

# **Improving Surgical Outcomes: Developing a Machine Learning Spine MRI Triage Tool**

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## **Abstract**

For patients suffering with back pain, getting a consultation appointment with a spine surgeon is sometimes a time-consuming procedure that involves patients having to wait up to 12 weeks between MRI tests and interactions with orthopedic doctors to determine if they are candidates for surgery. Notable problems include incorrect referrals, which result in many patients being referred to surgeons for unneeded spine surgeries. One of the largest Hospital Systems in Florida asked us for a machine learning tool to assess spine MRI scans, identify regions of spinal stenosis, and produce a probability score suggesting the possibility of surgery being required to resolve these issues. Three major problems that require quick attention confront the existing approach for ranking individuals with lumbar spine pain in the lower back. Initially, orthopedic spine surgeons take a long time to evaluate patients who might not require surgery. Second, the success rates of roughly 60% for spine surgery in treating this kind of pain are less than ideal. Finally, the procedure is challenged by prolonged patient wait periods, which strain orthopedic spine doctors' schedules and postpone treatment. Developing a proof-of-concept model and formulating a comprehensive long-term project management approach are the two primary goals of the project. Reducing patient wait times, maximizing surgeon schedules, and protecting the system's intellectual property are among the objectives. Our project leverages advancements in artificial intelligence (AI) to optimize decision-making processes in the medical field, particularly in determining the necessity of spine surgery from MRI images. Our aim extends beyond mere image classification; we strive to enhance the entire patient care system, from initial consultation to potential surgery, by integrating AI to improve efficiency, reduce costs, and optimize resource allocation. Our machine learning model is built on the principles of deep learning, utilizing Convolutional Neural Networks (CNNs) to process and analyze MRI images. By leveraging the layered architecture of CNNs, we enable the model to automatically learn and extract hierarchical features from the images. This deep learning approach allows our model to identify complex patterns and nuances in the medical images, improving the accuracy of our predictions and supporting more informed decision-making in spine surgery assessments. This model holds the potential to transform healthcare by providing quicker, more accurate diagnoses and ensuring timely interventions. As AI technology continues to evolve, our approach will adapt to incorporate new research and advancements, ensuring its continued relevance and effectiveness. Implementing our machine learning spine MRI triage tool at Orlando Health is projected to significantly enhance their economic performance over the next five years. By improving efficiency and resource allocation, the weekly revenue is expected to grow from \$2.6 million to \$3.28 million. The ML model will save approximately \$1 million annually in surgical wages by reducing unnecessary assessments and surgeries. Additionally, the tool will generate an estimated \$192 million in new surgical growth by accurately identifying and prioritizing candidates for surgery. Enhanced patient satisfaction and loyalty, driven by quicker and more accurate diagnoses, will contribute an additional \$2 million annually. Furthermore, by minimizing human errors in documentation, the tool is projected to save \$1 million annually in reimbursement loss prevention. In total, these improvements amount to an estimated value of \$196 million over five years in cost savings and revenue growth. This demonstrates a substantial return on investment, underscoring the financial viability and transformative potential of our AI-driven approach in the medical field.

## **Keywords**

Machine Learning, Spine MRI, Triage Tool