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# Bag of Visual Words (BoVW)



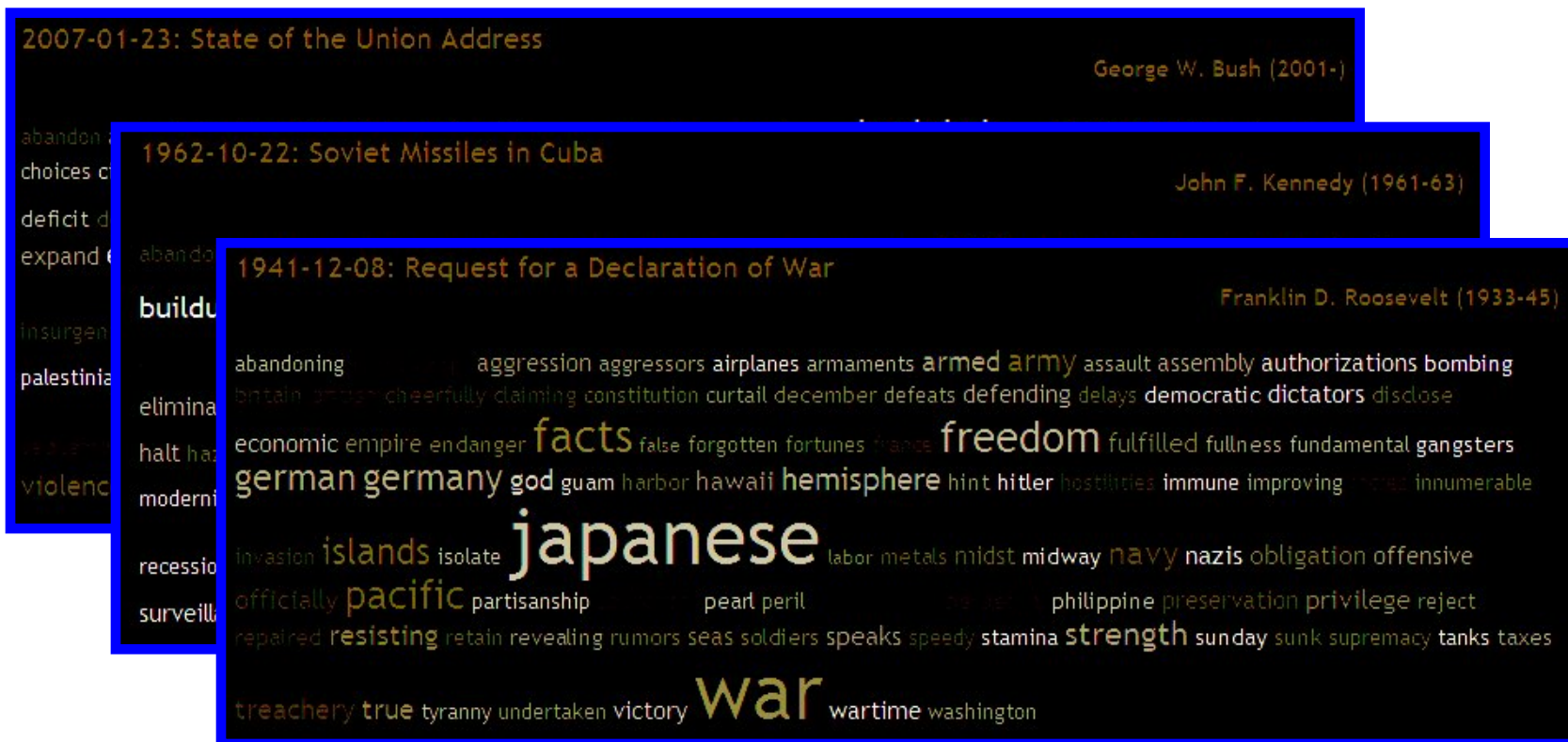
# Bags of features: Motivation

- Orderless document representation: frequencies of words from a dictionary Salton & McGill (1983)



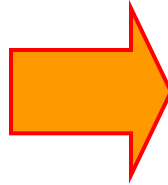
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# Bags of features

