

### 3. 计算机-学习优化：

正常短信  
9条



$P(\text{正常}) = 0.75$

$$P(\text{“您好”}|\text{正常}) = \frac{5 + 1}{16 + 4} = \frac{6}{20}$$
$$P(\text{“话费”}|\text{正常}) = \frac{4 + 1}{16 + 4} = \frac{5}{20}$$
$$P(\text{“链接”}|\text{正常}) = \frac{1 + 1}{16 + 4} = \frac{2}{20}$$
$$P(\text{“验证码”}|\text{正常}) = \frac{6 + 1}{16 + 4} = \frac{7}{20}$$

此时，我们手机又收到一条短信：  
“验证码 链接 链接 链接”



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

“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。

垃圾短信  
3条

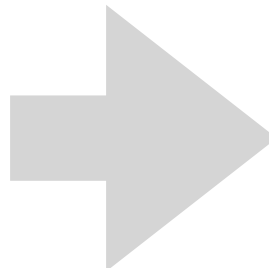
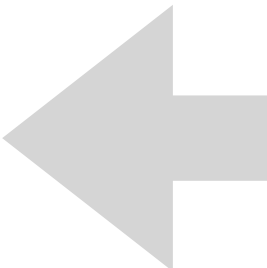


$P(\text{垃圾}) = 0.25$

$$P(\text{“您好”}|\text{垃圾}) = \frac{2 + 1}{8 + 4} = \frac{3}{12}$$
$$P(\text{“话费”}|\text{垃圾}) = \frac{1 + 1}{8 + 4} = \frac{2}{12}$$
$$P(\text{“链接”}|\text{垃圾}) = \frac{5 + 1}{8 + 4} = \frac{6}{12}$$
$$P(\text{“验证码”}|\text{垃圾}) = \frac{0 + 1}{8 + 4} = \frac{1}{12}$$

