

UNCLASSIFIED

# Neural Network Forecasting

## The Next Generation

November 13, 2006

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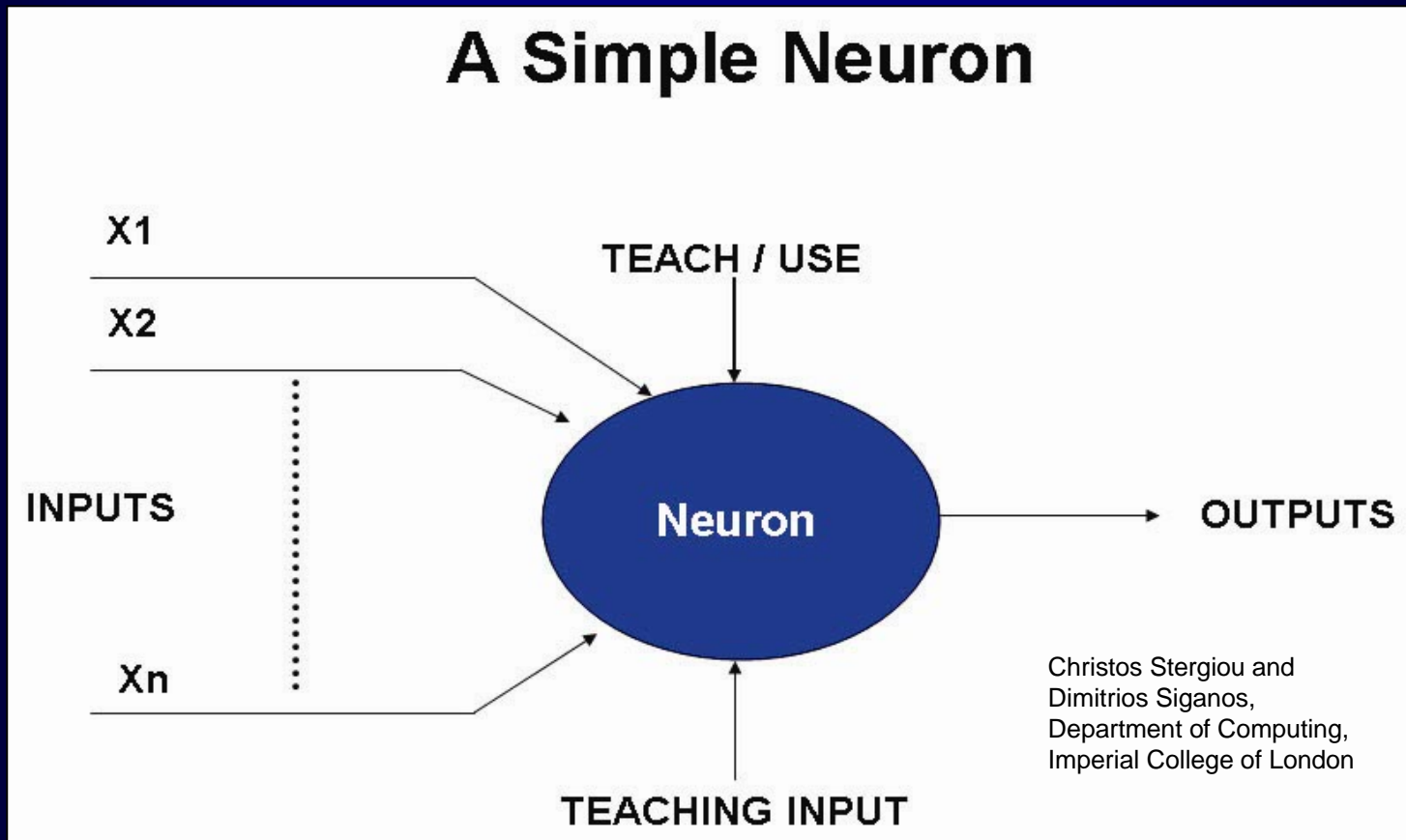
Henry Yennie