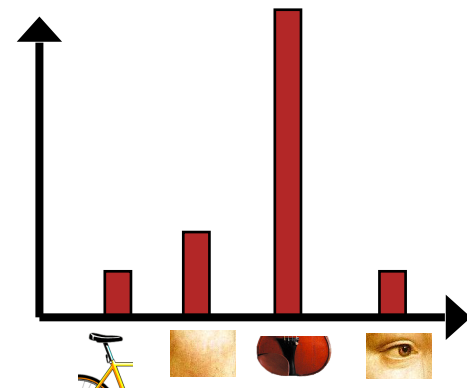
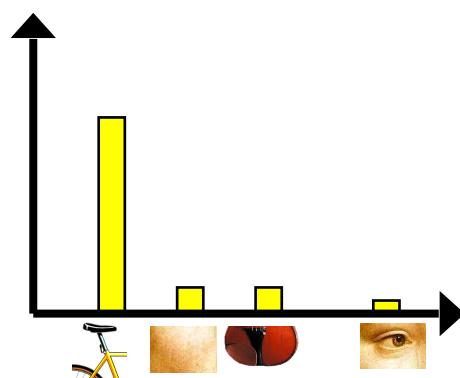
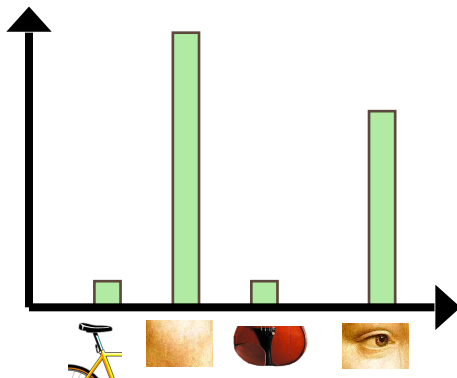
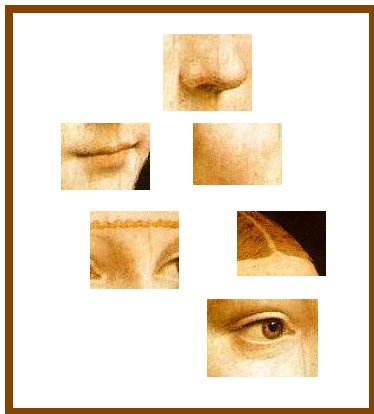
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# Traditional features: Bags-of-features

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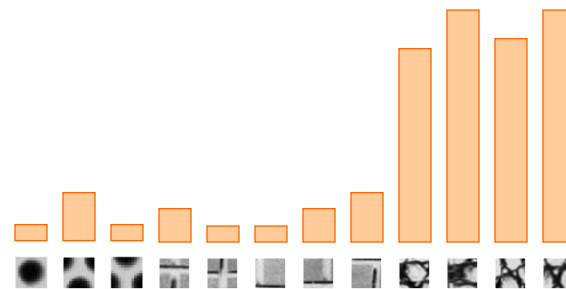
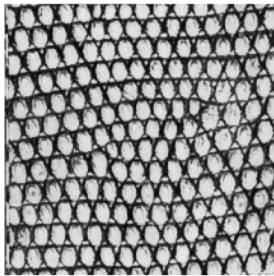
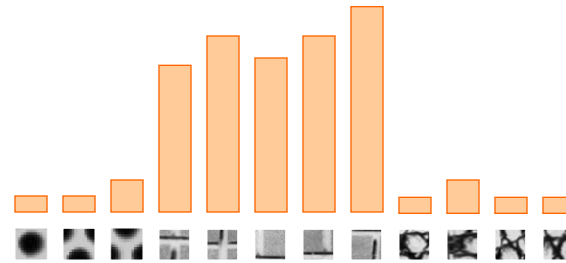
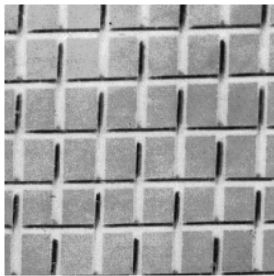
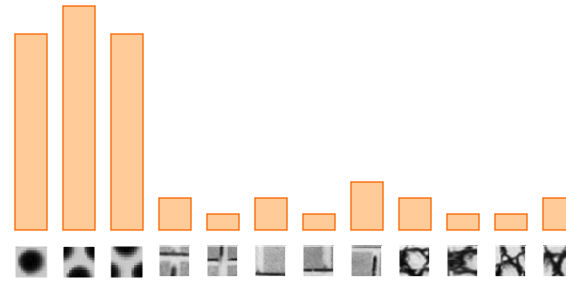
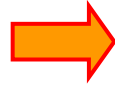
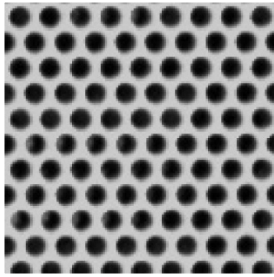
1. Extract local features
2. Learn “visual vocabulary”
3. Quantize local features using visual vocabulary
4. Represent images by frequencies of “visual words”







