

# § 4. Inverse Probability of Treatment Weighting (IPTW)

## § 4.1 Intuition for IPTW

Outline:

1. Understanding inverse weighting by relating it to Match

2. IPTW 的计算示例/目的(作用)

### § 4.1.1 Motivating Example

• A single binary confounder  $X$ .

• For those subjects  $X=1$ , their propensity score  $P(A=1|X=1)=0.1$  (在  $X=1$  的人中, 有 10% 的 subjects 接受处理)

• While for those subjects whose  $X=0$ , their propensity score  $P(A=1|X=0)=0.8$ , (在  $X=0$  的人中, 有 80% 的 subjects 接受处理)

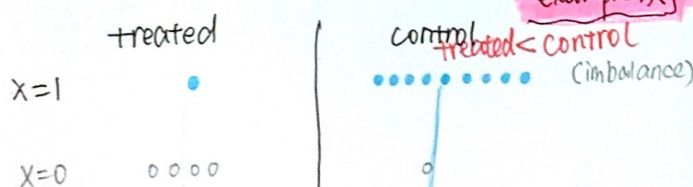
• For those subjects whose  $X=0$ , their propensity score  $P(A=1|X=0)=0.8$ , (在  $X=0$  的人中, 有 80% 的 subjects 接受处理)

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!  $P(A=1|X=1) + P(A=1|X=0) \neq 1$ .

$P(A=1|X=1) + P(A=0|X=1) = 1$

举例: Fig. {Motivating example} + [weighting in  $X=1$ ]



All the blue dots have the same propensity score. In Propensity score matching, the only subject in treated group will match with a randomized subject in control group.

Pps match: treated control  
表示 control 组的全部 9 个人

注: a treated person ends up representing 9 controls subjects. 但这并不是实际 match 的, 所以我们原本会丢弃其余的 8 个 subjects.  $\Rightarrow$  down-weight some control up-weight some

★ Inverse probability treatment weight based on treatment actually received. For treated subjects, we were weighed by the inverse of the probability of treatment.

## § 4.2 Weighting — in $X=0$

By the inverse of probability of treatment received.

For treated subjects: weight by the inverse of  $P(A=1|X)$

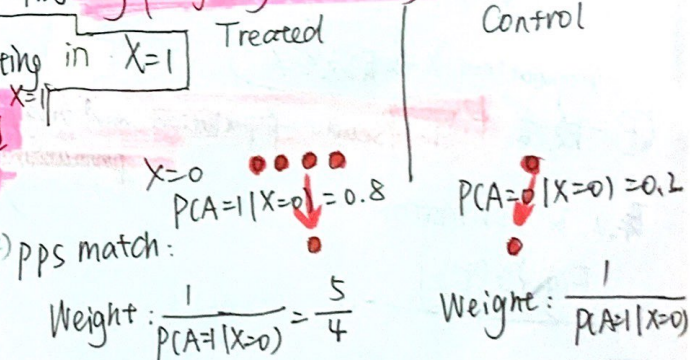
For control subjects: ...  $P(A=0|X)$

举例: Fig {IPTW 的计算示例}

最终把接受 treatment 的 subjects 的集合计数与 control subjects 的集合计数配平.

对 treated 即使有更多的 control subjects, 它们对数据分析的作用大小也是相等的.

举例: Fig {weighting in  $X=0$ } treated > control Control



Weight:  $\frac{1}{P(A=1|X=0)} = \frac{5}{4}$   
Weight:  $\frac{1}{P(A=0|X=0)} = \frac{1}{0.2} = 5$   
总结: 对每一种 X 的取值 (在 Pps 相同的 subjects 中) treated subjects 的 counting 与 control subjects 的 counting 相等.