

Machine Learning Homework 1

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1. Joint Distribution of Death Sentence, Victim Race, and Murderer Race

Each outcome corresponds to a murder trial.

Let $D = 1$ if the murderer gets the death sentence and 0 otherwise.

Let $M = 1$ if the murderer is white and 0 otherwise.

Let $V = 1$ if the victim is white and 0 otherwise.

Let $p(M = 1) = .5$.

Let $p(V = 1 | M = 1) = .8$.

Let $p(V = 1 | M = 0) = .2$.

Let $p(D = 1 | M = 1, V = 1) = .6$.

Let $p(D = 1 | M = 1, V = 0) = .4$.

Let $p(D = 1 | M = 0, V = 1) = .6$.

Let $p(D = 1 | M = 0, V = 0) = .4$.

These probabilities define the joint distribution of (M, V, D)

(a) Who is more likely to get the death sentence?

That is, what are $p(D = 1 | M = 1)$ and $p(D = 1 | M = 0)$?

(b) Find the joint distribution of (M, D) (give the two-way table).

(c) Are M and D independent ?

(d) Find the joint distribution of (M, D) given $V = 1$ (give the two-way table).

(e) Given $V = 1$, are M and D independent?

(f) Find the joint distribution of (M, D) given $V = 0$ (give the two-way table).

(g) Given $V = 0$, are M and D independent?

(h) Are M and V independent?

(i) Are D and V independent?

(j) How is D related to M and V ?

If correct for some population, what do these probabilities say about the impact of race on whether or not a murder is sentenced to death?