XAI HW4 Task 1

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1 Task 1

Consider the following model

$$f(x_1, x_2) = (x_1 + x_2)^2$$

Assume that $x_1, x_2 \sim U[-1, 1]$ and $x_1 = x_2$ (full dependency)

1.1 PD profile

$$g_{PD}^1(z) = \mathbb{E}_{x_2 \sim U[-1,1]}(z + x_2)^2 = z^2 + \mathbb{E}_{x_2 \sim U[-1,1]} 2zx_2 + \mathbb{E}_{x_2 \sim U[-1,1]} x_2^2 = z^2 + \frac{1}{3}$$

1.2 ME profile

$$\begin{aligned} g_{ME}^1(z) &= \mathbb{E}_{x_2|x_1=z}(z + x_2)^2 = z^2 + \mathbb{E}_{x_2|x_1=z} 2zx_2 + \mathbb{E}_{x_2|x_1=z} x_2^2 \\ &= z^2 + 2z^2 + z^2 = 4z^2 \end{aligned}$$

1.3 ALE profile

$$\begin{aligned} g_{AL}^1(z) &= \int_{-1}^{z} \mathbb{E}_{x_2|x_1=v} \frac{\partial (x_1 + x_2)^2}{\partial x_1} dv = \\ &= \int_{-1}^{z} 2v + 2v \, dv = 2z^2 - 2 \end{aligned}$$