LA DHH

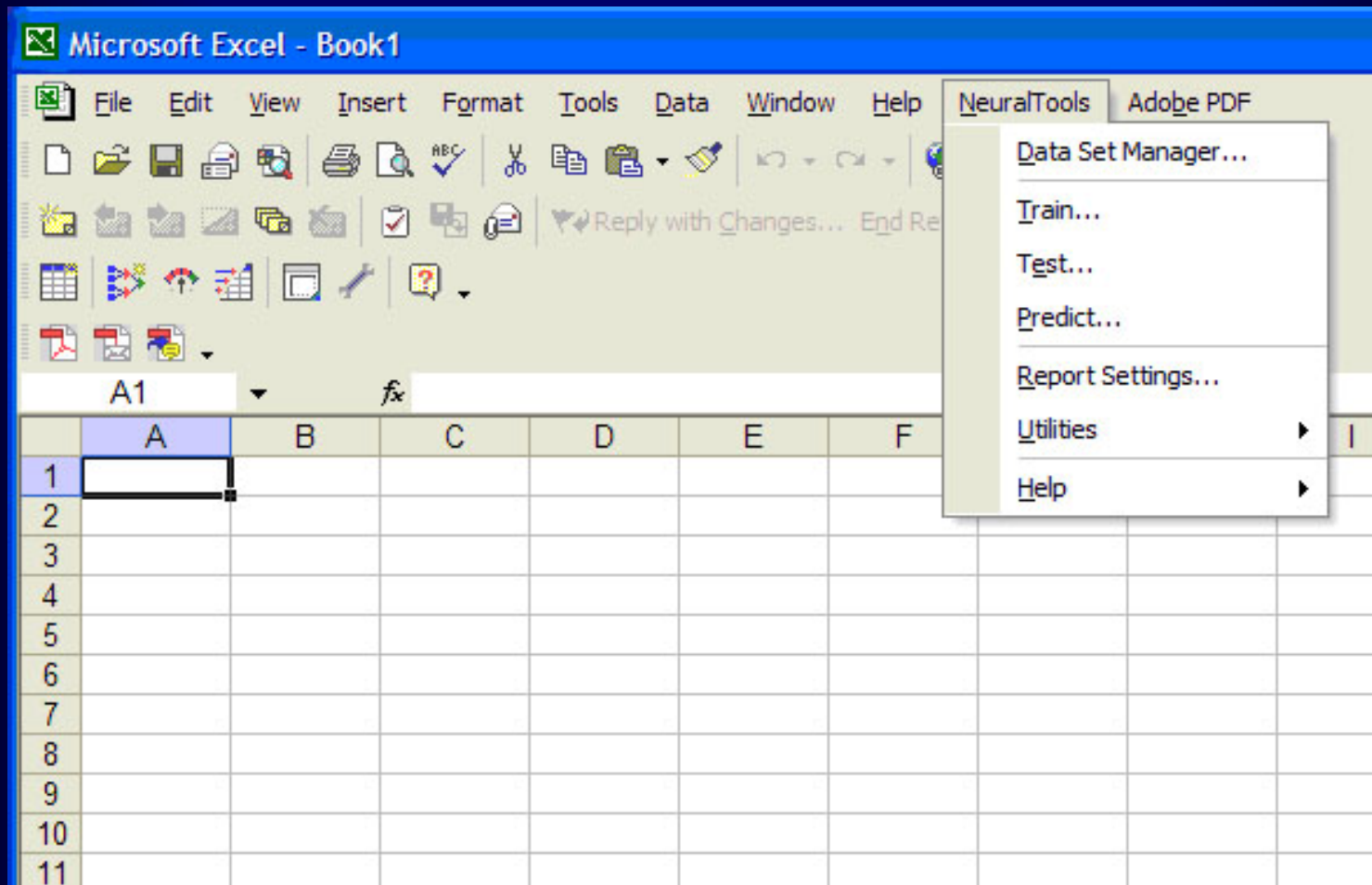
# Introduction

- **Numerical Forecasting**
  - Numeric problems in which the analyst must predict a specific numerical value for a time frame.
- **Classification Forecasting**
  - Classification problems in which the analyst must determine the category that the entity belongs to.

