png(here("plots", "beaver_density.png"),width=1200, height=600)
plot(density(beaver1$temp), main = "Estimation results using the built in density() function", xlab = "
dev.off()
```

```
## pdf
##   2
```

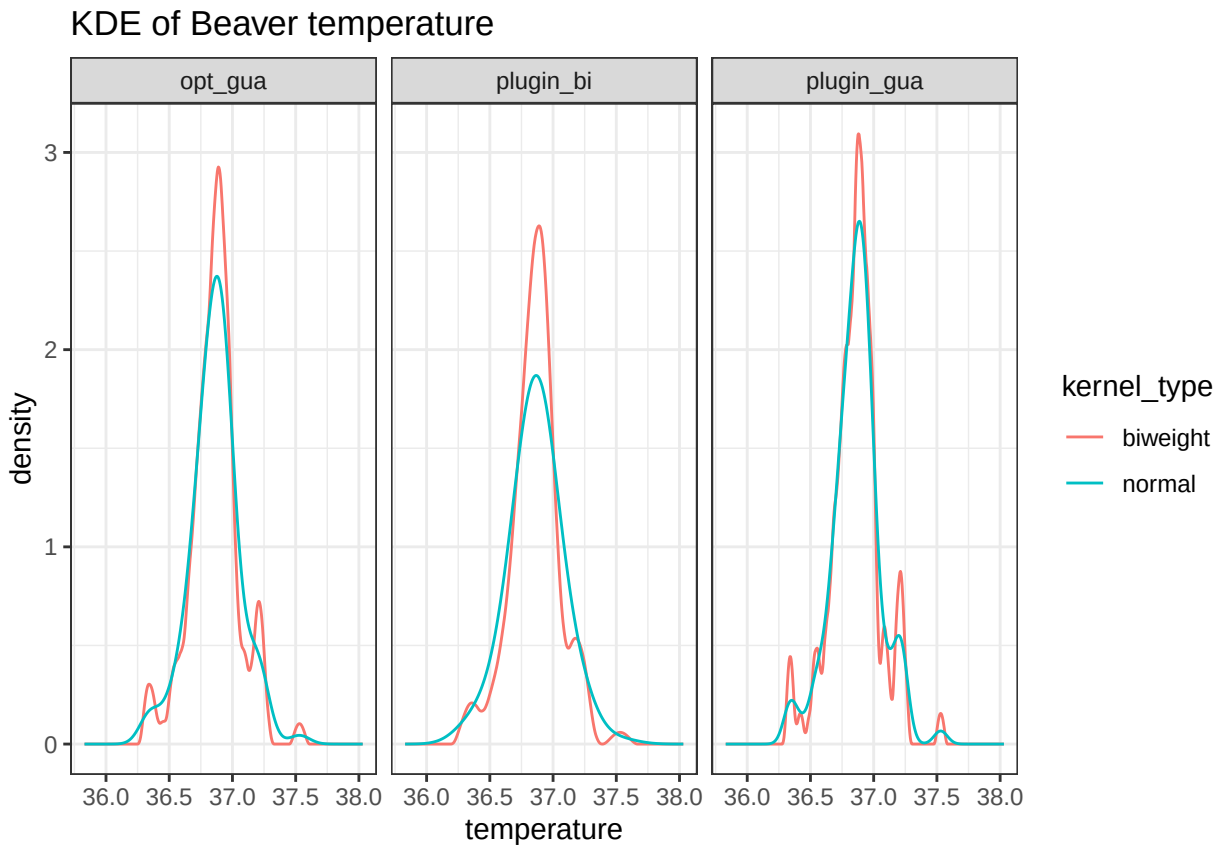
KDE estimation results using own function

```
est_big <- read_rds(here("results", "beaver.rds"))

est_big_df <- unnest(est_big)
```

```
## Warning: `cols` is now required.
## Please use `cols = c(f_ests, grid)`
```

```
est_big_df %>%
  ggplot()+
  geom_line(aes(x = grid,y = f_ests,color = kernel_type))+
  facet_wrap(~bandwidth_type)+
  xlab("temperature")+
  ylab("density")+
  theme_bw() +ggtitle("KDE of Beaver temperature")
```




```
# est_big_df %>%
#   ggplot()+
#   geom_line(aes(x = grid,y = f_ests,color = bandwidth_type), size=2)+
#   facet_wrap(~kernel_type)+
#   scale_colour_manual(values = method.c) +
#    xlab("temperature")+
#   ylab("density")+
#   theme_bw() +ggtitle("KDE of Beaver body temperature")+
#   theme(axis.text.x = element_text( hjust = 1), plot.title = element_text(size=20))+
#   theme(axis.text.y = element_text(colour = 'black', size = 12),
#           axis.title.y = element_text(size = 12,
#           hjust = 0.5, vjust = 0.2))

method.c <- c("plugin_gua" = "darkorange",
              "plugin_bi" = "dodgerblue",
              "opt_gua" = "gray")

png(here("plots", "beaver_KDE.png"),width=1200, height=600)

est_big_df %>% filter(kernel_type=="normal") %>%
  ggplot()+
  geom_line(aes(x = grid,y = f_ests,color = bandwidth_type), size=1.5)+
  facet_wrap(~kernel_type)+
  scale_colour_manual(values = method.c) +
   xlab("temperature")+
  ylab("density")+
```

```
  theme_bw() +ggtitle("KDE of Beaver body temperature")+
  theme(axis.text.x = element_text( hjust = 1), plot.title = element_text(size=20))+
  theme(axis.text.y = element_text(colour = 'black', size = 12),
          axis.title.y = element_text(size = 12,
          hjust = 0.5, vjust = 0.2))
dev.off()
```

```
## pdf
##   2
```