

The classification of oral squamous cell carcinoma (OSCC) by means of transfer learning

Abdul Rauf, Ahmad Ridhaudin^a; Mohd Isa, Wan Hasbullah^a; Khairuddin, Ismail Mohd^a; Mohd Razman, Mohd Azraai^a; Arzmi, Mohd Hafiz^b; P. P. Abdul Majeed, Anwar^{a, c, d, e, f}

^a Innovative Manufacturing, Mechatronics and Sports (iMAMS) Laboratory, Faculty of Manufacturing and Mechatronic Engineering, Universiti Malaysia Pahang, Pahang, Pekan, 26600, Malaysia

^b Cluster of Cancer Research Initiative, International Islamic University Malaysia, Pahang, Kuantan, 25200, Malaysia

^c Centre for Software Development and Integrated Computing, Universiti Malaysia Pahang, Pekan, 26600, Malaysia

^d Faculty of Engineering, Technology and Built Environment, UCSI University, Cheras, Kuala Lumpur Campus, Kuala Lumpur, 56000, Malaysia

^e EUREKA Robotics Centre, Cardiff School of Technologies, Cardiff Metropolitan University, Cardiff, C5 2YB, United Kingdom

^f School of Robotics, XJTLU Entrepreneur College (Taicang), Xi'an Jiaotong-Liverpool University, Suzhou, 215123, China

ABSTRACT

Patients that are diagnosed with oral cancer has more than an 83% survival chance if it is detected in its early stages. However, through conventional labour-intensive means, only 29% of cases are detected. It is worth mentioning that 90% of oral cancer is Oral Squamous Cell Carcinoma (OSCC) and is often caused by smoking and alcohol consumption. Computer-aided diagnostics could further increase the rate of detection of this form of oral cancer. The present study sought to employ a class of deep learning techniques known as transfer learning. The Inception V3 pre-trained convolutional neural network model is used to extract the features from texture-based images. Consequently, the malignant and benign nature of the cancer is identified from three different machine learning models, i.e., Support Vector Machine (SVM), k-Nearest Neighbors (kNN) and Random Forest (RF). It was shown from the study that an average of 91% classification accuracy was obtained from the test and validation dataset from the Inception V3-RF pipeline. The outcome of the present study could serve useful in an objective-based automatic diagnostic of OSCC and hence could possibly increase its detection.

KEYWORDS

InceptionV3; kNN; Oral cancer; Oral squamous cell carcinoma; RF; SVM; Transfer learning

REFERENCES

1. Warnakulasuriya, S.: Global epidemiology of oral and oropharyngeal cancer. *Oral Oncol.* 45(4-5), 309-316 (2009). <https://doi.org/10.1016/j.oraloncology.2008.06.002>
2. Hung, L.-C., et al.: Assessment of the risk of oral cancer incidence in a high-risk population and establishment of a predictive model for oral cancer incidence using a population-based cohort in Taiwan. *Int. J. Environ. Res. Public Health* 17(2), 665 (2020). <https://doi.org/10.3390/ijerph17020665>
3. Das, D.K., Bose, S., Maiti, A.K., Mitra, B., Mukherjee, G., Dutta, P.K.: Automatic identification of clinically relevant region from oral histological images for oral squamous cell carcinoma diagnosis. *Tissue Cell* 53(March), 111-119 (2018). <https://doi.org/10.1016/j.tice.2018.06.004>
4. Ren, J., Qi, M., Yuan, Y., Duan, S., Tao, X.: Machine learning-based MRI texture analysis to predict the histologic grade of oral squamous cell carcinoma. *Am. J. Roentgenol.* 215(5), 1-7 (2020). <https://doi.org/10.2214/AJR.19.22593>
5. Xu, S., et al.: An early diagnosis of oral cancer based on three-dimensional convolutional neural networks. *IEEE Access* 7, 158603-158611 (2019). <http://doi.org/10.1109/ACCESS.2019.2950286>
6. Noor, F.N.M., Isa, W.H.M., Majeed, A.P.P.A.: The diagnosis of diabetic retinopathy by means of transfer learning with conventional machine learning pipeline. *MEKATRONIKA* 2(2), 62-67 (2020)
7. Abdullah, M.A., et al.: The classification of skateboarding tricks via transfer learning pipelines. *PeerJ Comput. Sci.* 7, e680 (2021)