Wave based transforms for ML

Let us consider, how the variables change over time and how values change with respect to the mean using z-score,

$$z = \frac{x - \mu}{\sigma}$$

where,

x = value
μ = mean
σ = standard deviation

Now when we apply this to the conic sections ~~and~~ (ellipse, parabola and hyperbola), we get,

* Ellipse equation,
Let us consider the equation,

$$\frac{x^2}{\sigma_x^2} + \frac{y^2}{\sigma_y^2} = 1$$

$$\frac{(x - \mu_x)^2}{\sigma_x^2} + \frac{(y - \mu_y)^2}{\sigma_y^2} = 1$$

On simplifying we get,

$$y = \mu_y + \sigma_y \sqrt{1 - \frac{(x - \mu_x)^2}{\sigma_x^2}}$$

And when we plot this for every date 't', we get a waveform

* Parabolic Wave equation :
Let us consider the parabola equation,

$$y = x^2$$

$$\frac{y - \mu_y}{\sigma_y} = \left(\frac{x - \mu_x}{\sigma_x}\right)^2$$

$$y(t) = \frac{\sigma_y}{\sigma_x^2} (x(t) - \mu_x)^2 + \mu_y$$

where, y = target, x = input variable
And when we plot it for every date 't', we get a parabolic wave

* Hyperbolic Wave equation;
Let us consider the equation of a hyperbola, on the origin.

$$\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$$

Applying the transforms we get,

$$\frac{(x - \mu_x)^2}{\sigma_x^2} - \frac{(y - \mu_y)^2}{\sigma_y^2} = 1$$

On simplifying we get,

$$y(t) = \mu_y + \sigma_y \sqrt{\frac{(x(t) - \mu_x)^2}{\sigma_x^2} - 1}$$

(For $|x - \mu_x| < \sigma_x$) ⇒ ∴, the square root becomes imaginary