# Artificial Neural Network (ANN) Algorithm



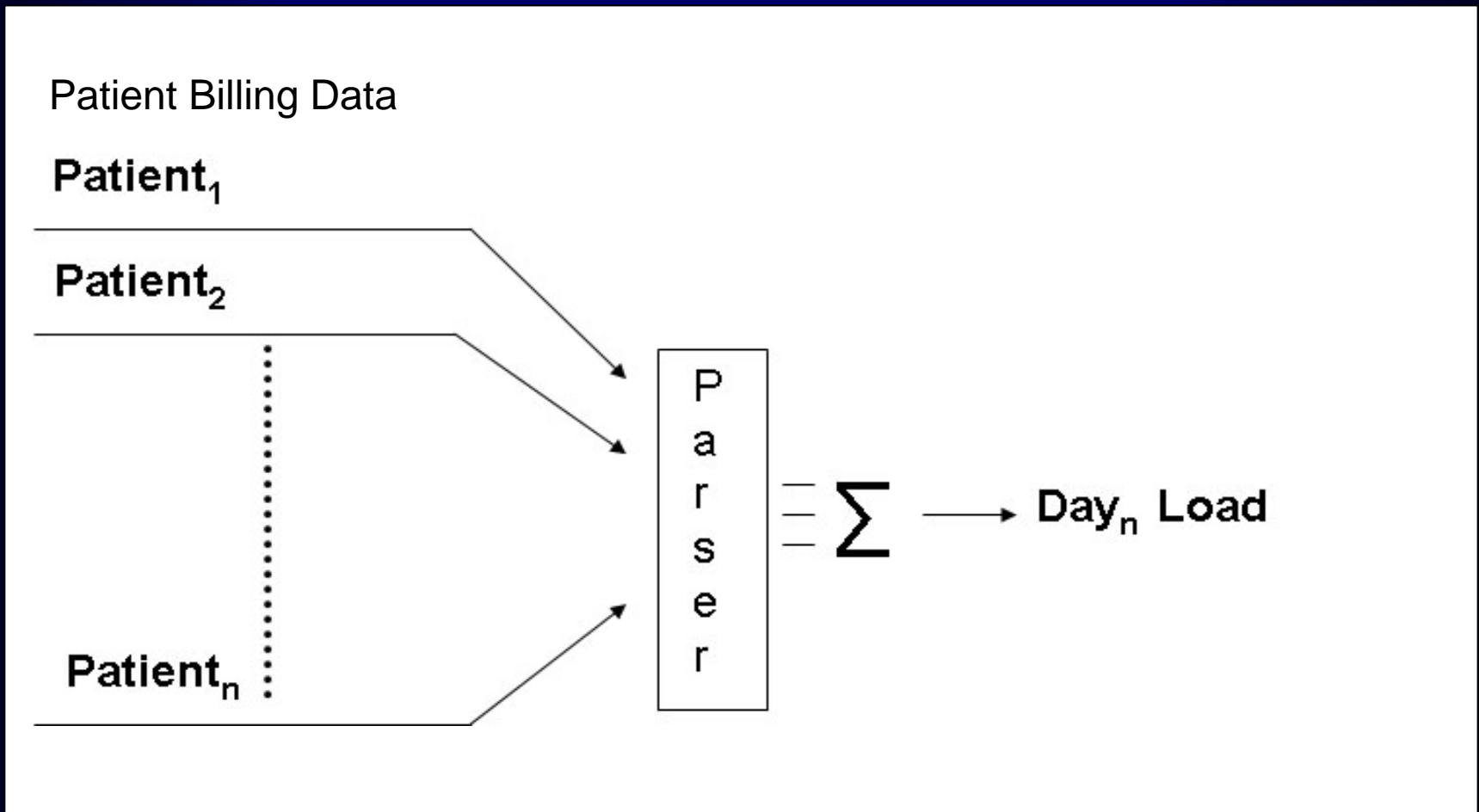
# ANN software Add-in



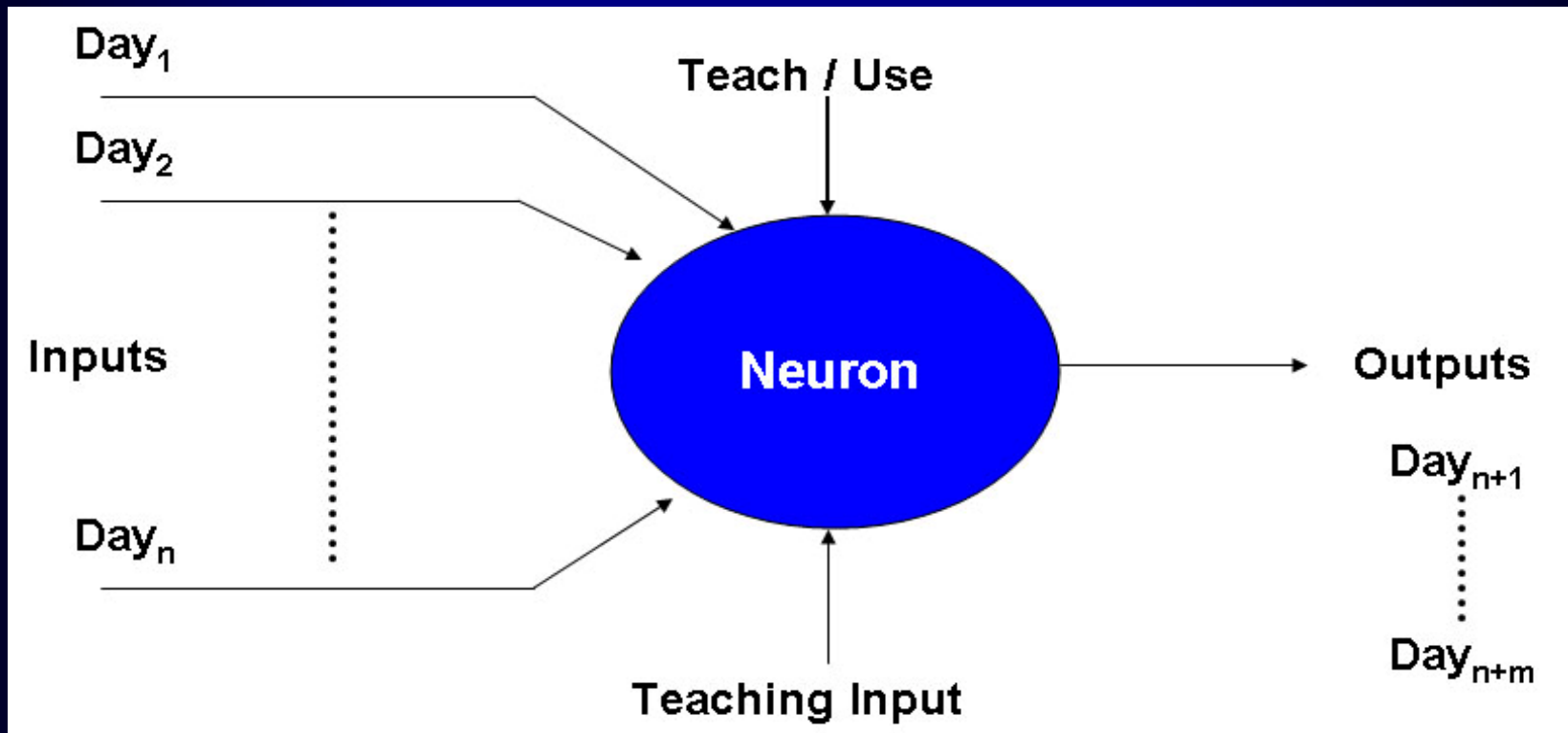
# Case Study #1

- Forecast the Number of Patient Admissions for a group of 9 metropolitan hospitals.
- Use patient billing data from the prior 3 years to model the trends/load for a critical peak period.
  - Proven, trusted data source
  - Requires significant parsing

