

Ultrasonography Diagnostics Using Gaussian Mixture Model

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Abstract: The problem of diagnostics of diseases of thyroid gland is addressed, namely Hashimoto's Lymphotitic thyroiditis, which is one of most usual thyroid gland diseases. As opposed to expensive diagnosis using magnetic resonance or by painful invasive methods, we base our method on using ultrasound images. Sonographic imaging of thyroid gland is done routinely and these images can be used to find new cases which can help to start treatment as soon as possible.

It is hard for physician, to make thyroid gland diagnostics based on ultrasound image only. However, we have found out (see [2, 3]), that Hashimoto's Lymphotitic thyroiditis changes the pattern of the ultrasound scan.

For diagnostics, we use the statistics method. Database of ultrasound images with known diagnosis is used for learning. Pattern features are calculated and Gaussian mixture model in the space of pattern features is used. In diagnostics stage, the sonogram of person with unknown diagnostics is taken and the most probable diagnosis is inferred using Bayesian inference with on Gaussian clusters of pattern features. Hashimoto's lymphocytic thyroiditis is ideally suited for this approach, however, we research possibilities to use it for diagnostics of another diseases of thyroid gland or even other internal diseases.

References

- [1] L. Wartfsky and S. H. Ingbar, "Disease of the thyroid," in *Principles of Internal Medicine*, Harrison, Ed., number 1712. McGraw-Hill Inc., New York, 1991, 12th Ed.
- [2] D. Smutek, R. Šára, P. Sucharda, and L. Tesař, "Different types of image texture features in ultrasound of patients with lymphocytic thyroiditis," in *Proceedings of ISICT 2003*, A. M. et al., Ed., pp. 100–102, Trinity College Dublin, Ireland, September 2003. Computer Science Press, Trinity College Dublin.
- [3] D. Smutek, R. Šára, P. Sucharda, T. Tjahjadi, and M. Švec, "Image texture analysis of sonograms in chronic inflammations of thyroid gland," *Ultrasound in Medicine and Biology*, 29(11):1531–1543, 2003.
- [4] R. Šára, D. Smutek, P. Sucharda, and Š. Svačina, "Systematic construction of texture features for hashimoto's lymphocytic thyroiditis recognition from sonographic images," in *Proceedings of Artificial Intelligence in Medicine (AIME'01)*, pp. 339–348, Cascais, Portugal, July 2001. Springer Verlag LNAI 2101.