Hw 2/21

Runan Yao

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Simulation : high dim sphere and cube

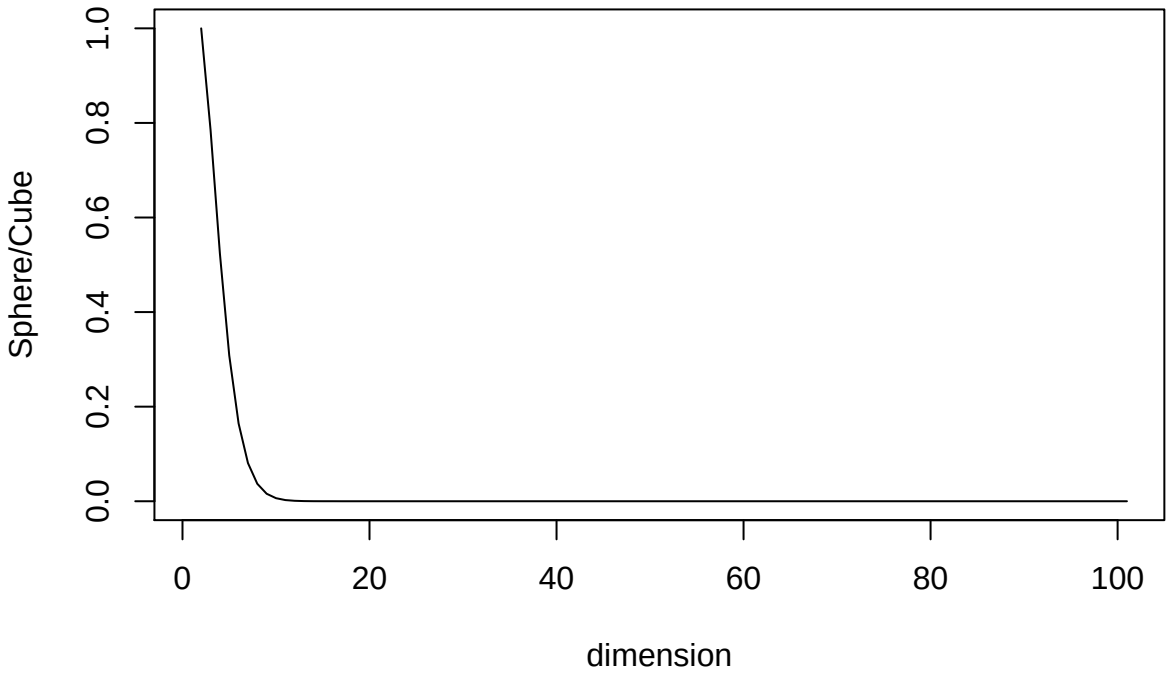
Basic funcions

```
Sphere.Volume<-function(d, r){
  return( (2*r^d*pi^(d/2)) / (d*gamma(d/2)) )
}

Cube.Volume<-function(d, r){
  return( (2*r)^d )
}

Sphere.DifferentRatio <- function(d,r,e){
  #return (r^d - (r-e)^d)/(r^d) this won't work when d is large
  return (1 - (1 - e/r)^d)
}
```

Sphere v.s. Cube

Code:

```
## Warning in gamma(d/2): NaNs produced
```



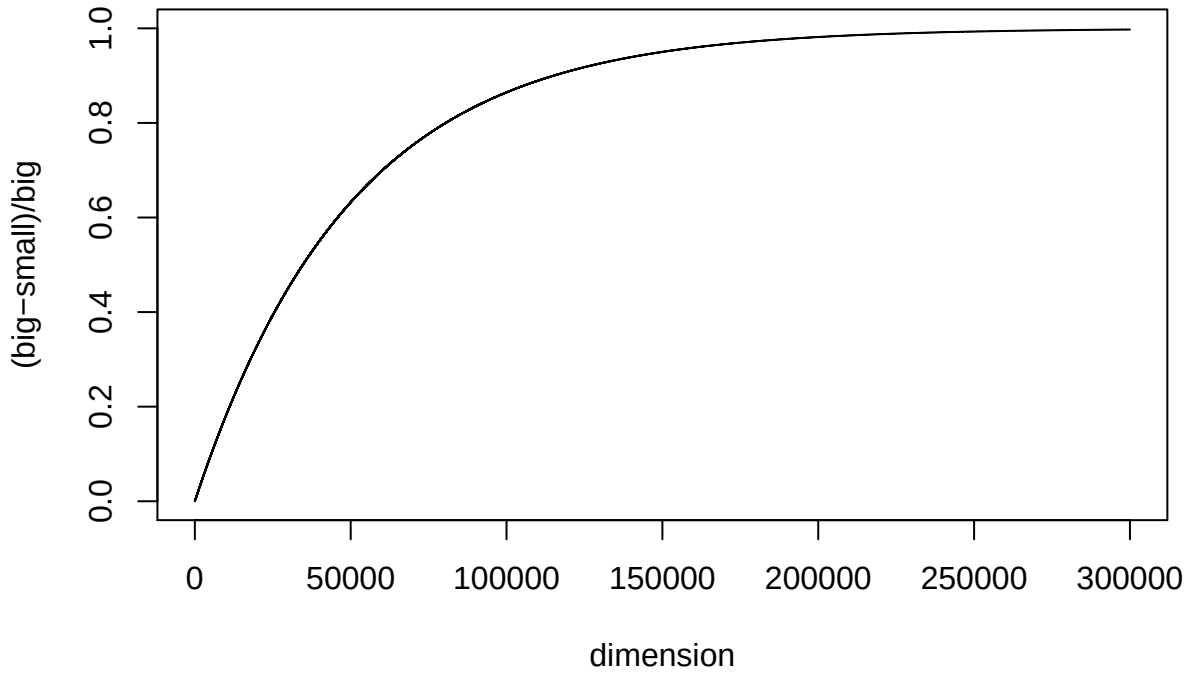
Conclusion:

1. The code does not work when dimension is very large. Because gamma function will produce a huge result.
2. Simulation shows, when dimension is increase, the volume of sphere become very small compare to the volume of cube.

Big Sphere v.s. Small Sphere

Code:

```
r = 100
e = 0.002
d = seq(0,300000,by=1)
ratio2 = Sphere.DifferentRatio(d,r,e)
plot(ratio2, type = 'l', ylim = c(0,1), xlab = 'dimension', ylab = '(big-small)/big')
```



Conclusion:

1. When dimension increase, the volume of the difference between small sphere and big sphere increase.
2. When dimension is sufficiently large, the different space between small sphere and big sphere hold almost all the space of big sphere.