

Incorporating Deep Learning and Explainable AI (XAI) to predict postnatal outcomes in fetuses with congenital obstructive uropathies

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Introduction

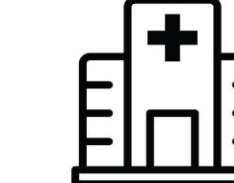
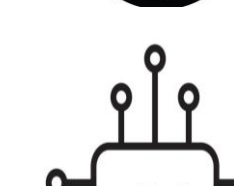
Prediction of outcomes in congenital obstructive uropathies is currently based on **subjective assessment**, which shows **poor agreement and low accuracy**.

Deep Learning with explainable AI (XAI) could enhance understanding and support clinical decisions by **highlighting relevant features** influencing predictions.

Aim

To integrate Deep Learning with Explainable AI (XAI) to provide an objective and reproducible antenatal assessment tool for predicting postnatal renal outcomes

Methods

-  Retrospective, cross-sectional study
-  University Medical Center Groningen (UMCG)
-  Unilateral congenital obstructive uropathies (n=97)
-  Third trimester ultrasound images (2013-2023)
-  Deep Learning model and XAI Methods (GradCAM)
- Adverse postnatal outcome:** Abnormal renal function (renogram $\leq 40\%$ and/ or postnatal surgical intervention)

Results

Renal images of 97 cases of unilateral congenital obstructive uropathies were included for developing the Deep Learning model.

The best performing model, EfficientNetB4 architecture showed a performance with an AUC of 0.7 in classifying outcomes.

GradCAM-based visual explanations (Figure 1) revealed the spatial regions that contributed the most to the model's decision: renal pelvis for cases with favorable outcome (left) and renal cortex for cases with adverse outcome (right).

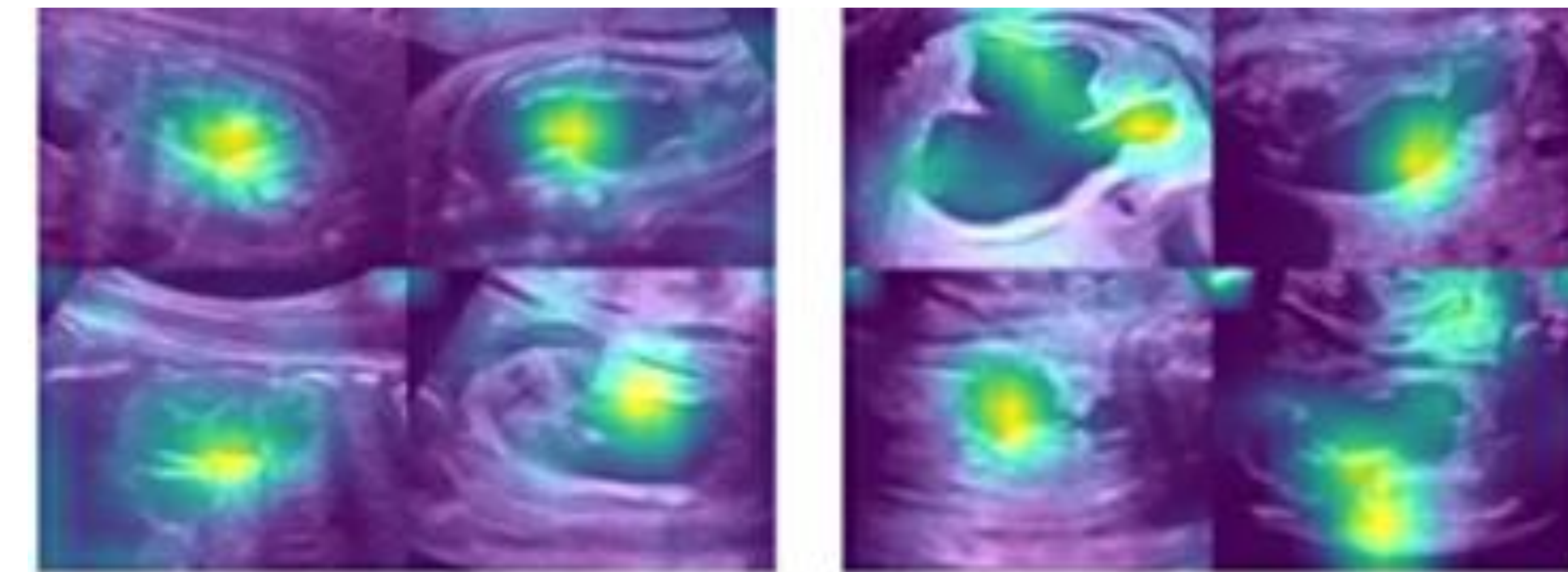


Figure 1. XAI visualization of important predictive features

Conclusions

Our **Deep Learning model** provided an **accurate, objective and reproducible assessment tool to predict postnatal renal function**. XAI highlighted the anatomical regions typically assessed by clinicians; renal cortex and pelvis. This **underscores the potential of integrating XAI to achieve a more objective and interpretable prediction of renal outcome** and can help clinicians focus on the **most important predictive features**.