

Cardiac Implantable Devices Identification based on Chest-X-rays using Machine Learning Algorithms

Dorys Chavez MD¹, Seth Lowey¹, L. Nedda Dastmalchi DO¹, MA, Tran Nguyen MD¹, Gina Adam Ph.D², Marco Mercader MD¹

¹ Department of Cardiology, The George Washington University School of Medicine Health Sciences, Washington, DC
² Department of Engineering, The George Washington University, Washington, DC

Email address: Dchavez@gwu.edu

Background

- For the last 10 years, our team has provided pacemakers and defibrillators to the population of Honduras. There's an increased prevalence of third degree heart block as a result of Chagas disease in the region.
- There were missing records on hundreds of devices, which called for an advanced method to provide high quality care to identify device manufacturer and provide timely and high quality care.
- We utilized "Pacemaker-ID" a phone application that identifies the manufacturer of pacemakers and defibrillators from a chest X-Ray image.

Introduction

- "Pacemaker-ID" uses a deep learning algorithms which utilizes convolutional neural networks¹.
- Convolutional neural network includes data acquisition and data preprocessing, it develops a network architecture, validating the algorithm performance².

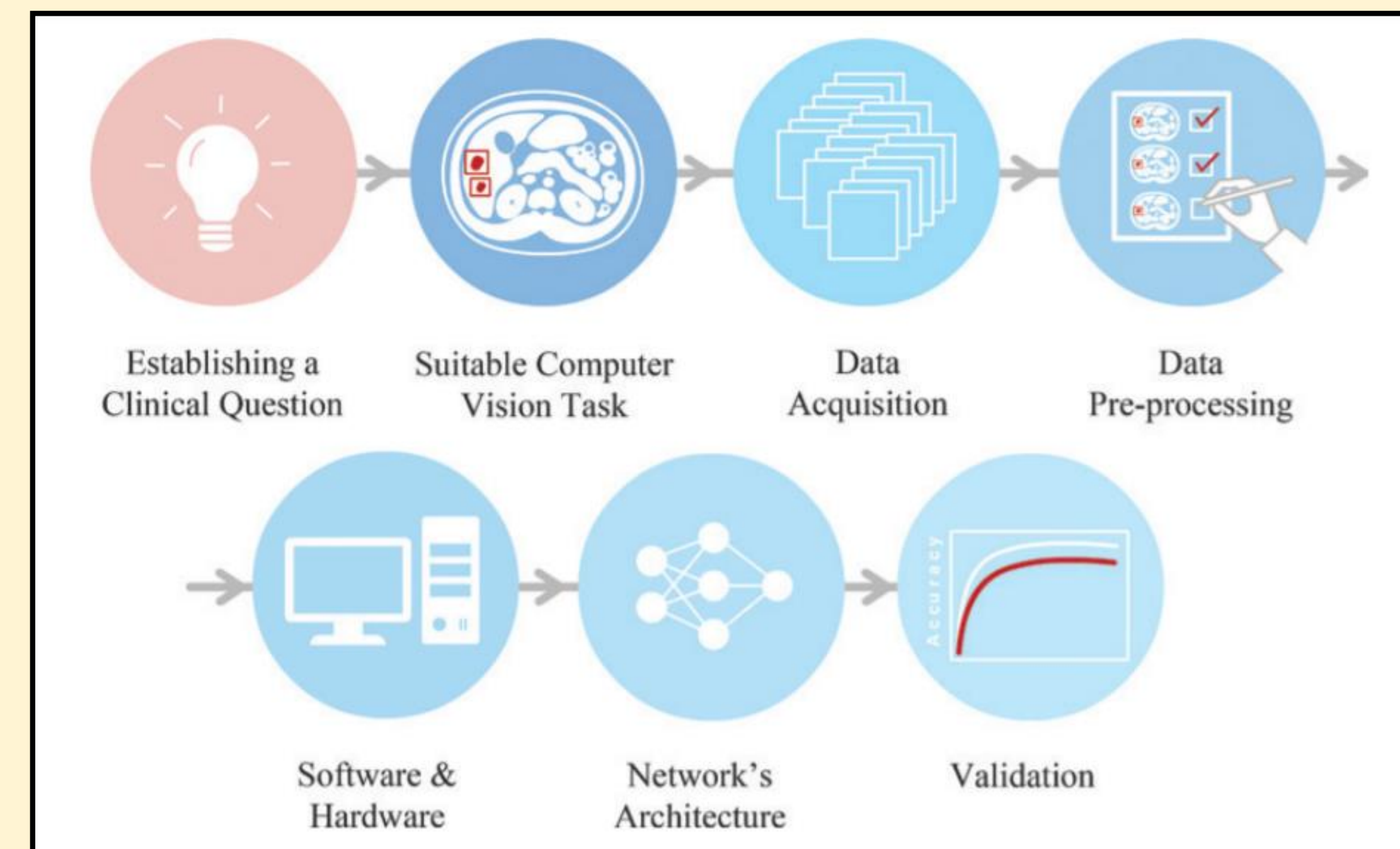
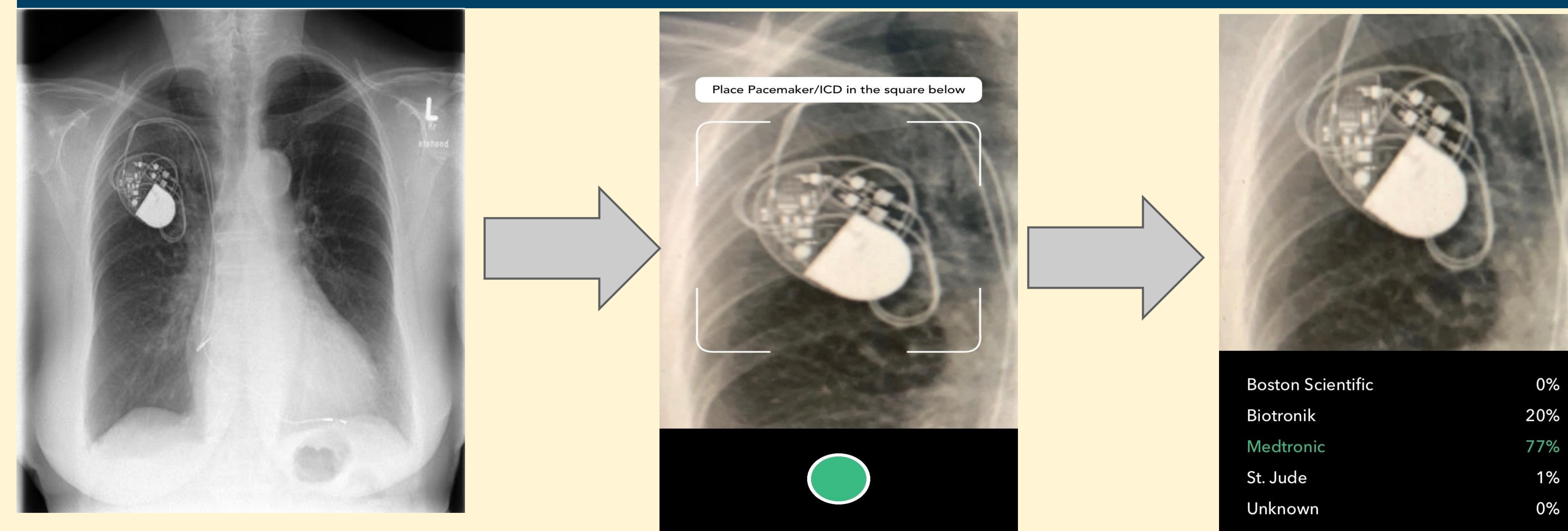
Objectives

- To investigate accuracy of the "Pacemaker-ID" app in identifying the manufacturer of cardiac implantable electronic devices.

