Fitting distributions in R

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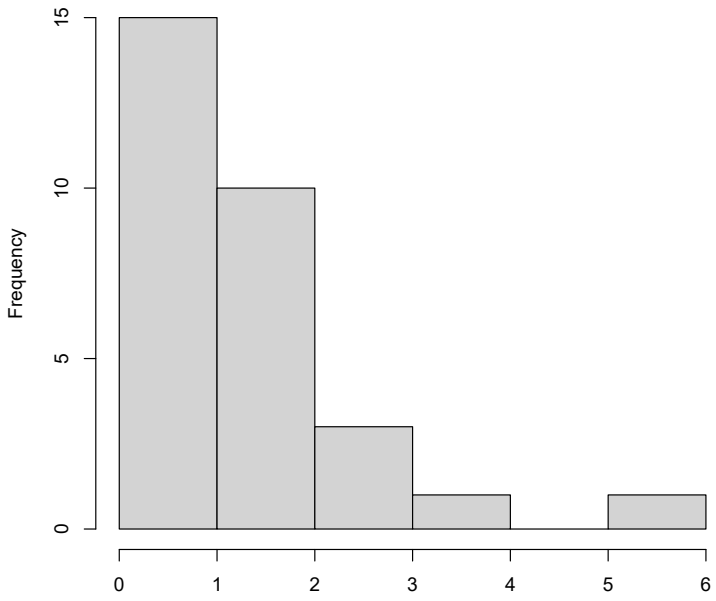
Generating data

I am creating a skewed data here for demonstration. In this case, I am generating a distribution with 30 data points from the exponential distribution, and plotting the histogram of the data.

```
set.seed(123) # Setting seed for reproducibility of random numbers
dist <- rexp(30, rate = 0.75)
par(mar = c(2,5,0,0)) # To remove margins around plot
hist(dist, main = "", xlab = "") # Plotting without title and x axis label
```



Loading required libraries

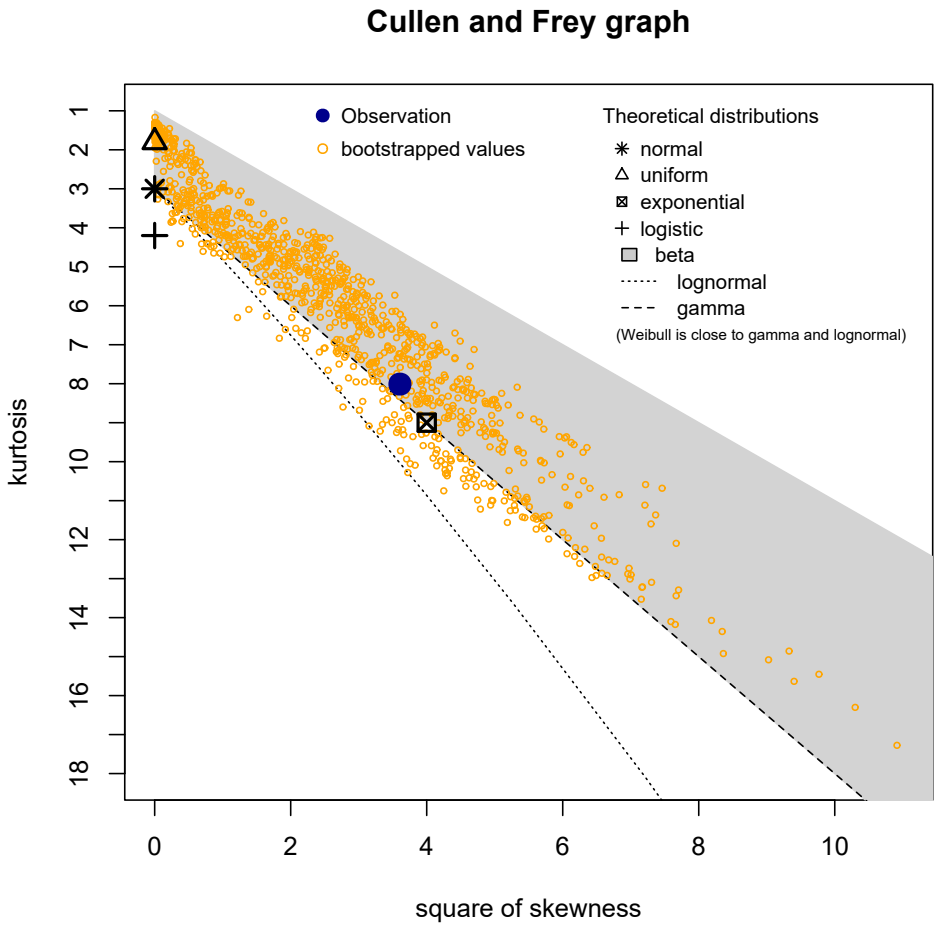
We will be using the package `fitdistrplus` for fitting distributions on the data. We will also load `knitr` to use the `kable()` function for producing nice looking tables.

```
library(fitdistrplus)
library(knitr)
```

