

# Introduction to data science & artificial intelligence (INF7100)

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#242 Testing

été 2020

# Testing and Errors



Drunkometer, **How Police Nab Drunk Drivers.**

# Type I and Type II Errors

$$\hat{Y} = 0$$

NEGATIVE

$$\hat{Y} = 1$$

POSITIVE

$$Y = 0$$

NOT PREGNANT



$$Y = 1$$

PREGNANT



via [@freakonometrics](#)'s tweet.

# Type I and Type II Errors

We want to test some (null) hypothesis  $H_0$ . A positive result corresponds to rejecting the null hypothesis, while a negative result corresponds to failing to reject the null hypothesis.

- ▶ **Type I error** is rejection of a true null hypothesis, e.g. convicting an innocent defendant in court, equivalent to a **false positive**  
probability of type I error is  $\alpha$  called **significance level**
- ▶ **Type II error** is the failure to reject a false null hypothesis, i.e. acquitting a criminal in court  
equivalent to a **false negative**  
probability of type II error is  $\beta$ , and  $1 - \beta$  is called **power**

E.g.  $H_0$ : "The message is not a spam"

# Type I and Type II Error Balance

Traditionally we try to set Type I error probability as 5% or 1%, as in there is only a 5 or 1 in 100 chance that the variation that we are seeing is due to chance.

E.g. on student's height,  $H_0 : \mu_M = \mu_F + 10\text{cm}$

