

# A Neural Network Approach to High-Cost Patients Detection

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## Contextualization

- Public health has always been an area of great importance
- Efficient resource management in this area is a necessity
- COVID-19 pandemic further increased this need

## Contextualization

- A known phenomenon in healthcare is that of High-need high-cost (HNHC) patients
- A small portion of the population represents a large part of costs
- In 2013, 5% of Medicaid's highest cost beneficiaries (US) accounted for 54% of total expenses

# Problem

- The main problem tackled in this work is the detection of high-cost patients
- A viable approach in this scenario is to detect patients who are at risk of becoming high-cost, before this transition takes place
- This portion of the population often receives inefficient care, such as unnecessary hospitalizations, and have critical health needs that are not met

# Motivation

- Machine learning models can assist healthcare managers' decision making
- By give care of these individuals a high priority, resources can be used where they are likely to produce good results at a lower cost

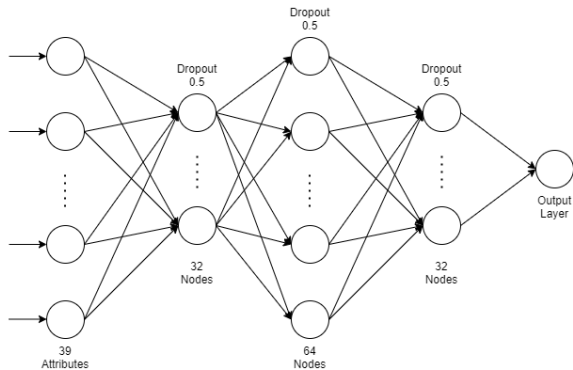
# Objectives

- Implementation of neural network models for the described problem
- Comparison of results obtained with those found in previous works
- Development of needed tools to create the proposed models
- Validation of attribute set defined by **Shenas 2012**

## Methodology Summary

- The methodology used for the development of this work consisted of **five sequential steps**
  - 1 Dataset Analysis
  - 2 Dataset Pre-processing
  - 3 Modeling
  - 4 Benchmarking
  - 5 Results Analysis

# Final Network





Metrics obtained using the 5% highest expenditures as target (First year values)

	<b>Value</b>	<b>Standard Deviation</b>
<b>Sensitivity</b>	90%	0,018
<b>Specificity</b>	83%	0,02
<b>Accuracy</b>	86%	0,007
<b>Precision</b>	84%	0,01
<b>F1 Score</b>	87%	0,006

Metrics obtained using the 5% highest expenditures as target (Second year values)

	<b>Value</b>	<b>Standard Deviation</b>
<b>Sensitivity</b>	91%	0,02
<b>Specificity</b>	84%	0,03
<b>Accuracy</b>	88%	0,009
<b>Precision</b>	86%	0,02
<b>F1 Score</b>	88%	0,008

## Metrics reported by Shenao using 5% highest expenditures as targets

	<b>C 5.0</b>	<b>CHAID</b>	<b>NN</b>
<b>Sensitivity</b>	56%	<b>90%</b>	87%
<b>Specificity</b>	<b>96%</b>	86%	86%
<b>Accuracy</b>	<b>96%</b>	86%	86%

## Results Presented by Meehan

	<b>Logistic Regression</b>	<b>Naive Bayes</b>	<b>J48</b>
<b>Sensitivity</b>	74%	<b>74,10%</b>	67,20%
<b>Specificity</b>	77,10%	76,90%	<b>82,20%</b>
<b>Accuracy</b>	<b>75,55%</b>	75,49%	74,73%
<b>F-Measure</b>	<b>75,50%</b>	<b>75,50%</b>	74,60%

## Results Analysis

- The obtained results are similar to those presented by **Shenas 2012**, this corroborates with the minimum attributes set defined in that work
- While the metrics presented are similar, the cases proportion where the model returned a high-cost prediction for a low-cost patient was higher in the model generated by **Shenas 2012**
- This also suggests that similar or better results can be achieved when more data is available

## Conclusions and Contributions

The main conclusions derived from this work include

- Validation of previously-defined attributes set using data from the same source, and in a larger period and quantity
- From obtained results, we concluded that neural networks are a valid approach for the proposed problem

## Conclusions and Contributions

- As more data becomes available in the future, both from the MEPS dataset and from other sources, the results can be improved
- The creation of necessary tools, available on github, for the pre-processing of MEPS files (2006-2016)

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## Contact

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