

SIFT TEXTURE DESCRIPTION FOR UNDERSTANDING BREAST ULTRASOUND IMAGES

Joan Massich, Fabrice Meriaudeau, Melcior Sentís, Sergi Ganau, Elsa Pérez, Domenec Puig, Robert Martí, Arnau Oliver and Joan Martí

Abstract

Texture is a powerful cue for describing structures that show a high degree of similarity in their image intensity patterns. This paper describes the use of Self-Invariant Feature Transform (SIFT), both as low-level and high-level descriptors, applied to differentiate the tissues present in breast US images. For such a task, a subset of 16 images has been randomly selected from a larger dataset of 700 Ultra-Sound (US) images acquired at the *UDIAT Diagnostic Centre of Parc Taulí* in Sabadell (Catalunya), between 2010 and 2012. This subset has been complemented with multi-label Ground Truth (GT), as illustrated in figure 1. Experimental results are provided showing the validity of the proposed approach for describing the tissues in breast US images.



Fig. 1: Dataset sample. From left to right: image sample, accompanying multi-label GT, tissue label GT color-coding.

SIFT as a low-level descriptor, tested using Maximum A Posteriori (MAP)

For the low-level texture descriptors case, SIFT descriptors are extracted from a regular grid. The high-level texture descriptor is build as a Bag-of-Features (BoF) of SIFT descriptors.