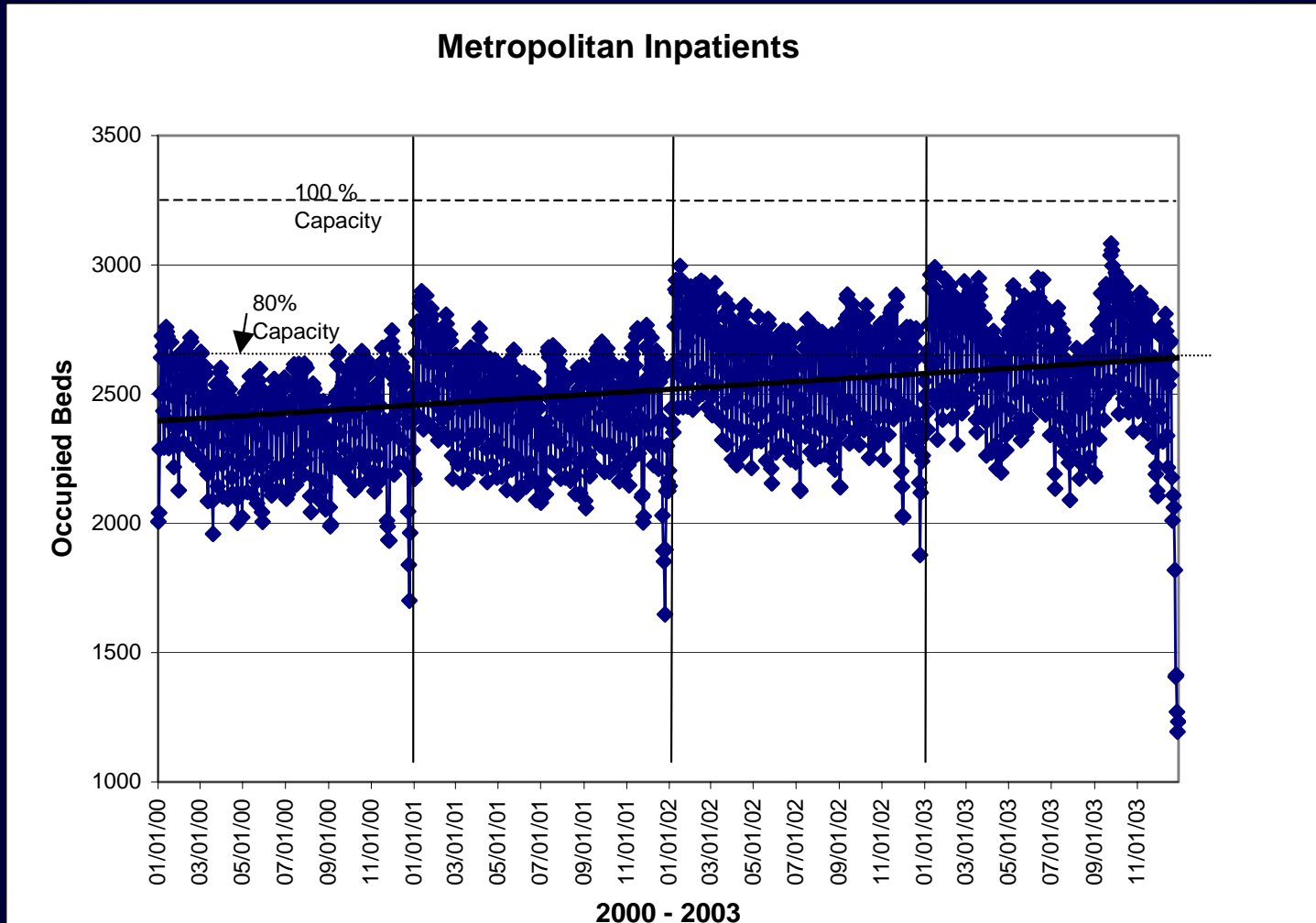
# Data Preparation Methodology



# ANN Training/Testing

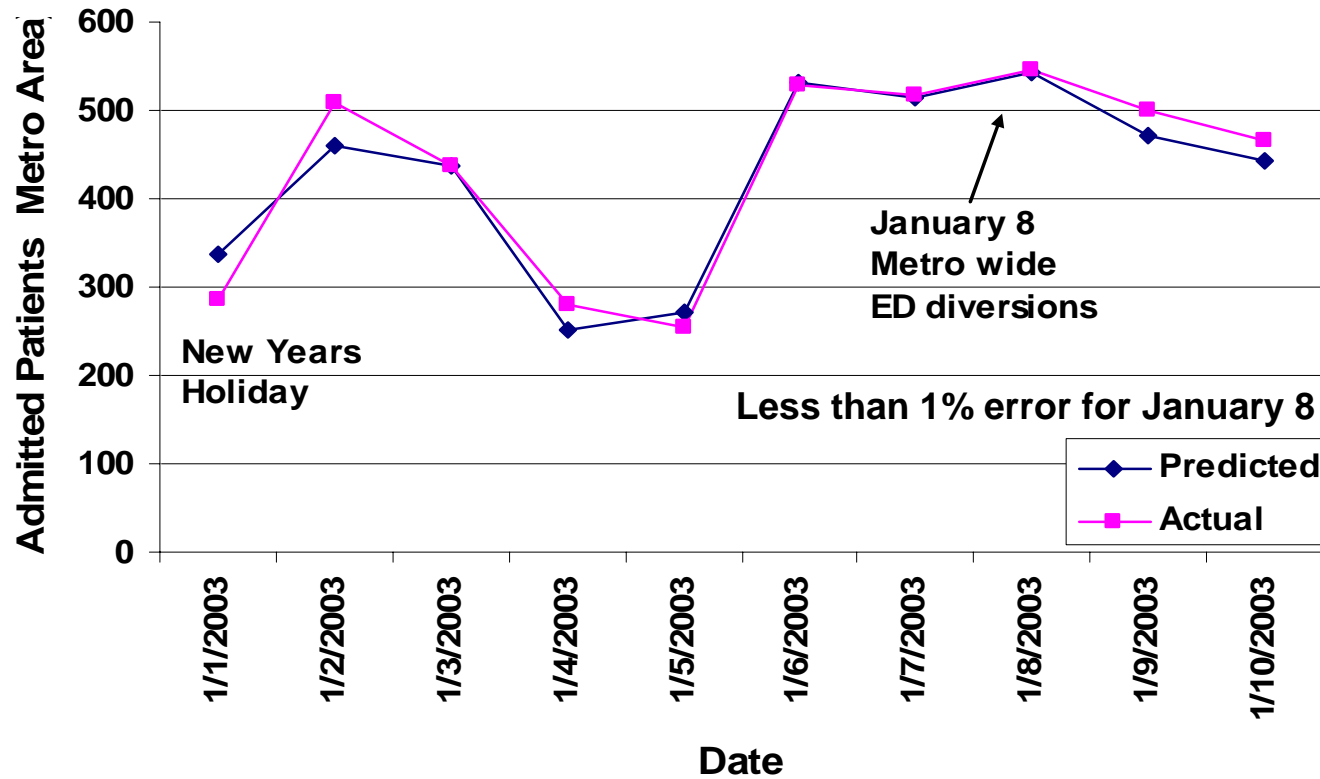


# Four Year Data Set



# Output from ANN Prediction

January 1-10, 2003 Patient Admissions Prediction



## Case Studies #2 and 3

Hurricanes Katrina and Rita are among the most serious natural disasters to hit the United States, and the deaths associated with these storms demanded unique responses from all levels of government.

## Case Studies #2 and 3

**The Find Family National Call Center (FFNCC)** was established in Baton Rouge, LA to assist the