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A MACHINE LEARNING FRAMEWORK FOR CONTEXT SPECIFIC COLLIMATION AND WORKFLOW PHASE DETECTION

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Summary: Collimators control the field of view (FoV) by using thick blades to block X-rays leaving the source to image the patient. When the blades are adjusted to reduce the FoV, the area of the patient receiving radiation is reduced. Current fluoroscopy systems allow only for manual collimation by the operator. This can be done from the control panel using physical controls. Nonetheless, manual collimation is time consuming, causes interruption to the clinical Workflow, and is operator dependant. This is because the operator has to first identify a region of interest (RoI), then collimate around the RoI depending on the type of the procedure, workflow phase, and interventionist`s preferences. In this work, we propose a learning based framework that can autonomously predict the workflow phase and localize an object of interest during congenital cardiac interventions (CCIs). In particular, we propose to learn the task of workflow recognition by using a convolutional neural network model. For training and evaluating our model, 4500 images from 25 clinical cases acquired during Biplane CCIs at Evelina London Children's Hospital, UK, were used. A training accuracy of 99% and an evaluation accuracy of 86% were achieved. The framework allows for optimal and automatic adjustment of collimation depending on the predicted workflow around the localized devices, which we refer to as context specific collimation.