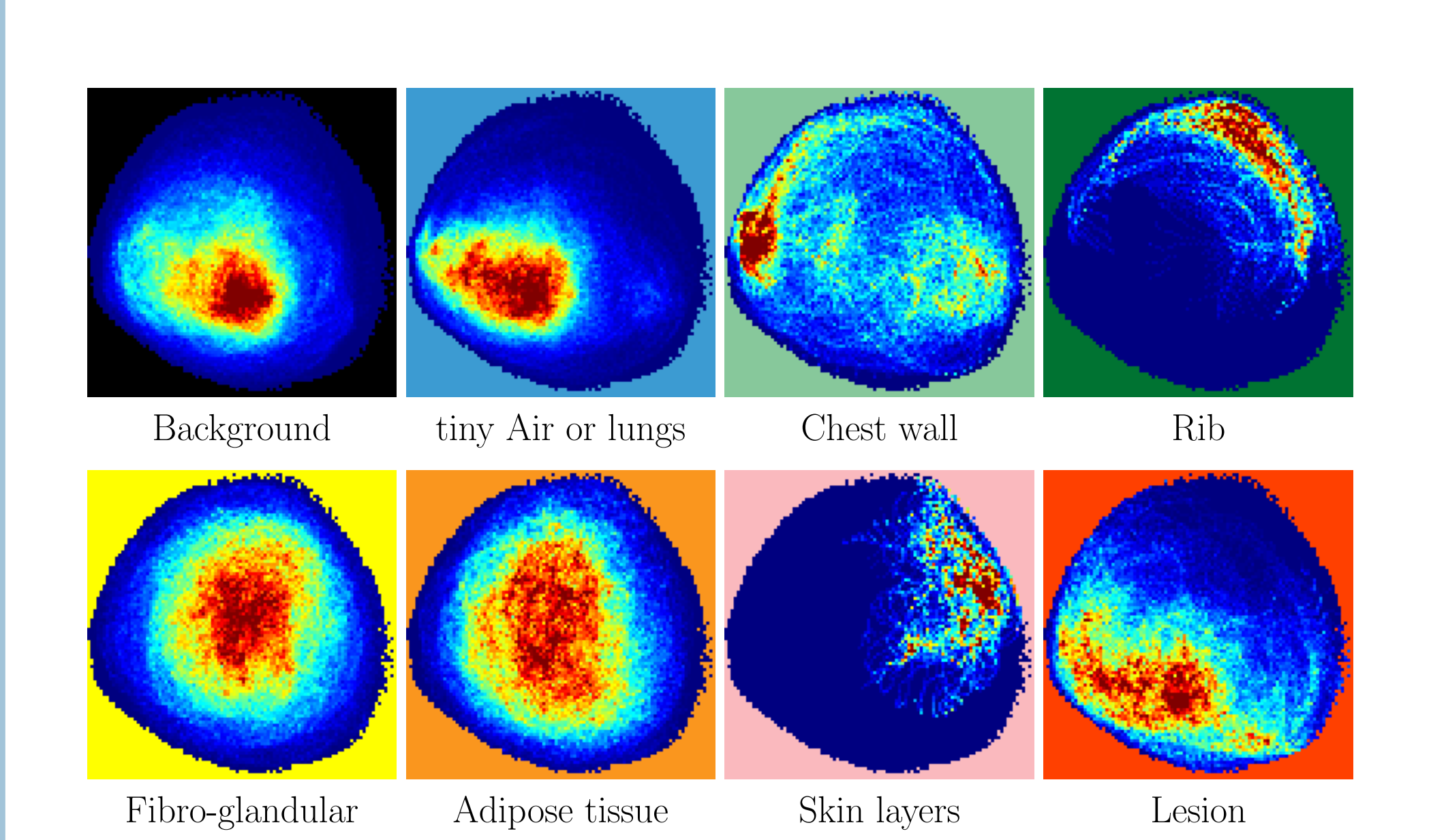


Fig. 2: Distribution of the SIFT descriptors for some classes in the GT.

