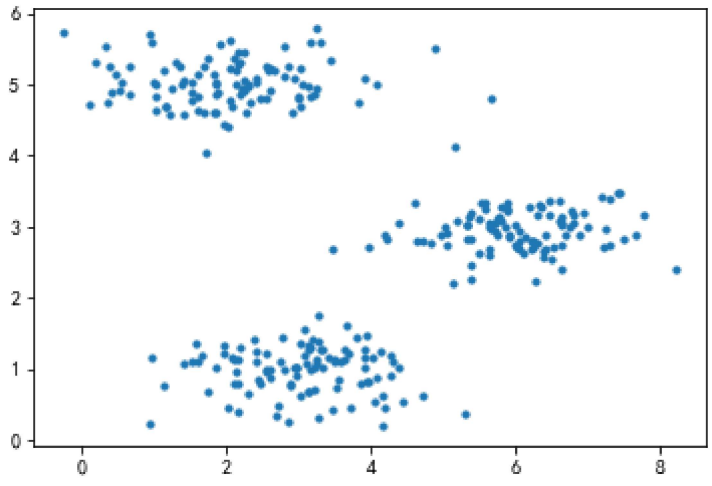
In [1]:
```
import numpy as np
import matplotlib.pyplot as plt
import glob
import os
import scipy.io as sio
# %matplotlib Widget
```

In [2]:
```
plt.rcParams["font.sans-serif"] = "SimHei"
plt.rcParams["axes.unicode_minus"] = False
```

K-means聚类

读取数据

In [3]:
```
paths = glob.glob("../Coursera-ML-AndrewNg-master/*kmeans*/data/*.mat")
data = sio.loadmat(paths[2])
keys = list(data.keys())
datax = data[keys[-1]]
plt.close(1)
plt.figure()
plt.scatter(datax[:, 0], datax[:, 1], s=10)
plt.show()
```



初始化样本类别

In [4]:
```
def initCluster(x, pivot):
    """初始化样本类别

    Parameters
    ----------
    x : ndarray
        输入样本
    pivot : ndarray
        聚类中心

    Returns
    -------
    idx : ndarray
        返回最小距离的pivot索引
    """
    idx = list()
    for i in range(len(x)):
        dist = np.linalg.norm(x[i] - pivot, axis=1) # 计算样本到聚类中心的欧氏距离
        idx.append(np.argmin(dist)) # 赋予类别
    return np.array(idx)
```

优化聚类中心

In [5]:
```
def meansPivot(x, idx, pivot):
    for i in range(pivot.shape[0]):
        pivot[i] = np.mean(x[idx == i], axis=0)
    return pivot
```

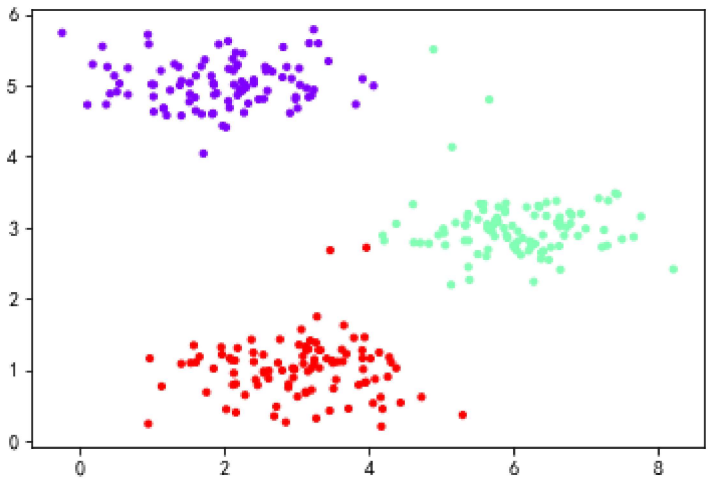
迭代最优中心点

In [6]:
```
k = np.random.choice(datax.shape[0], 3)
pivot = datax[k]
iters = 100
for _ in range(iters):
    idx = initCluster(datax, pivot)
    meansPivot(datax, idx, pivot)
```

聚类结果

In [7]:
```
plt.close(2)
plt.figure()
plt.scatter(datax[:, 0], datax[:, 1], c=idx, s=10, cmap="rainbow")
```

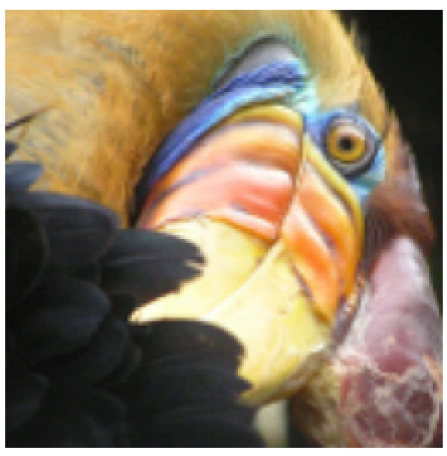
Out[7]: <matplotlib.collections.PathCollection at 0x2354106ea30>



读取图片

In [8]:
```
data = sio.loadmat(paths[0])
img = data["A"]
plt.close(3)
plt.figure()
plt.imshow(img)
plt.axis("off")
```

Out[8]: (-0.5, 127.5, 127.5, -0.5)



像素聚类

In [9]:
```
k = 16
perimeter = img.reshape((-1, 3)) / 256
pivot = perimeter[np.random.choice(len(perimeter), k)]
for _ in range(iters):
    idx = initCluster(perimeter, pivot)
    meansPivot(perimeter, idx, pivot)
```

In [10]:
```
for i in range(k):
    perimeter[idx == i] = pivot[i]
img = perimeter.reshape((128, 128, 3))
plt.close(4)
plt.figure()
plt.imshow(img)
plt.axis("off")
```

Out[10]: (-0.5, 127.5, 127.5, -0.5)