UPORABA UMETNE INTELIGENCE PRI OCENI KOSTNE STAROSTI V OTROŠKEM OBDOBJU

USE OF ARTIFICIAL INTELLIGENCE IN ASSESSMENT OF BONE AGE IN CHILDHOOD

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Prejeto/Recived: 15. 1. 2024
Sprejeto/Accepted: 30. 4. 2024

IZVLEČEK

Uvod in namen: Ocena kostne starosti pri otrocih je merilo stopnje zrelosti/razvoja skeleta v primerjavi z zrelostjo skeleta določeno za kronološko starost otroka. Izračunamo jo s pomočjo rentgenske slike leve roke in zapestja, slikanega v posteriorno-anteriorni projekciji. Določanje le-te je sprva potekalo ročno, z razvojem umetne inteligence pa se je pojavilo več avtomatiziranih metod. Od leta 2016 v klinični praksi na Pediatrični kliniki v UKC Ljubljana uporabljamo računalniški program BoneXpert. Namen prispevka je na primeru predstaviti proces ocenjevanja z ročnim izračunom in z avtomatiziranim izračunom.

Metode: Pri ocenjevanju kostne starosti po klasični metodi s pomočjo atlasa radiolog primerja točno določena skeletna področja na rentgenskem posnetku z enakimi področji na najbolj primerljivih referenčnih slikah, ki so zbrane v Greulich-Pyle atlasu. V slednjem so le-te ločene po spolu: pri fantih so slike razporejene od 0–18 let, pri dekletih pa od 0–19 let, v intervalih od treh mesecev do enega leta. Program BoneXpert pa deluje na podlagi strojnega učenja ter analizira sam in omogoča oceno kostne starosti za dečke v starostnem obdobju od 2,5–19 let in za deklice od 2–18 let. Končni rezultat je rentgenska slika z dodanimi vrednostmi izračuna, ki se kot datoteka DICOM v bolnišničnem PACS-u shrani v isti mapi kot izvorna rentgenska slika.

Rezultati: Pri deklici z normalno skeletno morfologijo smo prikazali izračun programa BoneXpert in opisali izračun kostne starosti z atlasom brez vrednosti: kronološka starost deklice je 7.88 let, v Greulich-Pyle vrednosti je 8.32 let in 8.28 let po Tanner-Whitehouse stopnji. Ročni izračun ni potreben zaradi normalnega skeleta.

Razprava in zaključek: BoneXpert skrajša čas do izvida ob normalni morfološki sliki kosti. V kliničnem okolju je pomembno, da radiolog prepozna v katerih situacijah analiza s pomočjo programa BoneXpert ni smiselna in uporabi ročni izračun. Človeški faktor pri procesu določanja kostne starosti ostaja ključen.

Ključne besede: pediatrija, kostna starost, radiologija, umetna inteligenca, BoneXpert

ABSTRACT

Introduction and purpose: Evaluation of bone age in children is a measure of skeletal maturity/development compared to the skeletal maturity determined for the chronological age of the child. It is calculated using a radiograph of the left hand with wrist in posterior-anterior projection. Initially, the bone age was determined manually, but with the development of artificial intelligence, several automated methods have emerged. Since 2016, the Pediatric Clinic at the University Medical Centre Ljubljana has been using the BoneXpert computer program in clinical practice. The purpose of this poster is to present the process of evaluation with manual calculation and with automated calculation.

Methods: When assessing bone age using the classical method with the atlas, a radiologist compares specific skeletal areas on the X-ray image with the corresponding areas on the most relevant reference images collected in the Greulich-Pyle atlas. In it. the images are separated by gender: for boys, the images range from 0-18 years, and for girls, from 0-19 years, at intervals of three months to one year. The BoneXpert program operates on machine learning, automatically analyzes and provides an assessment of bone age for boys aged 2.5-19 years and for girls aged 2-18 years. The final result is an X-ray image with calculated values that is saved as a DICOM file in the same folder of the hospital's PACS system as the original X-ray image.

Results: For the girl with normal skeletal morphology, we demonstrate the calculation with BoneXpert and describe the calculation with the atlas without values: the chronological age of the girl is 7.88 years, with values of 8.32 years according to Greulich-Pyle and 8.28 years according to Tanner-Whitehall system. A manual calculation is not necessary due to the normal skeleton.

Discussion and conclusion: BoneXpert shortens the time to diagnosis with a normal morphologic bone image. In a clinical setting, it is crucial for the radiologist to recognize situations where the analysis with BoneXpert is not useful and uses manual calculation. The human factor in determining bone age remains critical.

Keywords: paediatric, bone age, radiology, artificial intelligence - AI, BoneXpert

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