# Texture recognition



Julesz 1981; Cula & Dana, 2001; Leung & Malik 2001; Mori, Belongie & Malik, 2001; Schmid 2001; Varma & Zisserman, 2002, 2003; Lazebnik, Schmid & Ponce, 2003



# 1. Local feature extraction

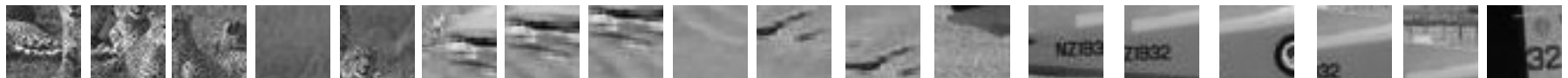
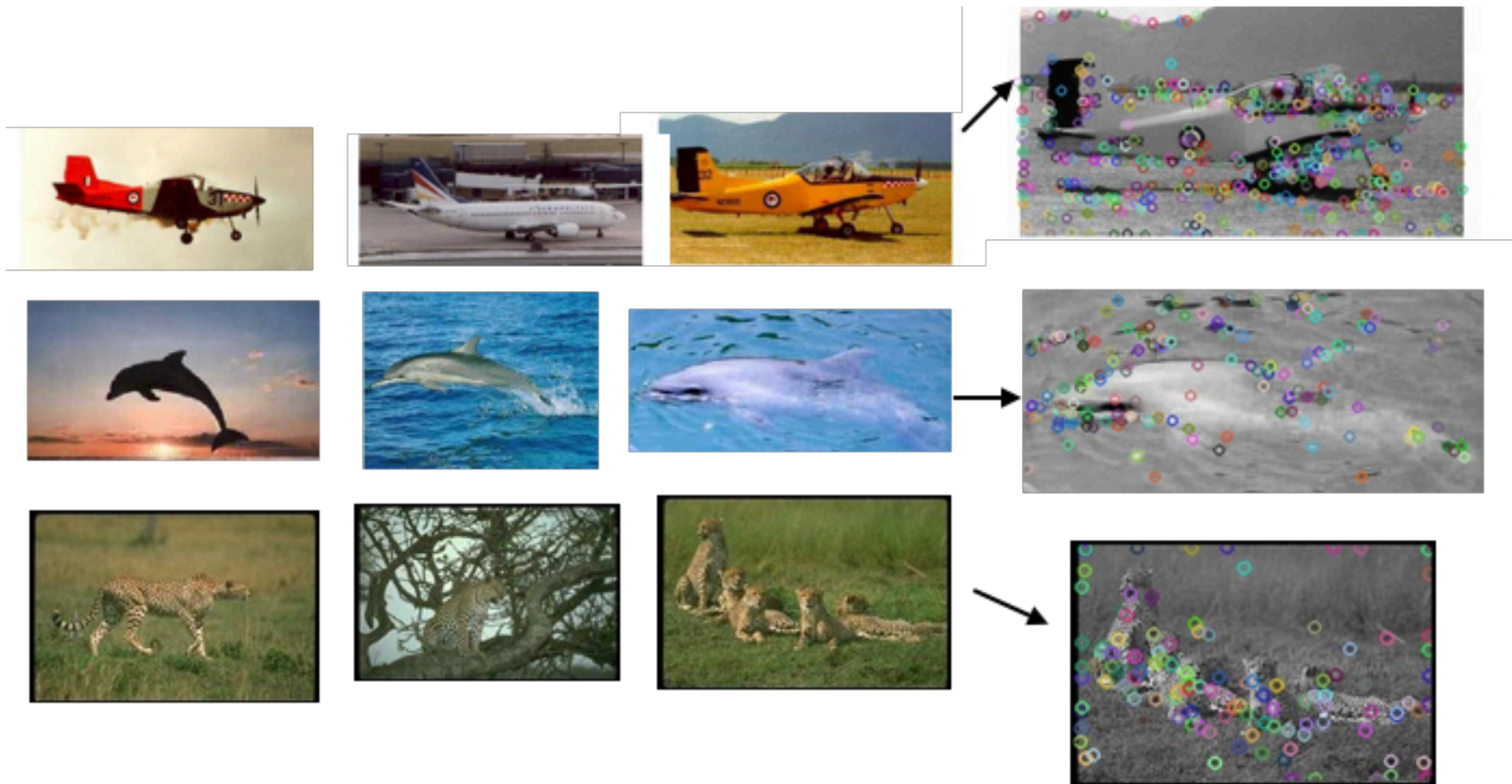
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- Sample patches and extract descriptors