families that had gotten separated and sent to many locations around the US following Hurricanes Katrina and Rita. The call center was designed to serve the entire US.

## Case Studies #2 and 3

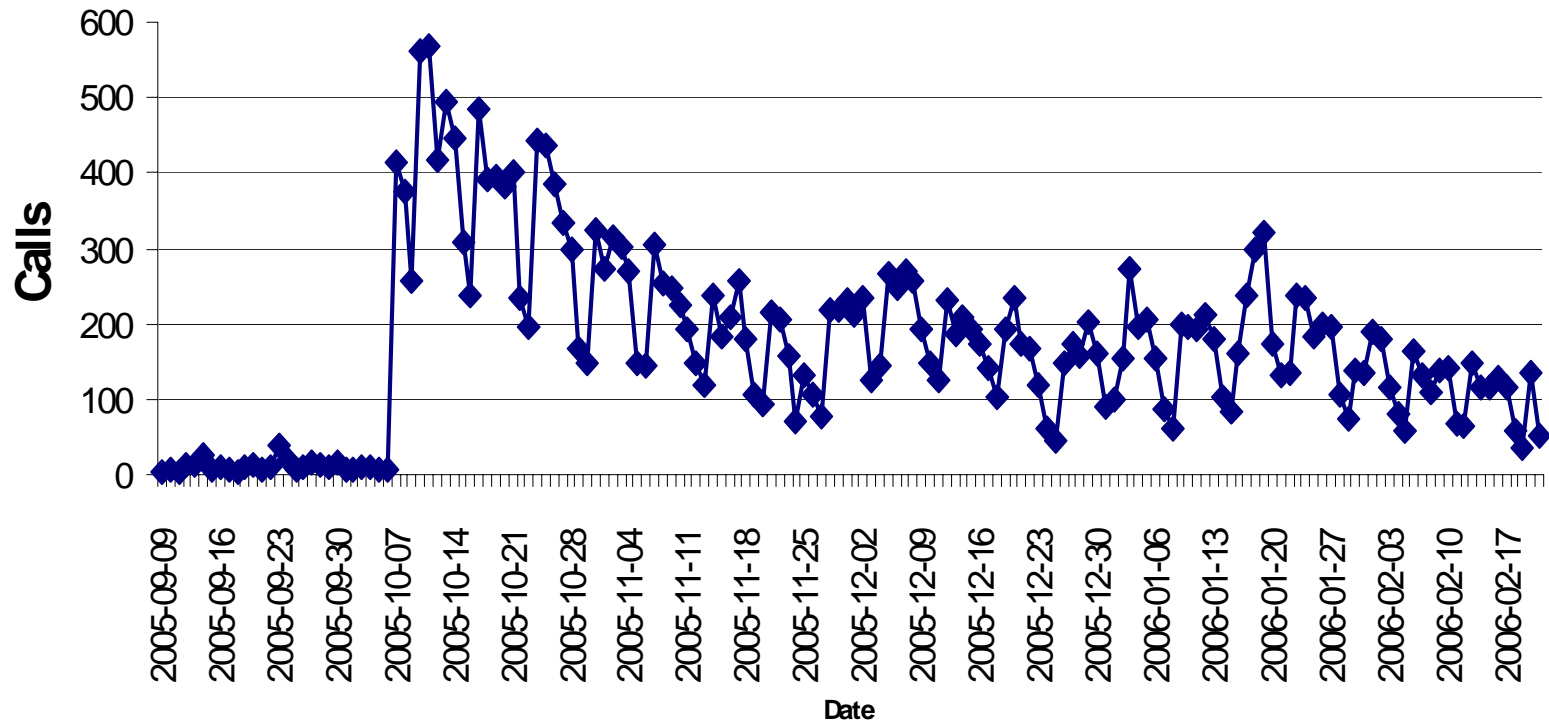
No detailed information from **WTC 9/11** or the **Alfred P. Murrah Federal Building in Oklahoma City (April 19, 1995)** for family support was kept. From the inception of the FFNCC, the data trends and subsequent modeling for this disaster were stored so that they can become the standard for planning for family support that may be needed for future events.

