

## Student's t-distribution

Student's t-distribution is a PDF that is similar to the Gaussian PDF, but is often a better model for small sample sizes.

Let  $\underline{X}$  be a r.v.,  $\bar{x}$  be a sample mean,  $\mu_{\bar{x}}$  be the sample mean,  $S_{\bar{x}}$  be the sample variance, and  $N$  be the sample size. Let  $x_i$  be a value of r.v.  $\underline{X}$  in the sample. We define

Let  $\nu$  be the number of **statistical degrees of freedom**. This is defined as the number of samples  $N$  minus the number of constraints  $c$  ( $\nu \equiv N - c$ ). When computing means,  $c=0$ . When computing standard deviations and variations, we require the mean, so  $c=1$ .

Let  $\Gamma$  be the **gamma function**.  $\Gamma$  has the following properties:

It can be said that a normally distributed r.v. value  $x_i$  in a small sample will be within  $\pm t_{\nu, p}$  sample standard deviations of the sample mean with  $P\%$  confidence. That is,