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Robot Radiology: AI for Cervical Cancer Detection

Artificial Intelligence (AI) has already exceeded human abilities in several areas. It is expected that soon AI will be used to read biomedical images more accurately than medical personnel alone. This could potentially result in better early cervical cancer detection at much lower cost.

See Also: AI Systems 'Augment' Human Diagnosticians

As Sharon Xiaolei Huang, associate professor of computer science and engineering at Lehigh University in Bethlehem, PA points out, humans and computers are complementary and that is primarily what AI is all about. Working on creating techniques to enable computers to understand images the way humans do, Huang and her team have now created a cervical cancer screen technique that could perform as well or better than human interpretation or other traditional screening results such as Pap tests and HPV tests. In less-developed countries, this technique could be utilised quite effectively since 80% of deaths from cervical cancer occur in these countries.

More Accurate Screening, Less Cost

The new screening system is built on image-based classifiers that have been constructed from a large number of Cervigram images. The images, when read, can help detect cervical intraepithelial neoplasia (CIN), the precancerous change and abnormal growth of squamous cells on the surface of the cervix.

Huang explains that cervigrams can be an excellent screening tool in less developed regions where clinical tests such as Pap and HPV are too expensive and not widely available. But since there has been concern regarding the overall effectiveness of Cervigrams due to poor correlation between visual lesion recognition and high-grade disease, it is believed AI could help solve this problem and provide more accuracy.

"Our method would be an effective low-cost addition to a battery of tests helping to lower the false positive rate since it provides 10% better sensitivity and specificity than any other screening method, including Pap and HPV tests," says Huang.

Correlating Images and Data

Huang's team has created hand-crafted pyramid features and have investigated the performance of a framework known as convolutional neural networks (CNN) for cervical disease classification. Their results are published in Pattern Recognition.

In order to build the screening tool, the team used data from 1,112 patient visits. 345 patients had positive lesions for moderate or severe dysplasia and 767 patients had negative lesions with mild dysplasia. The programme they have designed creates automatic segments tissue regions seen in these images and correlates the visual features from these images to the development of precancerous lesions. "In practice, this could mean that medical staff analysing a new patient's Cervigram could retrieve data about similar cases--not only in terms of optics, but also pathology since the dataset contains information about the outcomes of women at various stages of pathology," Huang explains.

Findings show that their tool outperforms every single Pap or HPV test when achieving a specificity of 90%. When not constrained by this requirement, the tool is even more accurate.

Classification and Improved Technique

Huang's team is now working on the use of an established medical imaging techniqiue called optical coherence microscopy (OCM) which is commonly used to analyse breast tissue for computer-aided diagnoses. The goal is to help surgeons minimise the tissue removed in a cancer patient by providing highly accurate, real-time information about tissue health.

Source: Lehigh University
Image Credit: Pixabay

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