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## Spotting L3 slice in CT scans using deep convolutional network and transfer learning

Soufiane Belharbi<sup>a</sup>, Clément Chatelain<sup>a,d</sup>, Romain Hérault<sup>a,d</sup>, Sébastien Adam<sup>a,\*</sup>, Sébastien Thureau<sup>c,a</sup>, Mathieu Chastan<sup>b</sup>, Romain Modzelewski<sup>a,b</sup>

<sup>a</sup>*Normandie Univ, UNIROUEN, UNIHAVRE, INSA Rouen, LITIS, 76000 Rouen, France*

<sup>b</sup>*Henri Becquerel center, Department of Nuclear Medicine, 76000 Rouen, France.*

<sup>c</sup>*Henri Becquerel center, Department of Radiotherapy, 76000 Rouen, France.*

<sup>d</sup>*These authors contributed equally*

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### Abstract

In this article, we present a complete automated system for spotting a particular slice in a complete 3D Computed Tomography exam (CT scan). Our approach does not require any assumptions on which part of the patient's body is covered by the scan. It relies on an original machine learning regression approach. Our models are learned using the transfer learning trick by exploiting deep architectures that have been pre-trained on imageNet database, and therefore it requires very little annotation for its training. The whole pipeline consists of three steps : i) conversion of the CT scans into Maximum Intensity Projection (MIP) images, ii) prediction from a Convolutional Neural Network (CNN) applied in a sliding window fashion over the MIP image, and iii) robust analysis of the prediction sequence to predict the height of the desired slice within the whole CT scan. Our approach is applied to the detection of the third lumbar vertebra (L3) slice that has been found to be representative to the whole body composition. Our system is evaluated on a database collected in our clinical center, containing 642 CT scans from different patients. We obtained an average localization error of  $1.91 \pm 2.69$  slices (less than 5 mm) in an average time of less than 2.5 seconds/CT scan, allowing integration of the proposed system into daily clinical routines.

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\*Corresponding author

*Email address:* `Sebastien.Adam@univ-rouen.fr` (Sébastien Adam )

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