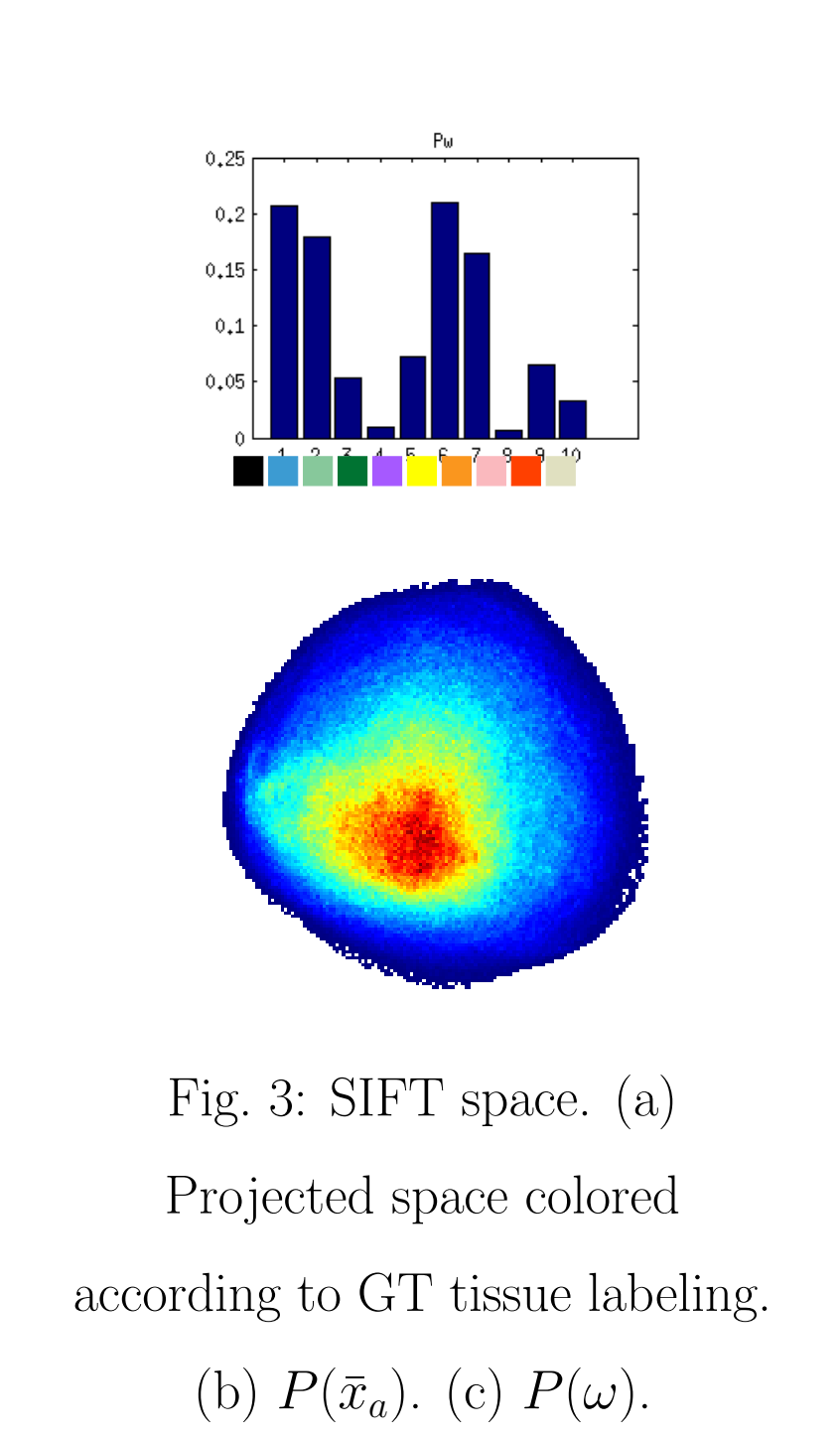


Fig. 3: SIFT space. (a) Projected space colored according to GT tissue labeling. (b) $P(\bar{x}_a)$. (c) $P(\omega)$.

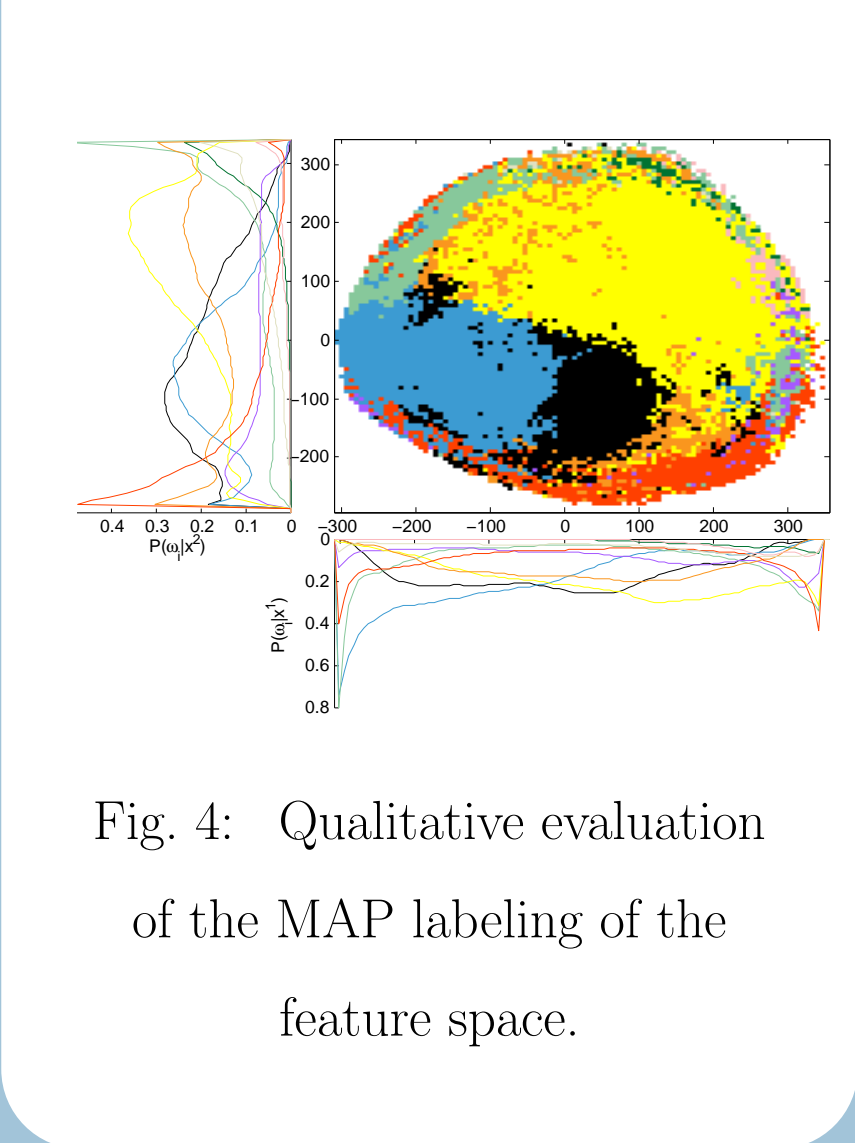


Fig. 4: Qualitative evaluation of the MAP labeling of the feature space.