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

“验证码 链接 链接 链接”为垃圾短信的概率

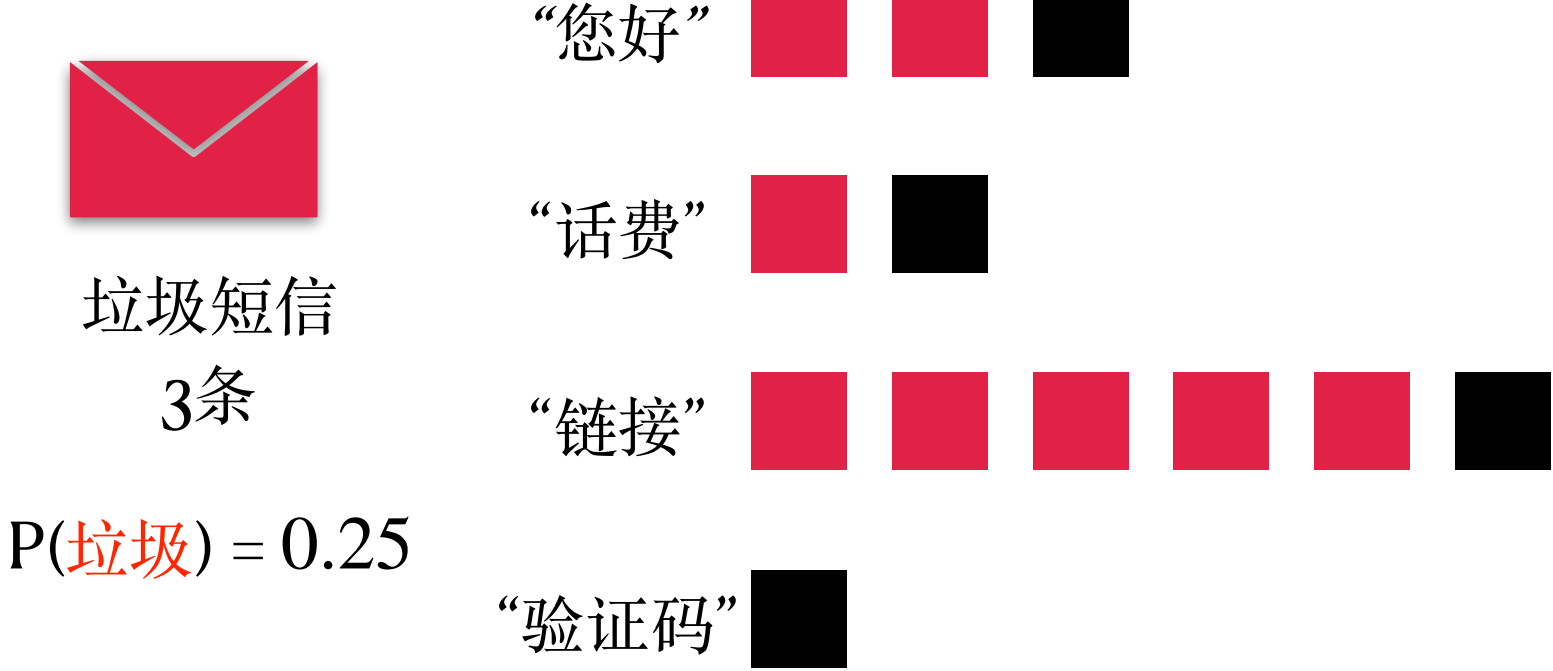
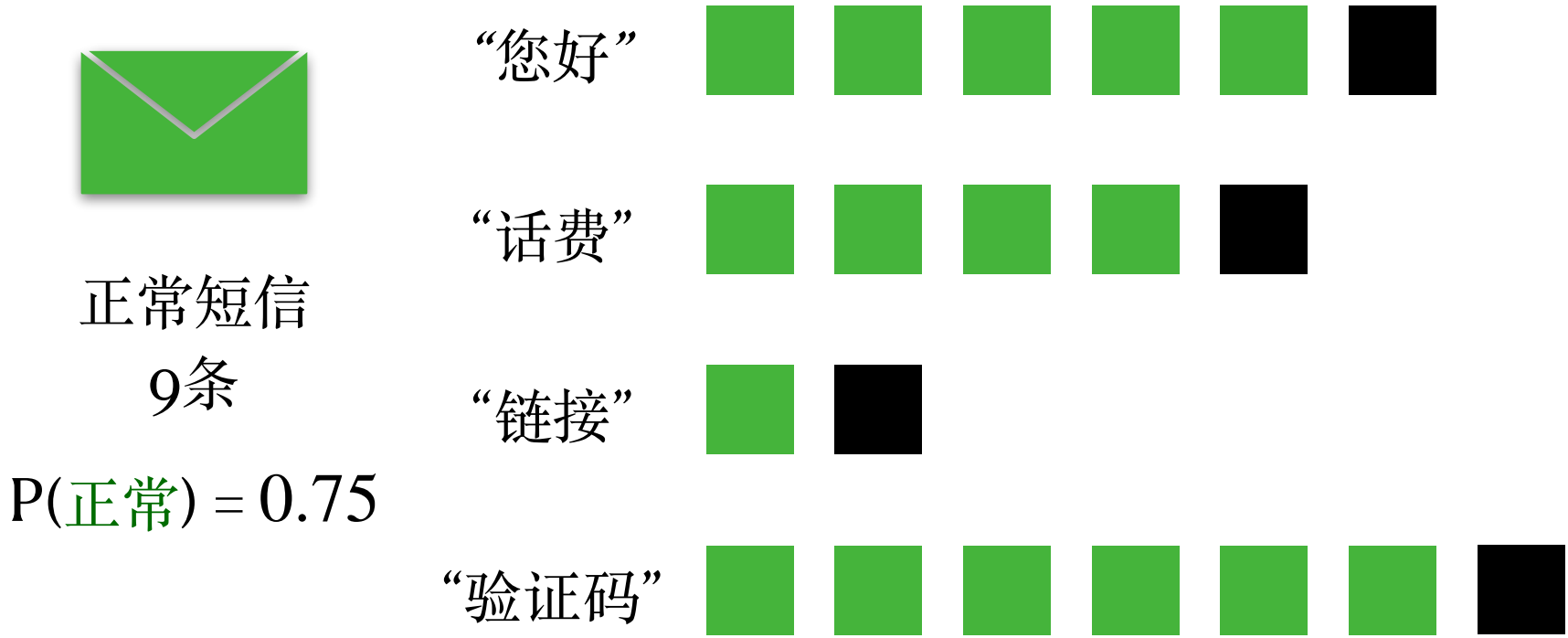


# 4. 总结

筛选 .....

学习 .....

应用 .....



