

CHAPTER 1: INTRODUCTION

1.1. Introduction

A Dental Patient's Chief Complaint (DPCC) is the reason for a person seeking medical attention that requires a dental encounter (Hameed, 2021), and this is something that a person communicates to describe the discomfort or expresses the treatment needed. DPCC provides information about the discomfort or treatment needs for both the care provider and the patient while also providing guidance on which Dental specialists should be taken to action.

Over 90% of Americans understand that it is important to keep their mouth healthy and this can be accomplished by seeing a dentist on a regular basis and they spend around \$1000 per year only to fix small issues such as cavities (Grillo, 2022). There are around 188.704 dentists actively practicing and the American Dental Association (ADA) recognizes there are 9 (nine) Dental Specialties within the dental profession as per 2021 shown on below table:

Table 1.1 List of Dental Specialties recognized by ADA

Specialty	Aspect area
public health dentistry (A)	Preventing and controlling dental disease through organized community efforts and does not handle patients directly based on chief complaint
endodontics (B)	Diagnosing, preventing, and treating diseases and injuries of the dental pulp and surrounding tissues; performing root canals
oral and maxillofacial pathology (C)	Research, identification, and diagnosis of diseases of the mouth, teeth, and surrounding regions
oral and maxillofacial radiology (D)	Diagnosing and managing oral diseases and disorders using x-rays, other forms of imaging
oral and maxillofacial surgery (E)	Diagnosing and surgically treating disease and injuries of mouth, oral and maxillofacial region
orthodontics and dentofacial orthopedics (F)	Diagnosing, intercepting, and correcting dental and facial irregularities
pediatric dentistry (G)	Diagnosing and treating the oral health care needs of infants and children through adolescence

periodontics (H)	Diagnosing and treating diseases of gum tissue and bones supporting teeth
prosthodontics (I)	Restoring natural teeth or replacing missing teeth or oral structures with artificial devices, such as dentures

A recent statistics shows that walk-in patients are a common phenomena in visiting dental specialties (Hwa Jeon & Kim, 2022, 1469) and an article suggests a patient should have knowledge about their symptoms prior to visiting the clinic.

The conditions above motivate this research to develop a multi-class classification solution to identify the category of dental patient chief complaints based on the dental specialists above, in order to be able to match the most suitable dental specialist by understanding dental patient complaints.

1.2. Problem Definition

A walk-in dental patient is defined as a patient who comes to the clinic dental without a prior appointment. A study conducted in South Korea specifically observing the behavior of this walk-in dental patient showed the following walk-in patient data for each dental specialty (Hwa Jeon & Kim, 2022, 1469):

- a. 11.8% of walk-in patients visit Oral & Maxillofacial surgery department(E)
- b. 20.6% of walk-in patients visit Orthodontics department (F)
- c. 16.0% of walk-in patients visit Endodontics department (B)
- d. 18.7% of walk-in patients visit Prosthetics department
- e. 14.7% of walk-in patients visit Pediatric department (G)
- f. 14.5% of walk-in patients visit Periodontology department (H)
- g. 2.5% of walk-in patients visit Implant center / Prosthodontics (I)

Statistics above show that walk-in dental patients can directly visit one of those 7 (seven) specialists to deal with their dental complaints. Recent research shows that the walk-in patient rate may reach 10-60% of pre-appointed daily visitors for the United State of America (USA) itself (Hwa Jeon & Kim, 2022, 1469). A Walk-in dentist is not always the right solution for getting treatment and dental patients are suggested to have knowledge about their symptoms before visiting the clinic (Smile Designers, 2020).

One of the known approaches in the Artificial Intelligent field that helps patients to obtain the knowledge of their symptoms by developing a medical text classification that utilize CNN architecture (Hughes et al., 2017, 2015) that claimed 92.3% of accuracy and 86% of F1 score, utilizing Multinomial Naive Bayes for classifying medical abstract (Stan et al., 2012) or general out-patient chief complaint classification that utilizes Bi-LSTM with Attention architecture (Che-Wen, 2020, 106) with claimed to have a 96% accuracy score with F1 Score 96% that classify 6 (six) class of category of out-patient chief complaint. Therefore based on the information above, rise research question as follows: “Does the model mentioned above (CNN, Multinomial Naive Bayes, or Bi-LSTM with Attention) can also provide at least the same level of accuracy and F1 score if applied on specific healthcare services such as dentistry in order to help people gain prior knowledge about their symptoms?”

1.3. Objective & Hypothesis

The objectives of this thesis are to provide solutions that classify dental patient chief complaints, match with one of dental specialty and identify which algorithm or model is suitable for solutions above. The hypothesis of this research is that there will be an improvement if sentence filtering is carried out on the CNN, Multinomial Naive Bayes and Bi-LSTM model which is implemented for specific patient complaints, in this case, dental patient chief complaint.

1.4. Assumption

Following assumption will use on this research, that the total label will be use on this experiment are only 6 (six) categories, due to following reasons:

1. The American Dental Association (ADA) recognizes 9 (nine) dental specialties, however based on recent statistics there are only 7 (seven) dental specialties that deal with patients directly (Hwa Jeon & Kim, 2022, 1469).
2. The “PEDIATRIC” category will be excluded in the classification process since the only parameter for the category refers to the patient's age regardless of the chief complaint.
3. Therefore, there are only 6 (six) of dental specialties that will be used for labeling the dataset, that are:

- PROSTHODONTICS,
- PERIODONTICS,
- ORTHODONTICS,
- ORAL SURGERY,
- ORAL PATHOLOGY,
- ENDODONTICS.

1.5. Scope and Limitation

This experiment will focus on and limited to the following subject:

1. The data that is being classified is limited to dental patient chief complaints.
2. The scope of this research is limited to the dental industry in the USA.
3. The experiment will focus on evaluating classification performance based on Accuracy, Precision, Recall and F1 score.
4. The data that will be used on this experiment will be combined both from a US discussion portal dataset and a translation discussion dataset Taiwan Hospital (from competitor journal) that is specific for the Dentist department.
5. This experiment will use some Python libraries to meet the goals of the experiment.