3. 计算机–学习优化：

正常短信
9条

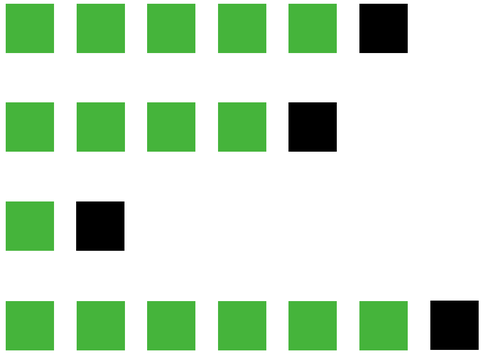
P(正常) = 0.75

“您好”

“话费”

“链接”

“验证码”



$$P(\text{“您好”}|\text{正常}) = \frac{5+1}{16+4} = \frac{6}{20}$$

$$P(\text{“话费”}|\text{正常}) = \frac{4+1}{16+4} = \frac{5}{20}$$

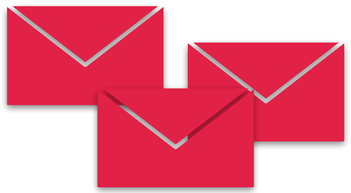
$$P(\text{“链接”}|\text{正常}) = \frac{1+1}{16+4} = \frac{2}{20}$$

$$P(\text{“验证码”}|\text{正常}) = \frac{6+1}{16+4} = \frac{7}{20}$$

解决方法为，让计算机默认每个词都**多出现一次**，

保证不会有0出现，并重新计算学习结果

垃圾短信
3条



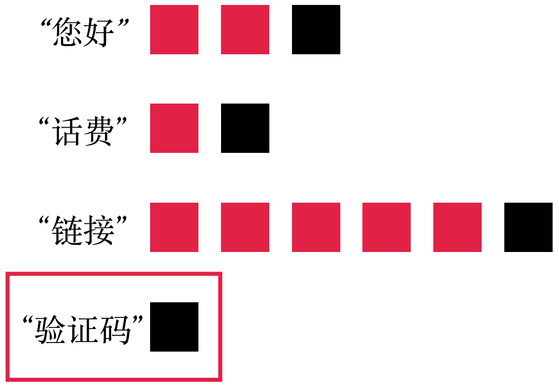
P(垃圾) = 0.25

“您好”

“话费”

“链接”

“验证码”



$$P(\text{“您好”}|\text{垃圾}) = \frac{2+1}{8+4} = \frac{3}{12}$$

$$P(\text{“话费”}|\text{垃圾}) = \frac{1+1}{8+4} = \frac{2}{12}$$

$$P(\text{“链接”}|\text{垃圾}) = \frac{5+1}{8+4} = \frac{6}{12}$$

$$P(\text{“验证码”}|\text{垃圾}) = \frac{0+1}{8+4} = \frac{1}{12}$$

3. 计算机–学习优化：

正常短信
9条

$P(正常) = 0.75$

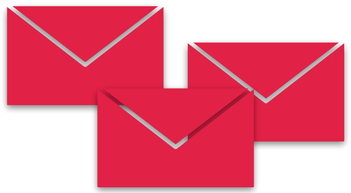
$P(“您好”|正常) = \frac{5+1}{16+4} = \frac{6}{20}$

$P(“话费”|正常) = \frac{4+1}{16+4} = \frac{5}{20}$

$P(“链接”|正常) = \frac{1+1}{16+4} = \frac{2}{20}$

$P(“验证码”|正常) = \frac{6+1}{16+4} = \frac{7}{20}$

垃圾短信
3条



$P(垃圾) = 0.25$

$P(“您好”|垃圾) = \frac{2+1}{8+4} = \frac{3}{12}$

$P(“话费”|垃圾) = \frac{1+1}{8+4} = \frac{2}{12}$

$P(“链接”|垃圾) = \frac{5+1}{8+4} = \frac{6}{12}$

$P(“验证码”|垃圾) = \frac{0+1}{8+4} = \frac{1}{12}$

此时，我们手机又收到一条短信：
“验证码 链接 链接 链接”

$P(正常) \times P(“验证码”|正常) \times P(“链接”|正常)^3 = 0.75 \times \frac{7}{20} \times (\frac{2}{20})^3 = 0.0002625$

“验证码 链接 链接 链接” 为正常短信的概率

再把优化后的学习结果应用到此短信上，

$0.0026 > 0.0002625$

计算机得出此短信为一条**垃圾短信**，符合实际。

$P(垃圾) \times P(“验证码”|垃圾) \times P(“链接”|垃圾)^3 = 0.25 \times \frac{1}{12} \times (\frac{6}{12})^3 = 0.0026$

“验证码 链接 链接 链接” 为垃圾短信的概率