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

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

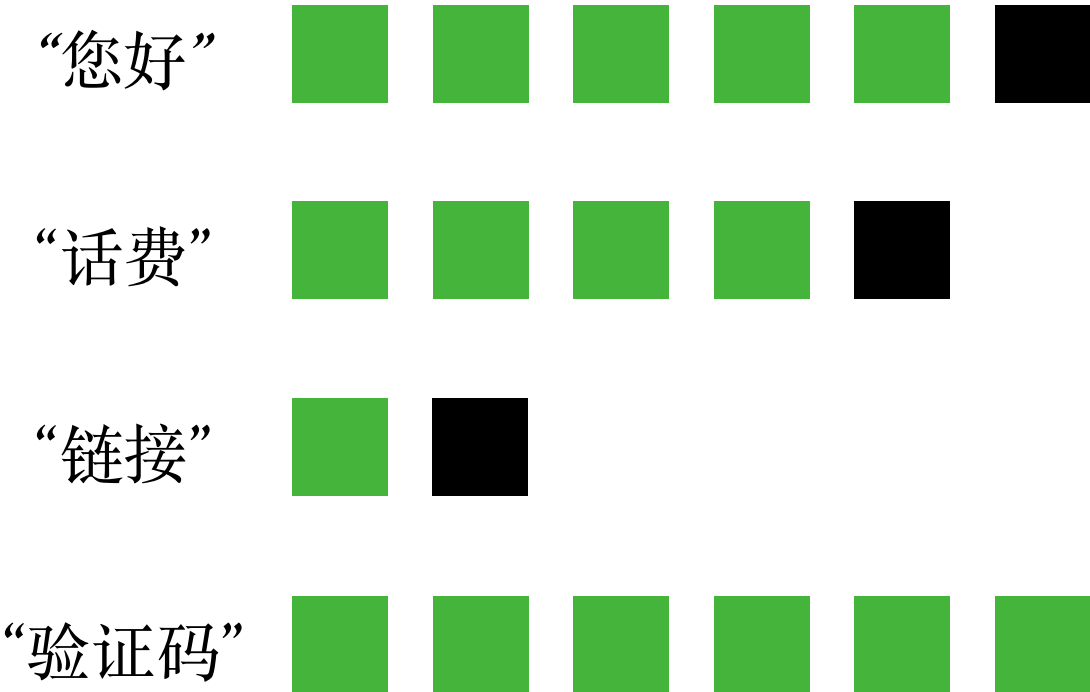
“验证码 链接 链接 链接” 为垃圾短信的概率

0.0026 > 0.0002625, 垃圾短信。

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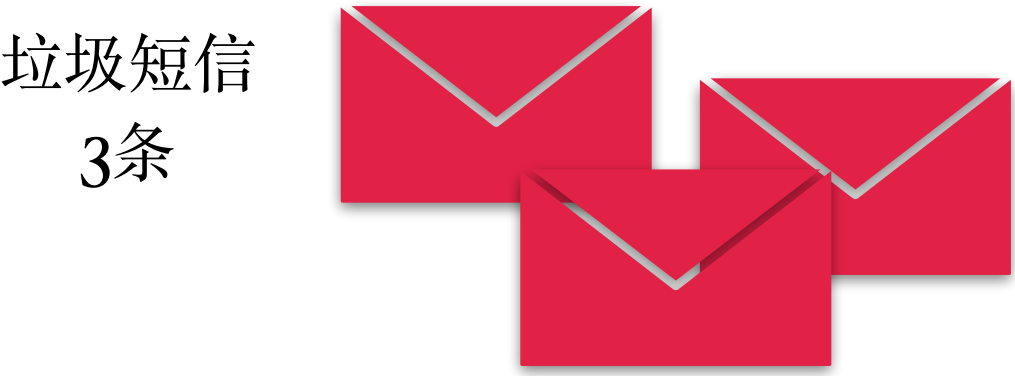
$P(\text{“话费”}|\text{正常}) = \frac{4 + 1}{16 + 4} = \frac{5}{20}$

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

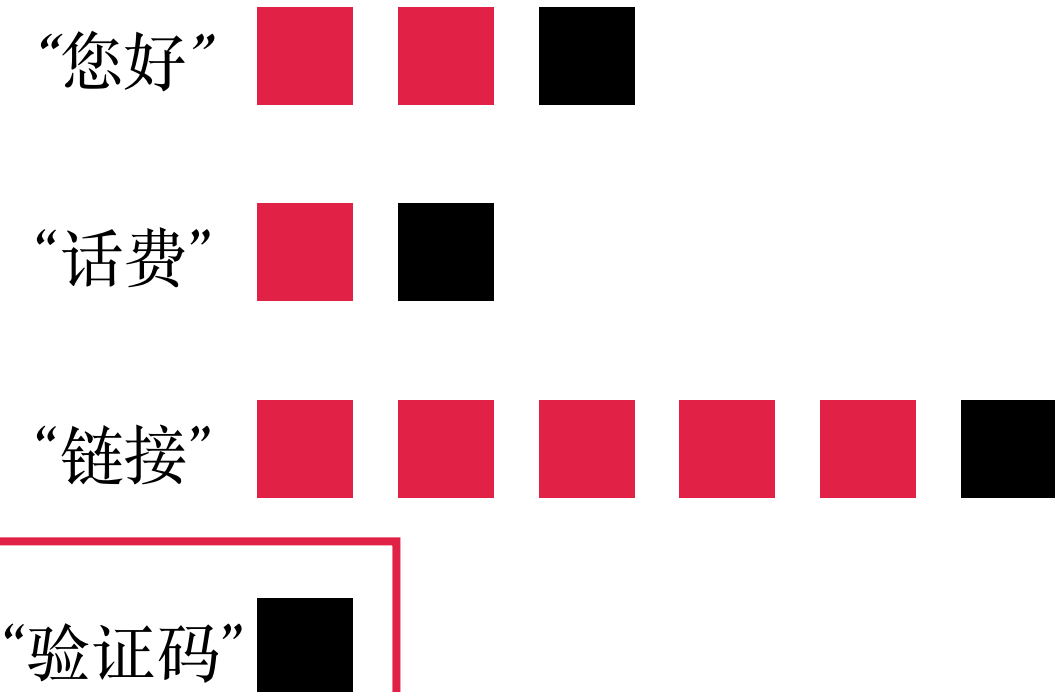
$P(\text{“验证码”}|\text{正常}) = \frac{6 + 1}{16 + 4} = \frac{7}{20}$

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



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

