Untitled

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$$\min_{q} \sum_{t=1}^{n} \alpha |y_t - q(x_t)|^{+} + (1-\alpha)|y_t - q(x_t)|^{-}, \tag{1}$$

where $q(x_t)$ is the estimated quantile value at a given time t and $|x|^{+} = \max\{0, x\}$ and $|x|^{-} = -\min\{0, x\}$. To model this problem as a Linear Programming problem, thus being able to use a modern solver to fit our model, we can create variables ε_t^{+} e ε_t^{-} to represent $|y - q(x_t)|^{+}$ and $|y - q(x_t)|^{-}$, respectively. So we have:

$$\begin{aligned}
\min_{q, \varepsilon_t^{+}, \varepsilon_t^{-}} \; & \sum_{t=1}^{n} \left(\lambda \varepsilon_t^{+} + (1-\lambda)\varepsilon_t^{-} \right) \\
\text{s.t. } & \varepsilon_t^{+} - \varepsilon_t^{-} = y_t - q(x_t), && \forall t \in \{1, \ldots, n\}, \\
& \varepsilon_t^{+}, \varepsilon_t^{-} \geq 0, && \forall t \in \{1, \ldots, n\}.
\end{aligned} \tag{2}$$

Probabilistic Forecast of Wind Power

In this approach, we find an approximation for the forecasted variable density $\hat{f}_{t+k|t}$ by estimating a range of m quantile forecasts:

$$\hat{f}_{t+k|t} = \{\hat{q}_{t+k|t}^{(\alpha_i)} | 0 \leq \alpha_1 \leq \cdots \leq \alpha_i \leq \alpha_m leq 1\}$$