Cost Sensitive Classification

- Example: Bayesian classifer
  - Given a test record x:
    - Compute p(i|x) for each class *i*
    - Decision rule: classify node as class k if

$$k = \arg\max_i p(i \mid x)$$

  - For 2-class, classify x as + if p(+|x) > p(-|x)
    - This decision rule implicitly assumes that C(+|+) = C(-|-) = 0 and C(+|-) = C(-|+)

Cost Sensitive Classification

- General decision rule:
  - Classify test record x as class k if

$$k = \arg\min_j \sum_i p(i \mid x) \times C(i, j)$$

- 2-class:
  - Cost(+) = p(+|x) C(+,+) + p(-|x) C(-,+)
  - Cost(-) = p(+|x) C(+,-) + p(-|x) C(-,-)
  - Decision rule: classify x as + if Cost(+) < Cost(-)
    - if C(+,+) = C(-,-) = 0:

$$p(+ \mid x) > \frac{C(-,+)}{C(-,+) + C(+,-)}$$