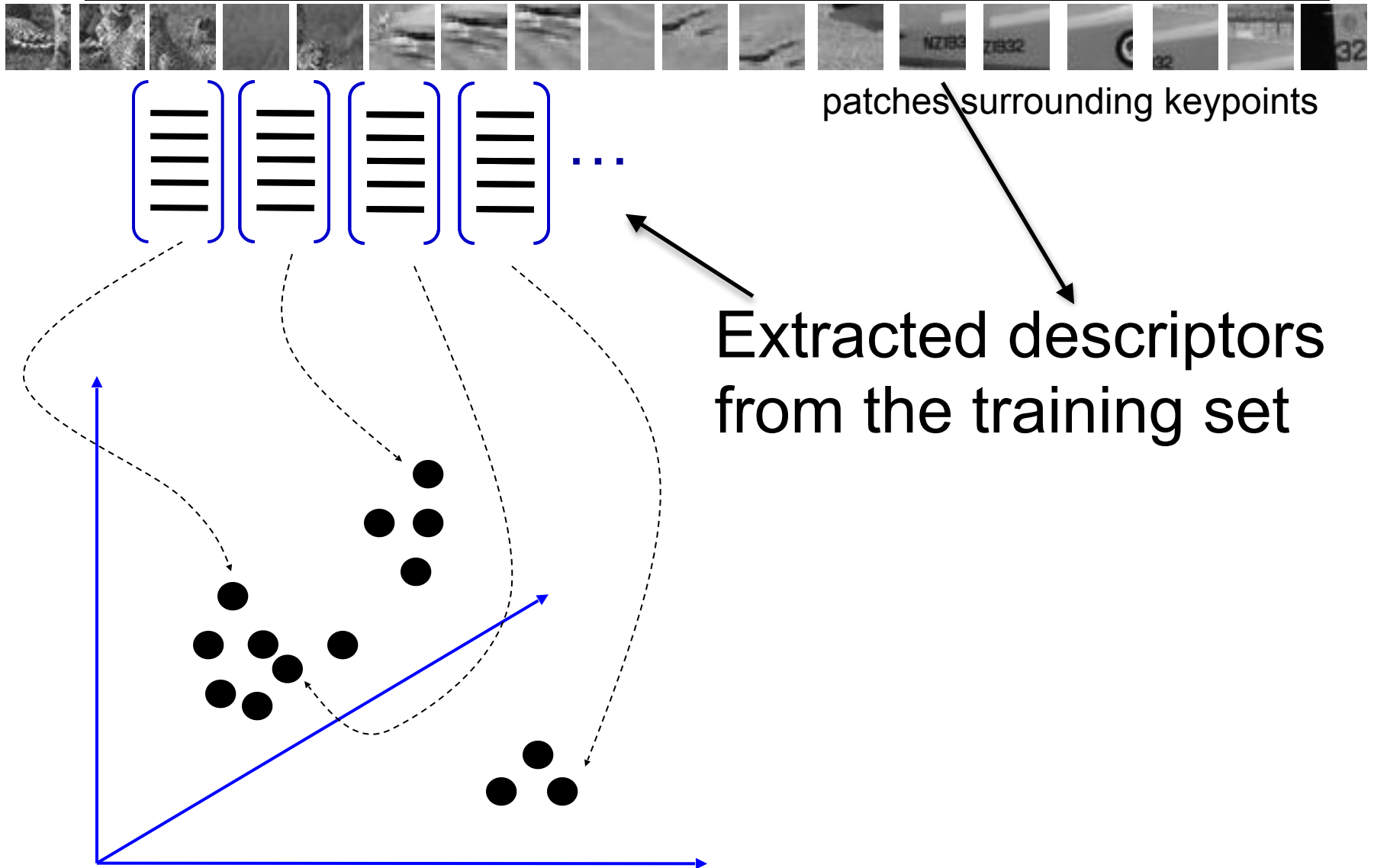
# Keypoints

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