## Case Study #2-FFCC

- The FFNCC operated 24 hours/day and 7days/week. The staff came from LA DHH and from volunteers.
- Track the incoming calls to date and try to forecast the near term calls. Resources!

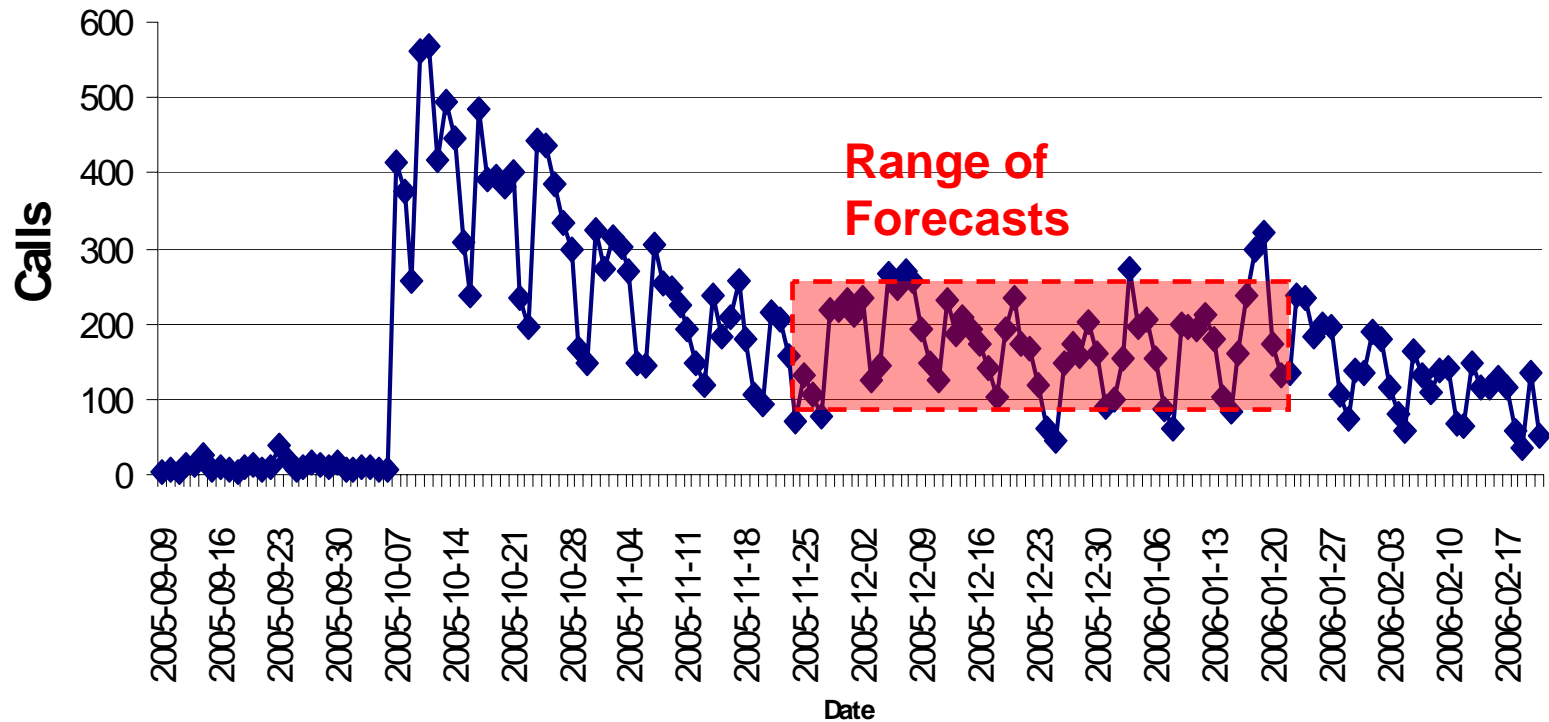
# Case Study #2 - FFNCC

## FFCC Call Volume by Day

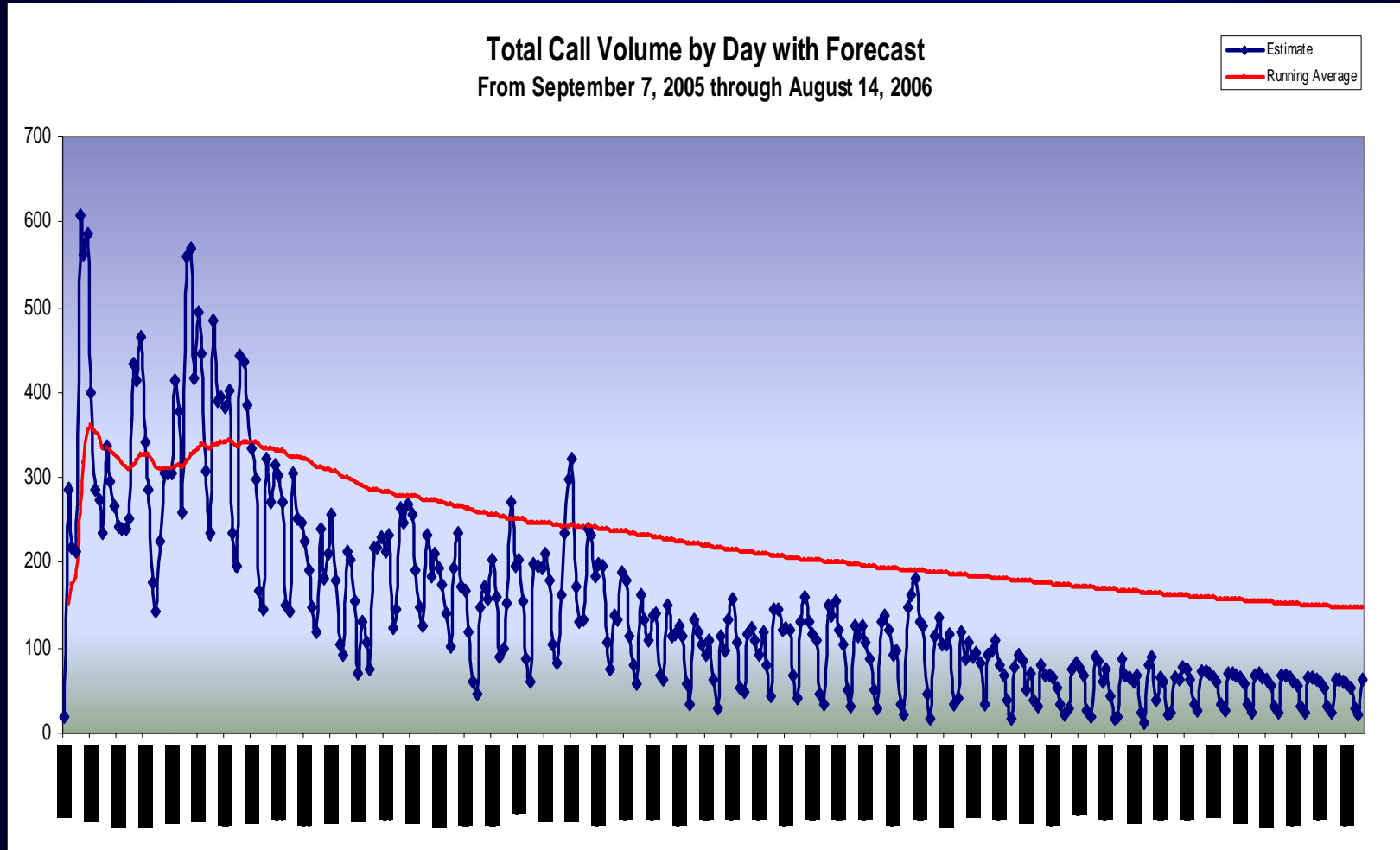


# Case Study #2 - FFNCC

## FFCC Call Volume by Day



# Case Study #2 - FFNCC



## Case Study #3 - BOD

During the post hurricane recovery in the US Gulf region, there were two groups of persons that need to be matched against each other.

- Corpses
- Missing Persons

# Missing Persons

When a family member or friend calls the FFCC to report missing person, the following information is collected:

- Name
- Age
- Race
- Sex
- Employment
- Hair Color
- College Educated
- Relation to Caller
- Is Caller Victim Spouse?

# Missing Persons

Body Markings

Known jewelry

Location where last seen / Date last seen

Legal Next of Kin (Parent, Daughter, Son, etc.)

Spouse Status

Mother Status

Father Status

Victim City

Victim State

Employed (?)

Marital Status

Military Service (Yes/No)

# The Unidentified Bodies

- Location found
- Gender
- Race
- Approximate Age
- Body Markings
- Clothing
- Date Found

# Multiattribute Forecasting

Based on the known information for the missing person, is the person among the unidentified dead or will the person be found alive?

Which of the unidentified bodies should be tested for DNA?

# Forecasted Resolution of Missing

LegalNOK	LegalNOK	Spouse_S	Mother_Status	Father_Status	V_CITY1
Daughter		Living	Deceased	Deceased	
Father	Unknown	Unknown	Living	Living	
Husband		Living	Unknown	Unknown	
Father		Unknown	Living	Living	
Daughter		Living	Unknown	Unknown	
Other	Unknown	Unknown	Unknown	Living	
Sister	Unknown	Unknown	Unknown	Unknown	
Brother		Living	Living	Deceased	
Sister		Unknown	Unknown	Unknown	
Brother		Living	Unknown	Unknown	
Father		Unknown	Living	Living	
Mother		Unknown	Unknown	Unknown	

