D-17

Least-Squares Conditional Density Estimation with Dimensionality Reduction

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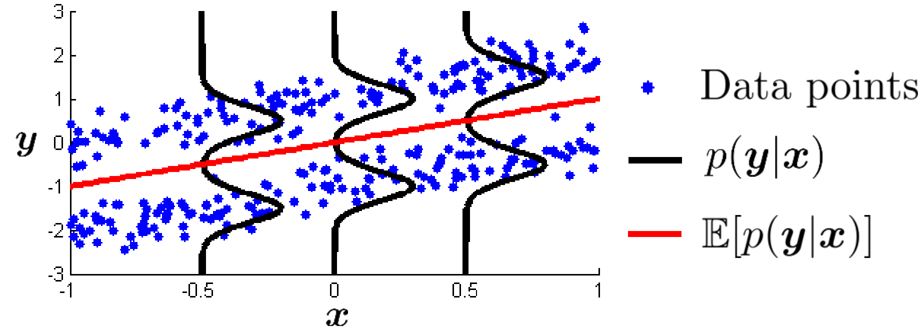
Conditional density estimation:

- In *regression*, we estimate the mean $\mathbb{E}[\cdot]$ of conditional density $p(\boldsymbol{y}|\boldsymbol{x})$.
  - The conditional *mean* $\mathbb{E}[p(\boldsymbol{y}|\boldsymbol{x})]$ alone is not informative enough to understand the data when conditional density possesses *multimodality*, *heteroscedasticity* and *asymmetry*.
  - We want to estimate the conditional *density* itself.



Existing method: Least-Squares Conditional Density Estimation (LSCDE)

- Least-squares fitting of conditional density model to true $p(\boldsymbol{y}|\boldsymbol{x})$.
- Optimal asymptotic convergence rate.
- The estimation is still challenging in high dimensionality.

Our contribution: Combine *conditional density estimation* with *dimensionality reduction*.

- We utilize square-loss variant of *conditional entropy*,

$$\mathrm{SCE}(Y|X) = -\frac{1}{2}\int (p(\boldsymbol{y}|\boldsymbol{x}) - 1)^2 \, p(\boldsymbol{x}) \mathrm{d}\boldsymbol{y} \mathrm{d}\boldsymbol{x}.$$