Assessing the distributions - step 1

We will use `descdist` function to assess the distribution. As the data is continuous, we need to provide the argument `discrete = FALSE` in the command (for discrete distributions like Poisson, it will be `TRUE`). As the sample size is low, in order to assess the distribution better, we will ask the command to bootstrap the data to create a large sample size (1000). The command will give us a plot for assessment.

```
descdist(dist, discrete = F, boot=1000)
```



In the plot, the blue circle is our data, and the orange circles are bootstrapped points. We see both fall in the gray region, near the dashed line and cross-mark.

The gray region indicates fit to beta distribution - the values of which range between 0-1, thus we won't consider beta distribution here.

The dashed line corresponds to gamma distribution, and the crossed mark corresponds to exponential distribution - a special case of gamma distribution. These two seems to be the viable options.

If the points were centered around the star-mark, then it normal distribution would have been a better fit.If the points were around the dotted line, then log-normal distribution would have been a viable option.In any case, we will check the fit to all of the options mentioned above.

Assessing the distributions - step 2

Fitting the distributions

We are going to fit the data to the distributions using `fitdist()` function.

```
normal <-fitdist(dist, "norm")
lognormal <-fitdist(dist, "lnorm")
exponential <-fitdist(dist, "exp")
gamma <-fitdist(dist, "gamma")
```

Assessing fit using plots

We are going to plot 4 different types of plots.

1st is a density function plot, providing a density estimation along with histogram of data and theoretical distribution.