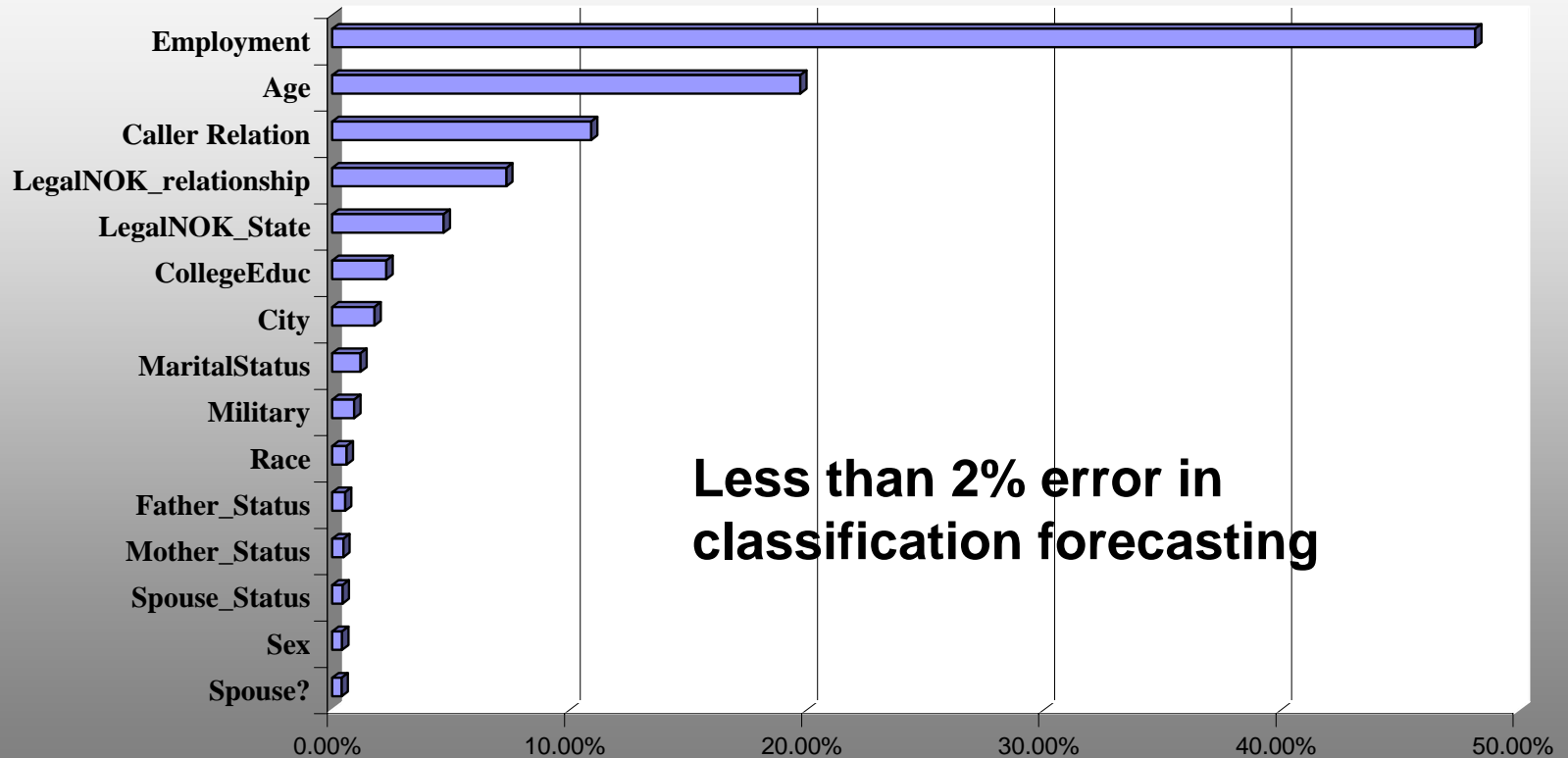
# Forecasted Resolution of Missing

V_STATE1	V_RACE1	V_SEX1	Employment	Victim	Mar	Military
LA	CAUCASIAN	FEMALE	No	Married	No	
LA	AFRICAN AMER	FEMALE	No	Never Mar	No	
LA	AFRICAN AMER	MALE	No	Married	No	
LA	AFRICAN AMER	MALE	No	Never Mar	No	
LA	CAUCASIAN	MALE	No	Married	No	
LA	NATIVE AMER	FEMALE	No	Divorced	No	
LA	CAUCASIAN	MALE	No	Divorced	Yes	
LA	AFRICAN AMER	MALE	No	Married	No	
LA	UNKNOWN	FEMALE	No	Unknown	No	
LA	CAUCASIAN	FEMALE	No	Married	No	
LA	AFRICAN AMER	FEMALE	No	Never Mar	No	
LA	CAUCASIAN	MALE	No	Never Mar	No	

# Forecasted Resolution of Missing

CollegeEd	I_RELATICS	Spouse?	V_AGESAS
No	FRIEND	No	28
No	FRIEND	No	27
No	NO RELAT	No	20
Yes	NO RELAT	Yes	90
No	SON	Yes	67
No	UNKNOWN	No	22
No	UNKNOWN	No	3
No	UNKNOWN	No	37
No	UNKNOWN	No	70
No	FRIEND	Yes	70
Yes	FRIEND	No	25
No	NO RELAT	Yes	70

## Attribute Rank



# BOD Summary Outcomes

- Total LA Reported Missing to FFCC 11,722
- Resolved 11,587
- Unresolved 135

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There were 1,464 deceased victims of Hurricane Katrina from Louisiana.

We even found people that didn't want to be found!

# Summary

- ANN's have evolved into easy to use, user friendly add on products. As such, ANN forecasting can become part of the analyst's tool kit.
- ANN forecasting can be used not only for numeric forecasting but it can also accurately forecast classification information.

# Questions?

Special Thanks go to

- Dr. Robert Bennett for initiating the Richmond Metro Patient Load project.
- The Louisiana Department of Health and Hospitals for allowing the DHH portion of this presentation.