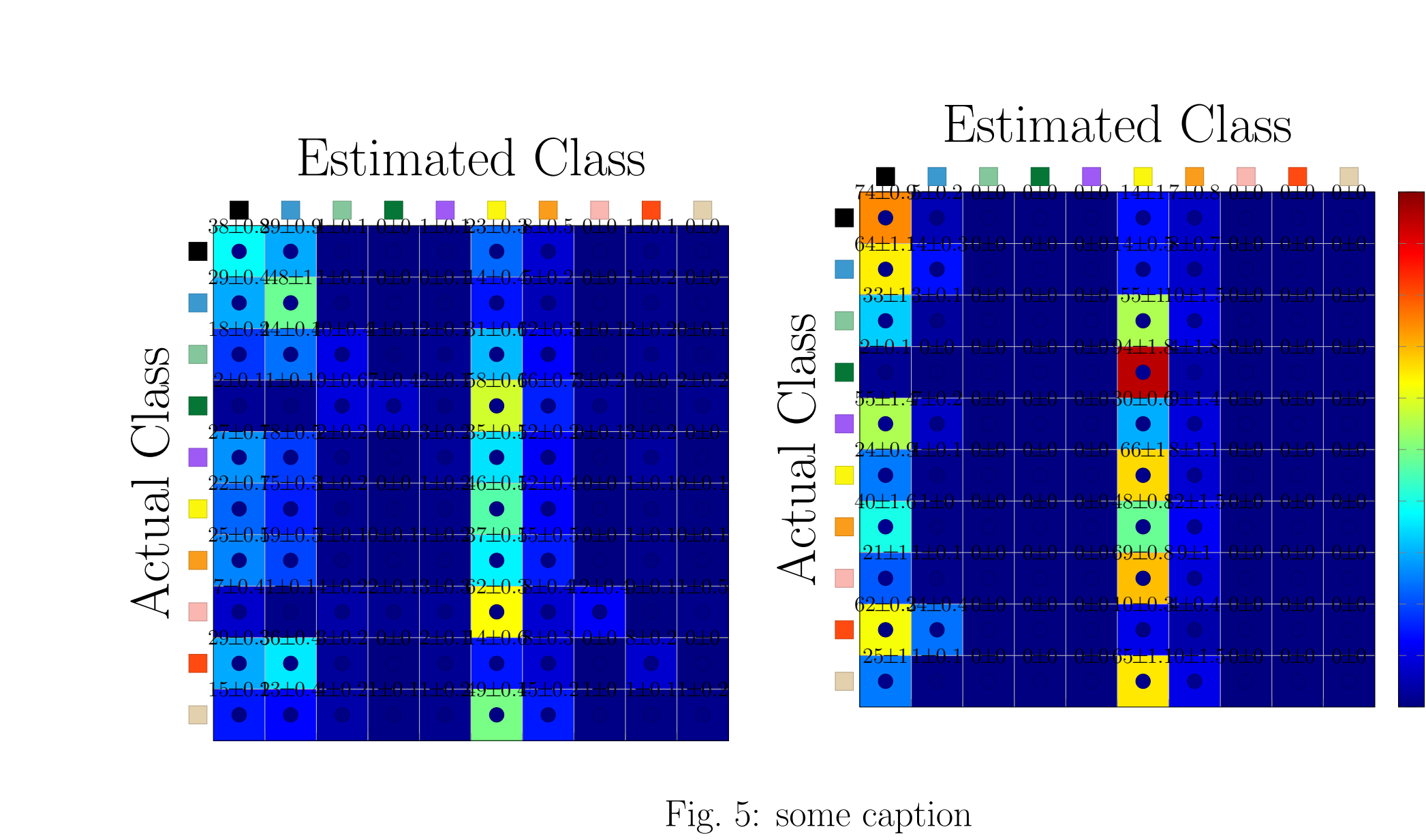


Fig. 5: some caption

SIFT as a high-level descriptor using Bag-of-Features (BoF), tested using Radial Basis Function (RBF)-Support Vector Machine (SVM) classifier

