# 人工智慧快速腎結石篩檢系統 1/2

## AI Rapid Nephrolithiasis(Kidney Stone) Screening

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## 開發背景 Background

腎結石好發於20歲以上成年人，目前全球每10人即有1人受腎結石之苦，治療後超過7成病人會再復發，嚴重者可能會造成敗血性休克或終身洗腎。臨床上患者多以是等到腎結石已產生症狀(血尿/腰腹痛等…)才就醫，且診斷率(X光+超音波)僅約70%，經研究如未提早診斷出腎結石則有高於健康人約4倍的風險，未來3年內會塞住輸尿管而導致劇烈腰痛、感染、影響腎功能，需要跑急診及接受腎結石手術治療，每年花費健保超過50億元。

Kidney stones are more prevalent in adults over 20 years old. Currently, one out of every ten people worldwide suffers from kidney stones. After treatment, over 50-70% of patients experience recurrence, and severe cases may lead to septic shock or renal failure. In clinical practice, patients with kidney stones were found out until symptoms (such as hematuria or flank pain) appear before seeking medical attention. The diagnosis rate (via X-ray and ultrasound) is only about 70%. Studies have shown that failing to diagnose kidney stones early increases the risk by about four times compared to healthy individuals. Within the next three years, there is a risk leading to severe flank pain, infection, and impairment of kidney function, necessitating emergency room visits and kidney stone surgery, with an annual cost exceeding 5 billion NT dollars in healthcare expenditures. Therefore, our team utilized simple health checkup clinical data from more than 5000 cases to develop an AI model, proposing the "Artificial Intelligence Rapid Kidney Stone Screening System." By simply inputting routine health checkup data, the system can quickly and accurately determine whether the individual has kidney stones.

## 技術摘要 Technical Introduction

本產品「人工智慧快速腎結石篩檢系統」在建置及訓練人工智慧模型時，使用之數據來源為高醫大附設醫院、高雄市立小港醫院及大同醫院共5,005例，分析結果將以10個簡單的臨床資訊(尿液及血液等)做為評估依據。之後進行臨床測試人工智慧模型，共使用高醫大附設醫院、高雄市立小港醫院及大同醫院共1,523例進行試驗，得到之結果為AUC:96.7%、敏感性:87.3%、特異性:94.5%、陽性預測率: 85.3%、陰性預測率: 95.4%、準確率:92.7%，準確率已達臨床使用需求，成果並已刊登於SCI期刊。

The data used in the development and training of the "Artificial Intelligence Rapid Kidney Stone Screening System" were sourced from Kaohsiung Medical University Hospital, Kaohsiung Municipal Ta-Tung Hospital, and Hsiao-Kang Hospital, totally 5,005 cases. The analysis was based on ten simple clinical parameters (urine and blood, etc.). Subsequently, the AI model underwent clinical testing using 1,523 cases from the aforementioned hospitals. The results obtained were as follows: AUC: 96.7%, sensitivity: 87.3%, specificity: 94.5%, positive predictive value: 85.3%, negative predictive value: 95.4%, accuracy: 92.7%. The accuracy has met clinical requirements, and the findings have been published in an SCI journal.

iStone 人工智慧快速腎結石篩檢系統

**Step 1**

受檢者授權健檢中心
使用健檢基本資料-
尿液、血液等臨床資訊

**Step 2**

健檢中心醫護輸入
臨床資訊至iStone
網頁

**Step 3**

快速運算回傳罹
患腎結石的機率


**Step 4**

受檢者健檢報告
提供患腎結石的機率

# 人工智慧快速腎結石篩檢系統 2/2

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## 技術特色 Technical Advantages

1. 提早篩檢：
「人工智慧快速腎結石篩檢系統」能夠提早篩檢體內是否有腎結石，並與醫師討論治療方案，減少患者因臨床症狀才就醫時產生之家庭及社會成本。
2. 快速且非侵入性：
傳統的X光和超音波檢查需要時間和專業醫生進行解讀，解讀結果會因醫師的經驗值而影響，且診斷率僅70%，且X光會有輻射劑量的產生。而「人工智慧快速腎結石篩檢系統」僅需輸入健檢常規檢測(血液及尿液)數據即可快速篩檢體內是否有腎結石。
3. 高準確率：
「人工智慧快速腎結石篩檢系統」的準確率高達92.7%，相比於X光及超音波的診斷率約70%，具有更高的準確性。

1. Early Screening
The system enables early screening for the presence of kidney stones in the body, allowing discussions with physicians regarding treatment plans, thereby reducing the family and societal costs incurred when patients seek medical attention only after experiencing clinical symptoms.
2. Rapid and Non-invasive exam
Traditional X-ray and ultrasound examinations require time and interpretation by experienced physicians, with diagnosis rates influenced by the physician's expertise, and only reaching about 70%. Additionally, X-rays involve radiation exposure. In contrast, our system only requires inputting routine health examination (blood and urine) data for quick screening of kidney stones in the body.
3. High Accuracy
The system boasts an accuracy rate of up to 92.7%, significantly higher than the approximately 70% diagnosis rate of X-rays and ultrasound, thereby offering greater precision.

## 應用範圍 Application

健檢中心、醫事檢驗所及醫療機構。

## 相關專利 Patent

- 中華民國專利(TW)：112149574
- 美國專利(US)：18/390,892
- 歐盟專利(EP)：23219076.9
- 中國專利(CN)：202311785080.1

2019-2021臨床測試結果 (樣本共1,523例)

- ✓ AUC ： 96.5%
- ✓ 敏感性： 86%
- ✓ 特異性： 94.7%
- ✓ 陽性預測率： 91.8%
- ✓ 陰性預測率： 90.7%
- ✓ 準確率： 91.7%