# 3. 计算机–学习优化：

正常短信
9条

P(正常) = 0.75

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

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

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

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

垃圾短信
3条

P(垃圾) = 0.25

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

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

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

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

此时，我们手机又收到一条短信：
**“验证码 链接 链接 链接”**

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

“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。

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

“验证码 链接 链接 链接” 为垃圾短信的概率

# 4. 总结

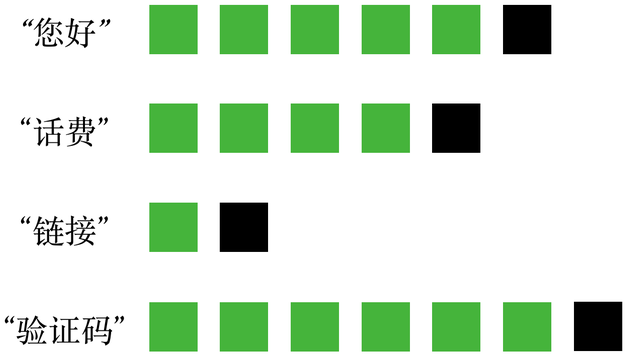
筛选 ……

学习 ……

应用 ……

正常短信
9条

P(正常) = 0.75



垃圾短信
3条

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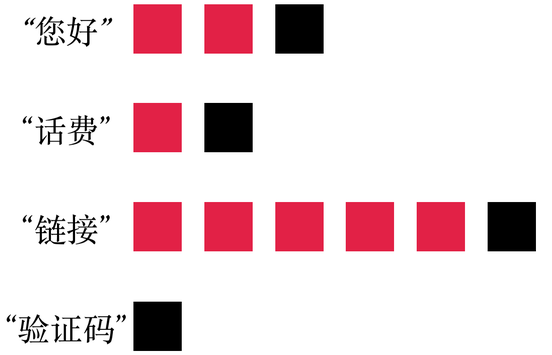


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**“验证码 链接 链接 链接”**

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

“验证码 链接 链接 链接” 为正常短信的概率

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

“验证码 链接 链接 链接” 为垃圾短信的概率

$0.0026 > 0.0002625$，**垃圾短信**。

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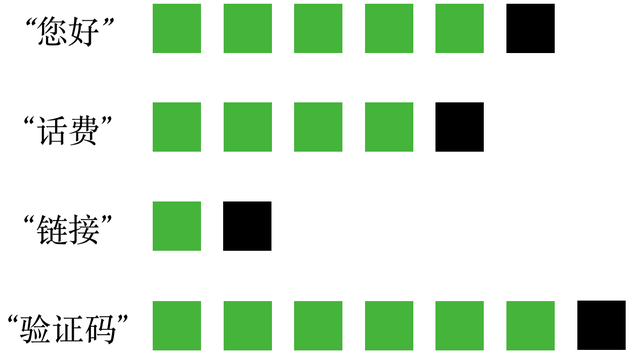


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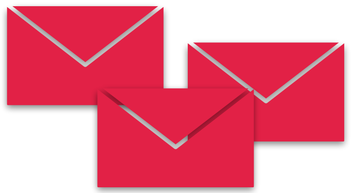
解决方法为，让计算机默认每个词都**多出现一次**，

保证不会有0出现，并重新计算学习结果

垃圾短信
3条



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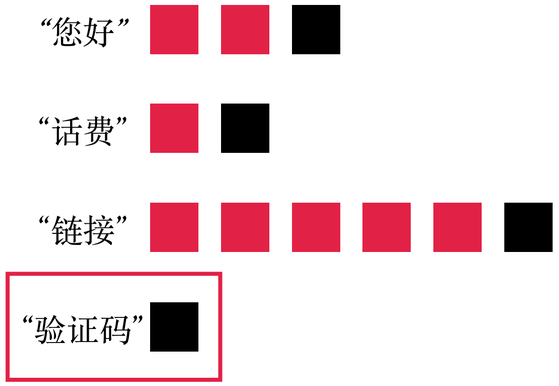


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