PI for Univariate data

X_{n+1} is a single future independent observation

$X \sim N(\mu, \sigma)$ $\quad \bar{X} \sim N(\mu, \sigma/\sqrt{n})$

and $X_{n+1} \sim N(\mu, \sigma)$

$$V(X_{n+1} - \bar{X}) = V(X_{n+1}) + V(\bar{X})$$

$$= \sigma^2 + \frac{\sigma^2}{n}$$

Also, $E(X_{n+1} - \bar{X}) = 0$

So $\bar{X} \pm t^*_{n-1} \sqrt{s^2 + \frac{s^2}{n}}$

$$\bar{X} \pm t^*_{n-1} \, s \sqrt{1 + \frac{1}{n}}$$