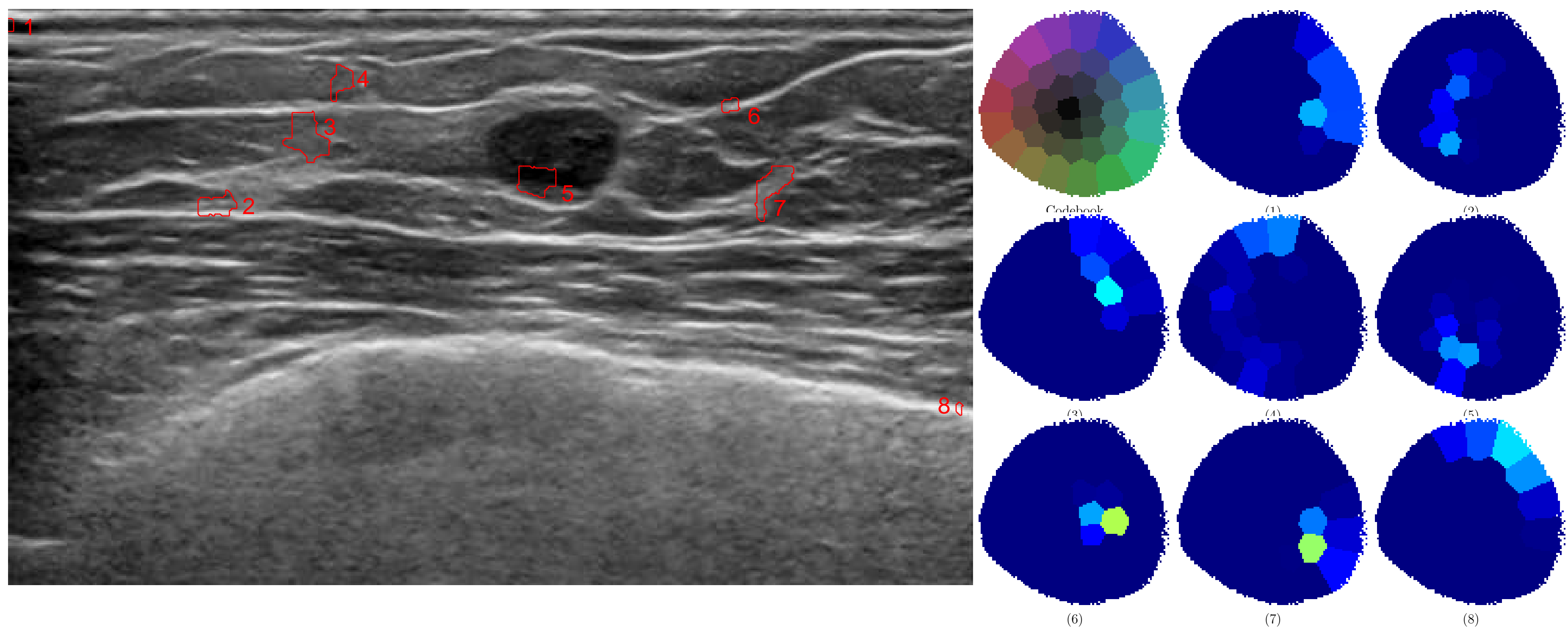


Fig. 6: SIFT-BoF descriptors qualitative analysis. (Left) image example. (Right) Dictionary representation colored using the location of the keypoint location in fig. ??a space. (1-8) Occurrence of the dictionary's key-points associated to each region highlighted in the original image.

Conclusion

The present study was designed to explore the usage of SIFT feature space as a texture for characterizing the different tissues present in a breast US image. The usage of SIFT either as a low-level or high-level texture descriptor has been evaluated in comparison to intensity features, which are the features most commonly used. The fact that SIFT and intensity descriptors produce similar results, encourages further studies on using SIFT texture descriptors characterizing breast tissues in US images.

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