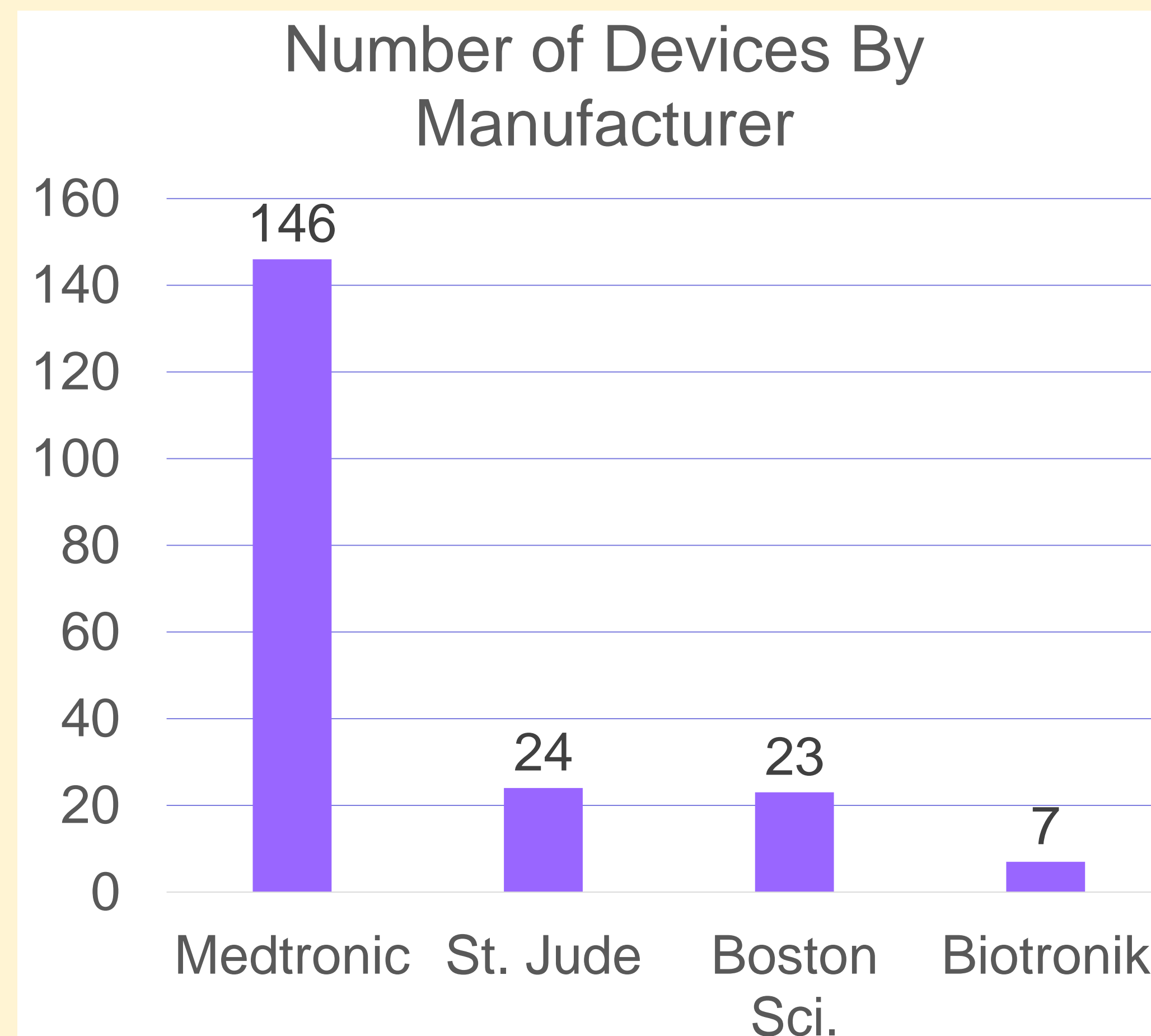
Methods

- A total of 200 x-rays were collected from 2017 to 2019 at The George Washington University in Washington, DC and Centro Medico Hospital in Honduras.

Algorithm



Baseline Characteristics



Results

	Predicted (percentages)					Total actual
	Boston Scientific	Biotronik	Medtronic	St. Jude	Unknown	
Iphone						
Boston Scientific	86%	14%	0%	0%	0%	7
Biotronik	0%	100%	0%	0%	0%	1
Medtronic	5%	20%	69%	6%	0%	125
St. Jude	6%	12%	6%	65%	12%	17
Android						
Boston Scientific	88%	0%	6%	6%	0%	16
Biotronik	0%	67%	33%	0%	0%	6
Medtronic	5%	0%	90%	5%	0%	21
St. Jude	14%	0%	14%	71%	0%	7
Actual (correct)						
Boston Scientific	88%	0%	6%	6%	0%	16
Biotronik	0%	67%	33%	0%	0%	6
Medtronic	5%	0%	90%	5%	0%	21
St. Jude	14%	0%	14%	71%	0%	7

Conclusions

- "Pacemaker-ID" application was found to have a 73 % overall accuracy in identifying devices.
- "Pacemaker ID" application could contribute to expedite the interrogation process by identifying device manufacturer in areas of limited resources.

References

- Weinreich M, Computer-aided detection and identification of implantable cardiac devices on CXR utilizing machine learning *J Am Coll Cardiol.* 2019 Mar, 73.
- Soffer, S. Convolutional network for images. *Radiology* 2019; 290:590-606.