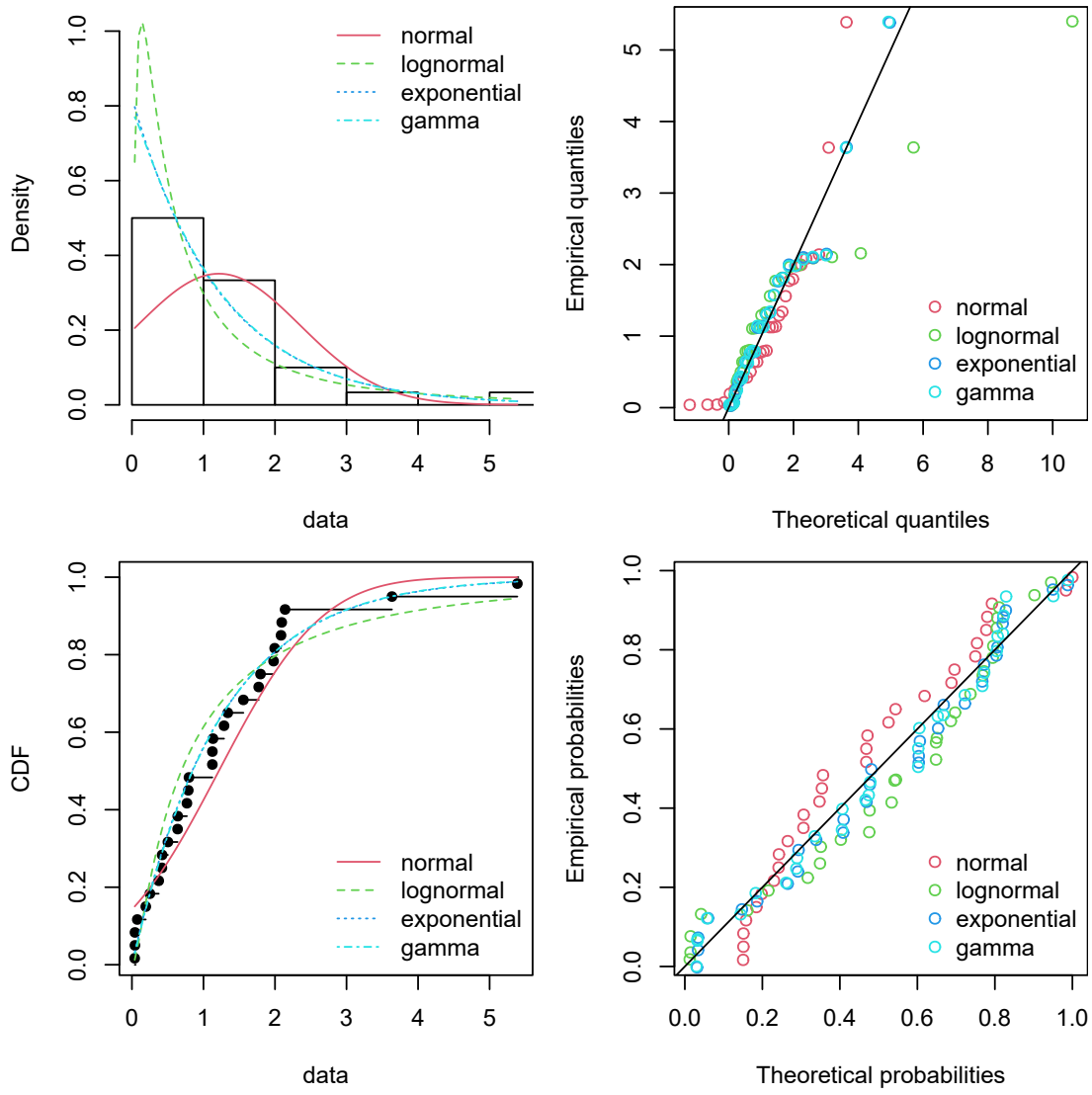
2nd is a Q-Q plot, providing a plot of the quantiles of our distribution along with the quantiles of the theoretical distribution we are comparing with.

3rd is a plot of the cumulative distribution function of the data and theoretical distribution.

4th is a plot of the probabilities of data and theoretical distribution.

```
plot.legend <-c("normal", "lognormal", "exponential", "gamma")

par(mfrow = c(2,2), mar = c(5,5,0,0))
denscomp(list(normal, lognormal, exponential, gamma),
        legendtext = plot.legend, main="")
qqcomp(list(normal, lognormal, exponential, gamma),
       legendtext = plot.legend, main="")
cdfcomp(list(normal, lognormal, exponential, gamma),
        legendtext = plot.legend, main="")
ppcomp(list(normal, lognormal, exponential, gamma),
       legendtext = plot.legend, main="")
```



From the plots above, we see that the exponential and gamma distributions fits the data better, while normal and log-normal deviates to some extent.

Assessing fit using AIC values

```
# Putting the AIC values in a list
aic <-c(normal$aic, lognormal$aic, exponential$aic, gamma$aic)

# Creating a dataframe with the results
res <-data.frame(plot.legend, aic)
names(res) <-c("Distribution", "AIC")

# Displaying the result
kable(res, format="simple")
```

Distribution	AIC
normal	96.82511
lognormal	81.88225
exponential	73.68396
gamma	75.67757

From the AIC scores, we see that fit of the data to normal distribution has the worst AIC score, followed by log-normal distribution. The other two are pretty close, with fit to exponential distribution having the best AIC, followed by gamma distribution - thus both of them can be said to fit the data well.
