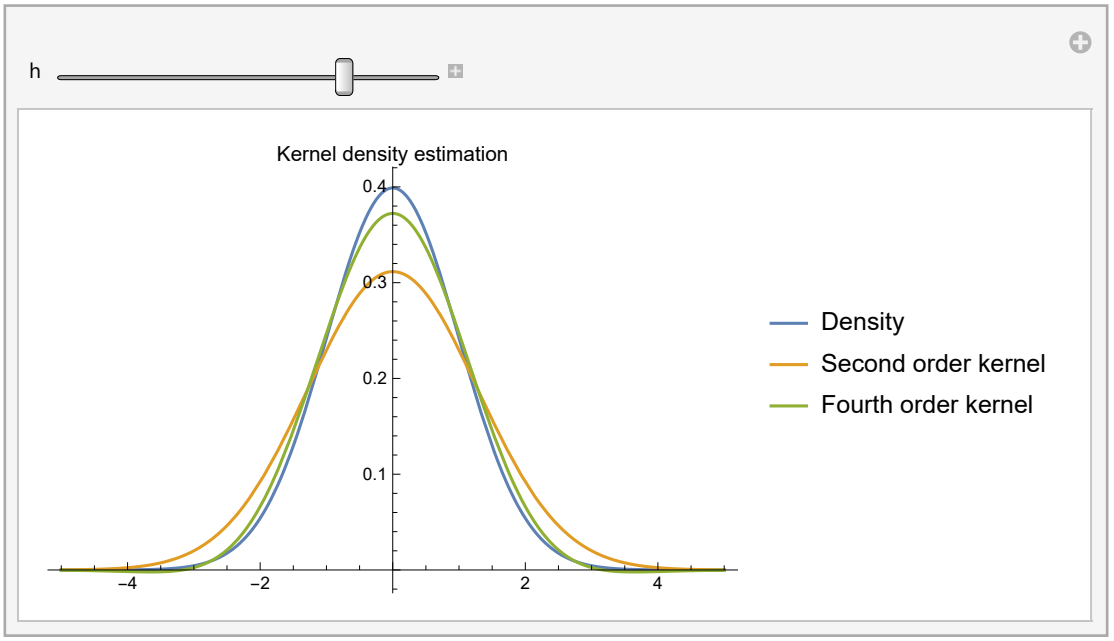
NMST434 : Exercise session XII

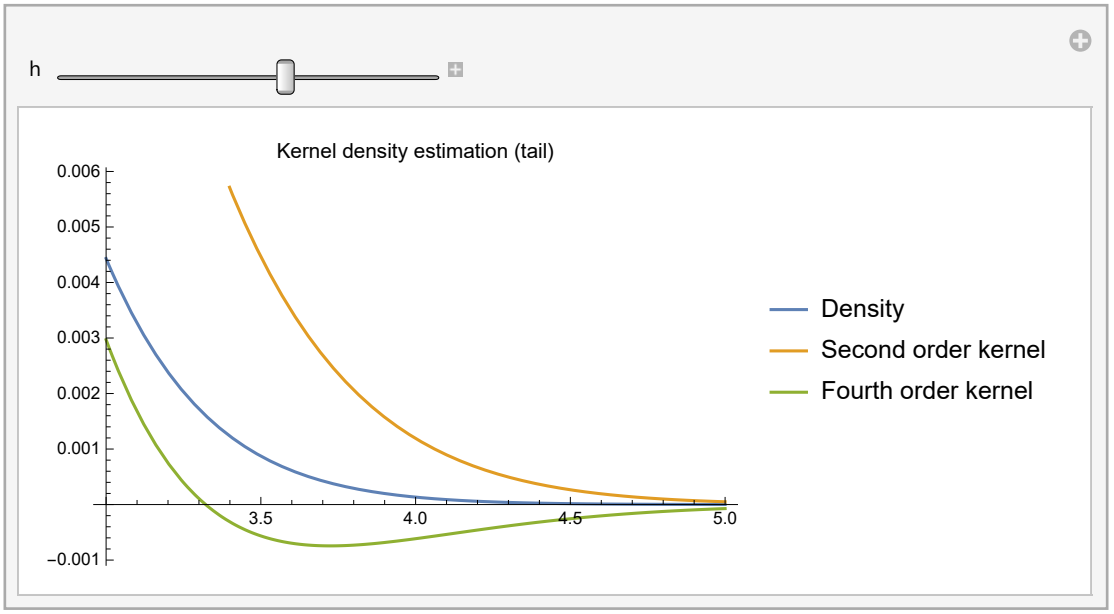
May 22, 2018

Kernel density estimation: bias and higher order kernels

Gaussian density

```
f[x_] = PDF[NormalDistribution[], x]; (* True density *)
K[t_] = PDF[NormalDistribution[], t]; (* Basic kernel *)
Kb[t_] = 1/2 (3 - t^2) 1/Sqrt[(2 π)] Exp[-t^2/2]; (* Higher order kernel *)
fh[x_, h_] = 1/h Integrate[K[(x - y)/h] f[y], {y, -∞, ∞}];
fhb[x_, h_] = 1/h Integrate[Kb[(x - y)/h] f[y], {y, -∞, ∞}];
Manipulate[Plot[{f[x], fh[x, h], fhb[x, h]}, {x, -5, 5},
  PlotLegends → {"Density", "Second order kernel", "Fourth order kernel"},
  PlotLabel → "Kernel density estimation"], {h, 0.1, 1}]
Manipulate[Plot[{f[x], fh[x, h], fhb[x, h]}, {x, 3, 5},
  PlotLegends → {"Density", "Second order kernel", "Fourth order kernel"},
  PlotLabel → "Kernel density estimation (tail)"], {h, 0.1, 1}]
```





Exponential density

```
fb[x_] = PDF[GammaDistribution[1, 1], x];(* True density *)
K[t_] = PDF[NormalDistribution[], t]; (* Basic kernel *)
fhc[x_, h_] = 1/h Integrate[K[(x - y)/h] fb[y], {y, -∞, ∞}];
Manipulate[
 Plot[{fb[x], fhc[x, h]}, {x, -5, 5}, PlotLegends → {"Density", "Second order kernel"},
  PlotLabel → "Kernel density estimation", PlotRange → All], {h, 0.1, 1}]
```