# 1: Introduction

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- Median: any number *t* such that the number of observations on both sides of it are equal

$$t = \text{Med}(\mathbf{x}),\ if\ \#\{x_i > t\} = \#\{x_i < t\},$$

- Median absolute deviation about the median (MAD)

$$\text{MAD}(\mathbf{x}) = \text{MAD}(x_1, x_2, ..., x_n) = \text{Med}\{|\mathbf{x} - \text{Med}(\mathbf{x})|\}.$$

- Normalized MAD (MADN): 0.6745 is the MAD for std normal

$$\text{MADN}(\mathbf{x}) = \frac{\text{MAD}(\mathbf{x})}{0.6745}.$$

- Goal of robust estimation: The ideal solution would be to have "the best of both worlds": estimates that behave like the classical ones when the data contain no outliers, but are insensitive to outliers otherwise. This is the data-oriented idea of robust estimation
- Classical

$$t_i = \frac{x_i - \bar{x}}{s},$$

- Robust alternative

$$t_i' = \frac{x_i - \text{Med}(\mathbf{x})}{\text{MADN}(\mathbf{x})}.$$