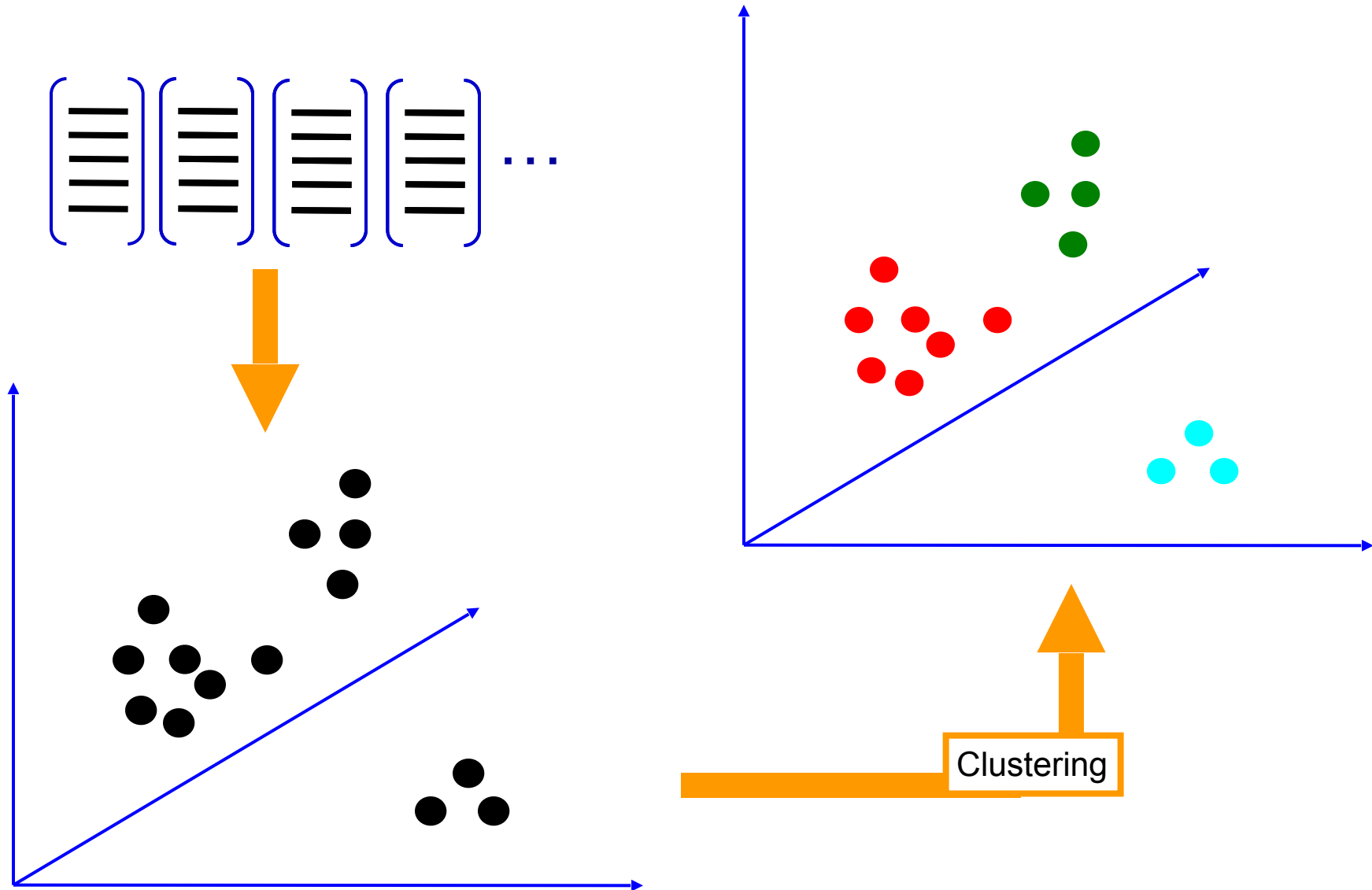
patches surrounding keypoints

