Prof. Young Jun Chai: artificial intelligence for thyroid ultrasound image analysis

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Editor's note

The focused issue "*The Management of Thyroid Tumors in 2020 and Beyond*" edited by Drs. Jonathon Russell and Jeremy Richmon is going to be released in *Annals of Thyroid* (*AOT*) in the coming months. This issue aims to review the state-of-art in the management of thyroid pathology, to provide a venue for original research focused on remote access or minimally invasive thyroid management and to review the success at extending proven management strategies into new geographic regions. Taking this opportunity, we have done a series of interviews with the authors discussing the highlights of their articles and sharing their experiences or stories in this field.

Prof. Young Jun Chai is an Associate Professor of Surgery at Seoul National University Boramae Medical Center. His professional interest is endocrine surgery of the thyroid, parathyroid and adrenal glands; his academic interest is the molecular biology of thyroid cancer. It is such an honor for *AOT* to interview Prof. Chai on his article "*Artificial intelligence for thyroid nodule ultrasound image analysis*" contributing to the focused issue, and his research and opinions in this field.

Expert's introduction

Young Jun Chai (*Figure 1*) is an Associated Professor of Surgery at Seoul National University Boramae Medical Center, where he was appointed in 2013. He was educated and trained at Seoul National University.

Prof. Chai's major professional interest is endocrine surgery of the thyroid, parathyroid and adrenal glands; he is academically interested in the molecular biology of thyroid cancer, has published more than 70 SCI(E) papers and three textbooks.

Prof. Chai serves as a member of American Head and Neck Society (AHNS), the managing Editor of the *Journal of Endocrinology* (*JES*), Secretary of the Korea Intraoperative Neural Monitoring Society (KINMoS), a member of the International Society of Oncoplastic Endocrine Surgeons (ISOPES), the Intraoperative Neural Monitoring Study Group (IONMSG), Secretary General of the Minimally Invasive Robotic and Endoscopic Thyroidectomy Study Group (MIRET).

Figure 1 Young Jun Chai, PhD.

Interview questions

AOT: How did you become involved in your research field?

Prof. Chai: I read several papers about thyroid ultrasound image analysis using machine learning or artificial intelligence. I found that the number of ultrasound images used in the previous study did not seem to be enough and tried to train a deep learning algorithm with larger number of images. Moreover, I would like to test the algorithm with external dataset from another institute in another country. Then, I proposed my idea to my colleagues and started to develop a deep learning algorithm.

AOT: Would you like to share the recent studies that you are focusing on?

Prof. Chai: In the previous study of my team (1), we developed deep learning algorithm which can predict whether a thyroid nodule is a benign or malignant. We used transfer leaning method, in which we used a pre-trained model which was trained with images from ImageNet to save time from starting the learning process from the beginning. The ImageNet dataset has more than 14 million images with annotation. In general, the number of the data required to train a model using transfer learning is about 1,000. Therefore, in the study, we trained the pre-trained model with 1,358 thyroid ultrasound images, and showed high sensitivity and negative predictive value. The number of thyroid ultrasound images has reached 4,500 and my team is planning to perform scratch learning, in which we train the entire model without using pre-trained model. Until now, it is not answered if scratch learning would show better performance than transfer learning. Comparing the performance of the two types of learning methods is noteworthy because it may suggest the appropriate number of training set to predict a thyroid ultrasound image.

AOT: In the focused issue "The Management of Thyroid Tumors in 2020 and Beyond", you have contributed an article on "artificial intelligence for thyroid nodule ultrasound image analysis". What will be the main points?

Prof. Chai: I will review the current status of artificial intelligence for thyroid ultrasound image analysis in South Korean and around the world. In the review I would like to potential advantages and disadvantages of using artificial intelligence in the clinical practice. In addition, I would discuss how to collect ultrasound images effectively from the various institutes, and how many images we have to collect for the deep learning algorithm to have acceptable performance.

AOT: What would you comment on the current status and development in artificial intelligence for thyroid nodule ultrasound image analysis in South Korea and around the world?

Prof. Chai: Artificial intelligence for thyroid nodule ultrasound image analysis is at basic level. In my team's experience, predicting thyroid nodule only with artificial intelligence is dangerous because current artificial intelligence cannot detect malignant nodules perfectly. Therefore, the role of artificial intelligence should be limited to assisting clinicians' decision making. In addition, there is a heterogeneity issue. Diagnostic accuracy of the ultrasound image analysis using artificial intelligence is greatly influenced by the quality of ultrasound machine and image resolution, and it is difficult to apply one deep learning model to different hospitals. A very large number of images is necessary to overcome the heterogeneity issue, and open-source database is required in the future.

AOT: How do you see the future direction of artificial intelligence for thyroid nodule ultrasound image analysis?

Prof. Chai: In general, artificial intelligence used for thyroid nodule ultrasound image analysis has high sensitivity and negative predictive value. This means that the nodules called benign by artificial intelligence are very likely to be benign and we can skip further diagnostic procedures such as fine needle aspiration cytology. Despite the current limitations, artificial intelligence could certainly serve as a clinical decision support tool, especially if an experienced clinician was unavailable.

Acknowledgments

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Footnote

Conflicts of Interest: The authors have no conflicts of interest to declare.

References

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