# **Evaluating the Compliance of MRI Brain** Scans to American College of Radiology (ACR) **Ordering Guidelines Using Text Mining.**

**Singapore Healthcare** Management 2018

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#### **Introduction and Aim**

Our previous research showed that MRI brain scans with indications



SingHealth

There were 2911 MRI brain scans done in KKH and SGH of which 2262 scans were ordered according to the given 16 ACR guidelines.

following the American College of Radiology (ACR) 2013 guidelines show a higher percentage of brain abnormalities compared to scans not following guidelines.

Process of manually classifying these indications according to whether or not they are following the ACR guidelines is labor intensive and time consuming.

Aim of our study is to develop a predictive model using text mining to automate this classification process.

### Methods

Anonymized reports of patients who had MRI brain scans in KK Women's and Children's Hospital (KKH) and Singapore General Hospital (SGH) were collected.

Reports were manually categorized by human operators in each hospital as to whether or not they conformed to the ACR ordering guidelines and key words identified.

80% of all subjects were randomly selected for model derivation and the rest of the 20% subjects for model validation.

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Both term frequency and term frequency-inverse document frequency (TF-IDF) were used as the weighting factor in text mining. Term frequency-inverse document frequency is a weight widely used in information retrieval and text mining. This weight is a statistical measure used to evaluate how important a word is to a document in a collection. The importance increases proportionally to the number of times a word appears in the document but is offset by the frequency of the word in the collection.

3 machine learning algorithms using the key words identified to predict whether or not the MRI brain scan follows ACR guidelines. Algorithms used were -generalized linear model, -random forest and

-support vector machines (SVM).

Area under the receiver operating characteristic curve (AUC) was used to compare the predictive models.

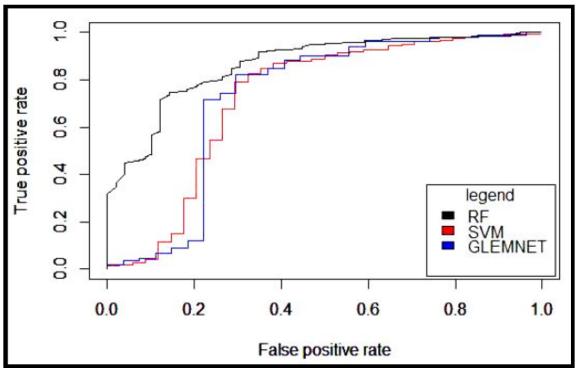
#### Model Development Overview

KKH-ACR	Data Cleaning → -Lowercase	 ombined	dataset
KKH-non ACR SGH-ACR	<ul> <li>-Remove numbers</li> <li>-Remove whitespace</li> <li>-Remove stopwords</li> <li>-Word stemming</li> </ul>	ning (80%)	Test set fo validation (20%)
SGH-non ACR	Convert to term frequency-inverse document frequency format.	andom orest	Support Vector Machine

#### Image guidance 16

#### surgery decompression

Based on term frequency-inverse document frequency weighting factor, performance was random forest model (AUC=0.84) generalised linear model (AUC=0.73) support vector machines (AUC=0.72).



## Conclusion

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The discriminatory ability of the predictive models is best using random forest for automated classification of MRI brain scans indications.