## 2. Learning the visual vocabulary

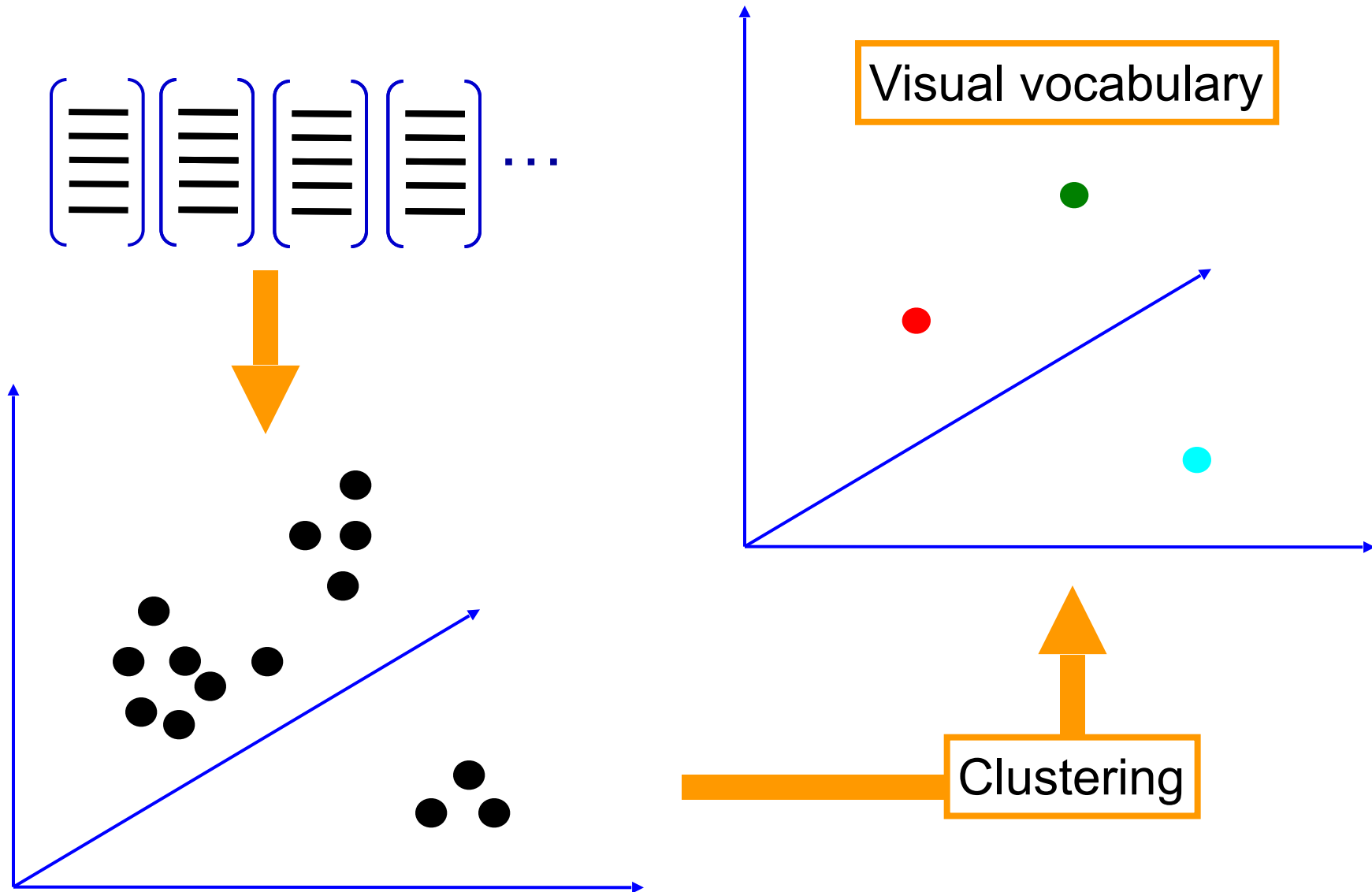


## 2. Learning the visual vocabulary

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## 2. Learning the visual vocabulary



# Bag-of-features steps

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1. Extract local features
2. Learn “visual vocabulary”
3. **Quantize local features using visual vocabulary**
4. **Represent images by frequencies of “visual words”**

