New AI tool efficiently detects asbestos in roofs so it can be removed

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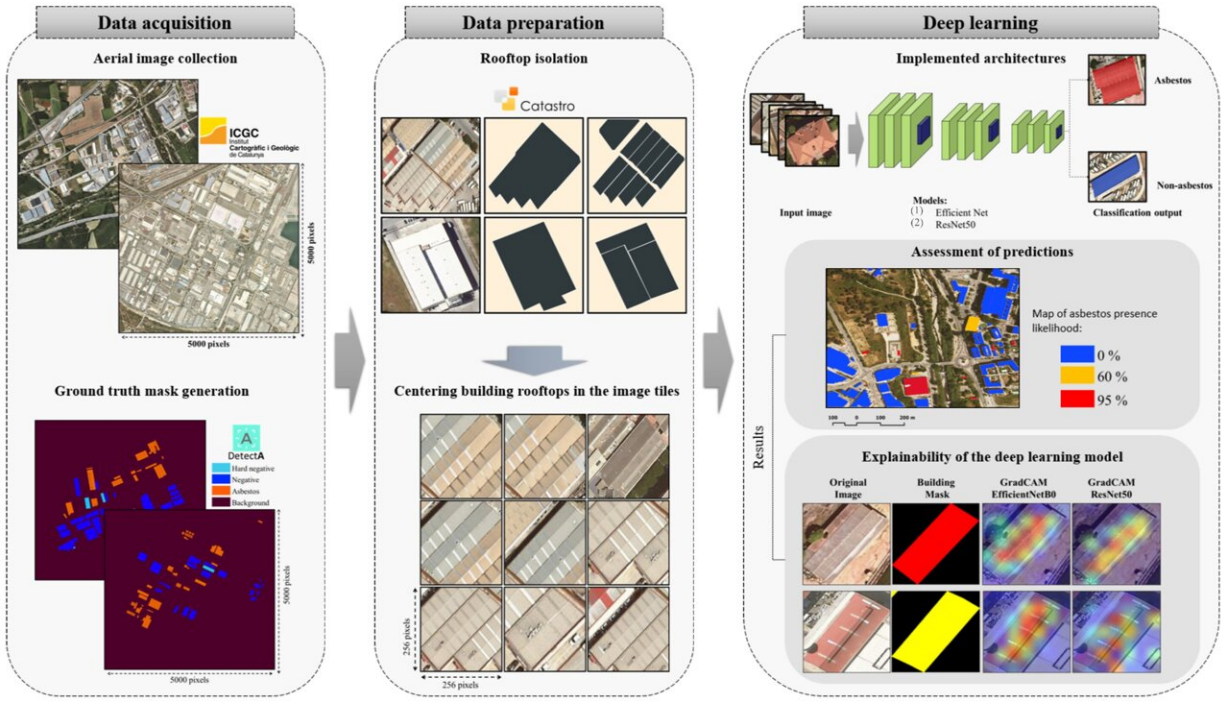

Data pre-processing and inference process overview. The left panel shows the two main data collection steps, while the central panel illustrates how buildings are isolated and centered owing to cadastral data. The right panel exemplifies, first, the classification task, which delivers a number in the range of [0,1] expressing the likelihood of the presence of asbestos in the image. The classification task undergoes a Grad-CAM analysis, delivering an interpretable heatmap to understand which part of the image is most responsible for the classification score. Credit: *Remote Sensing* (2024). DOI: 10.3390/rs16081342

A team of researchers from the Universitat Oberta de Catalunya (UOC) has designed and tested a new system for detecting asbestos that has not yet been removed from the roofs of buildings, despite regulatory requirements.

The software, developed in partnership with DetectA, applies artificial intelligence, deep learning and computer vision methods to aerial photographs, using RGB images, which are the most common and economical type.

This represents an important competitive advantage over previous attempts to create a similar system, which required multiband images that are more complex and difficult to obtain.

The success of this much more scalable project will allow the removal of this highly toxic building material to be more systematically and effectively monitored.

"Unlike infrared or hyperspectral imaging methods, our decision to train AI with RGB images ensures the methodology is versatile and adaptable. In Europe and many other countries around the world this type of aerial imaging is freely available in very high resolutions," explained Javier Borge Holthoefer, lead researcher of the Complex Systems group (CoSIN3) at the Internet Interdisciplinary Institute (IN3).

Borge Holthoefer is leading this research, together with Àgata Lapedriza, researcher with the eHealth Center's Artificial Intelligence for Human Well-being group (AIWELL) and a member of the UOC's Faculty of Computer Science, Multimedia and Telecommunications.

Their research has been published in *Remote Sensing*. UOC doctoral students Davoud Omarzadeh, Adonis González-Godoy, Cristina Bustos and Kevin Martín Fernández also contributed to the project, together

with the founders of DetectA, Carles Scotto and César Sánchez.

The researchers trained the deep learning system using thousands of photographs held by the Cartographic and Geological Institute of Catalonia, teaching the AI tool which roofs contain asbestos and which do not. In all, 2,244 images were used (1,168 positive for asbestos and 1,076 negative)—80% were used to train and validate the system, with the remaining images reserved for the final test.

The software is now able to determine if asbestos is present in new images by assessing different patterns, such as the color, texture and structure of the roofs, as well as the area surrounding the buildings.

The project will be useful in urban, industrial, coastal and rural areas. By law, municipalities should have performed a survey of buildings containing asbestos by April 2023, but not all of them have yet done so.

Hyperspectral photographs make it easier to detect asbestos, because they contain many more layers of information, but they are not ideal for developing an efficient detection method, due to their limited availability and the high cost of obtaining them.

The system developed by the UOC researchers is the first to use RGB images, which can be taken from aircraft and are commonly used by many countries' cartographic services.

"Although these images contain less information, we have achieved comparable results by training the deep learning system well, with a success rate of over 80%," explained the CoSIN3 researcher.

Banned for more than two decades

More than 20 years after its use in construction was banned, asbestos

remains a major public health problem. It is estimated that, in Catalonia alone, more than 4 million tons of asbestos fiber cement is still in place.

According to the World Health Organization it causes more than 100,000 deaths a year globally, mainly from lung cancer, but also other conditions including pleural tumors and pulmonary fibrosis. The legal target for removing asbestos from public buildings is 2028 and the target for private buildings is 2032.

The development of this technological solution will contribute to tackling one of the key issues in the fight against asbestos: how authorities can identify which roofs contain asbestos, so it can be removed by qualified, accredited professionals.

"There is currently no protocol or effective system for locating the asbestos that is still out there, because it is expensive and time-consuming to inventorize using people on the ground," said Holthoefer.

Now his team is looking into expanding the AI system training base in order to make it as effective in rural environments as it is in urban and industrial locations, where it is a little more reliable because the system was trained with more data from these areas, and also because asbestos wear and conservation is different in rural conditions, and it may be covered by layers of vegetation.

More information: Davoud Omarzadeh et al, Explainable Automatic Detection of Fiber–Cement Roofs in Aerial RGB Images, *Remote Sensing* (2024). DOI: 10.3390/rs16081342

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