

### **Assessment of Ultrasound-Based Radiomics as A Marker of Chronic Kidney Disease**

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Radiomics is a technique used to extract a large number of texture features from medical images to support diagnostic decisions using mathematical algorithms. Chronic Kidney Disease (CKD) is one of the major global health challenges. Ultrasound B-mode imaging is considered a first-line diagnostic method in CKD, based on visual features. Renal biopsy remains the golden marker for CKD detection. We recently showed that CKD can be detected using Radiomics features. Wavelet decomposed (Low-High) Gray Level Run Length based Normalized Run Length Non-Uniformity (WT(LH)GRLN) was identified as one of the best Radiomics feature to differentiate CKD and healthy kidneys. In the current study, we assessed the ability of WT(LH)GRLN to detect CKD grades on biopsy-proven CKD kidneys. CKD patients who were diagnosed based on biopsies (n = 65) and age-matched (p>0.05) volunteers (n = 68) without any clinical history of renal diseases were recruited with their consent. The study was approved by the institutional ethical committee. The Patient group was subdivided based on their biopsy reports. Minimal and mild fibrosis to patient group 1 and moderate and severe fibrosis to patient group 2. All groups underwent B-mode Ultrasound (Mindray, DC-80 Exp Insight) scans. Collected DICOM images were trend corrected and rotated, such that pole to pole axis was perpendicular to the vertical axis of the image. WT(LH)GRLN feature was calculated using a Python library (PyRadiomics). The mean value of WT(LH)GRLN in CKD kidneys ( $0.21 \pm 0.02$ ) was significantly less (T-test, two-tailed,  $p < 0.05$ ) than that of healthy kidneys ( $0.32 \pm 0.02$ ). No significant difference (T-test, two-tailed,  $p > 0.05$ ) in WT(LH)GRLN was found between the patient group 1 ( $0.21 \pm 0.01$ ) and the patient group 2 ( $0.20 \pm 0.02$ ). This study further confirms WT(LH)GRLN is a robust marker of CKD, although it is not able to differentiate CKD grades based on biopsies.

**Keywords:** Normalized run length non-uniformity, Radiomics, CKD

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