

A Cluster Analysis to Classify Days in the NAS

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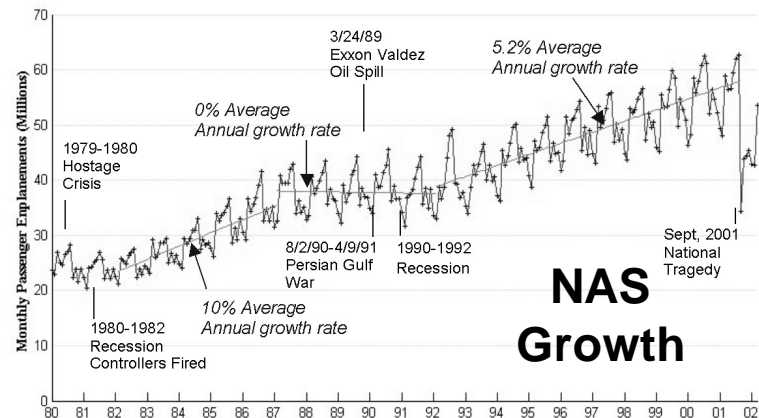
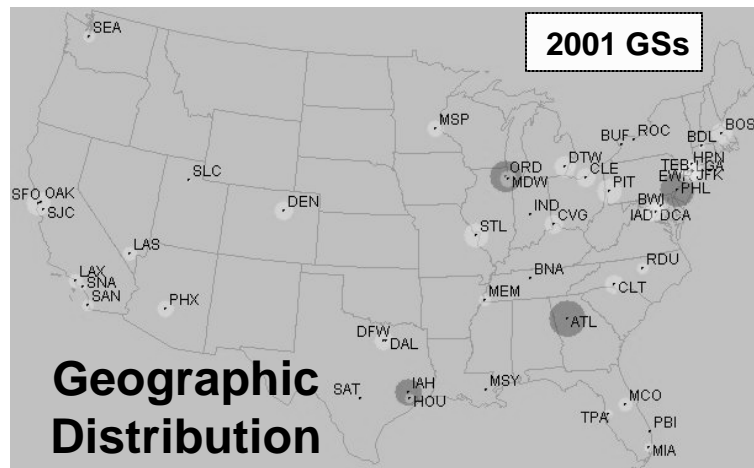
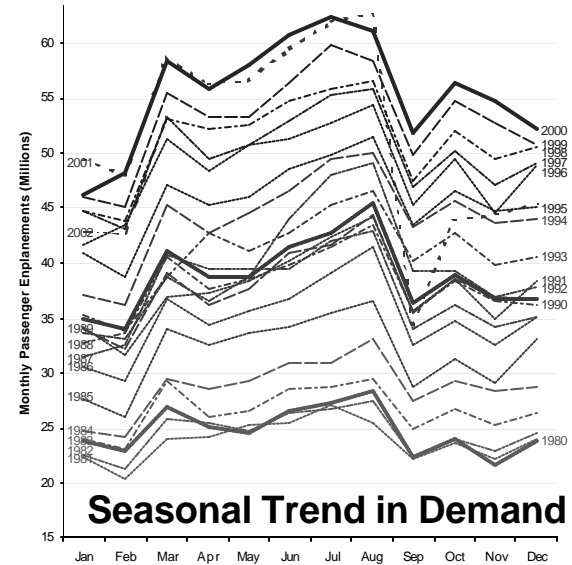
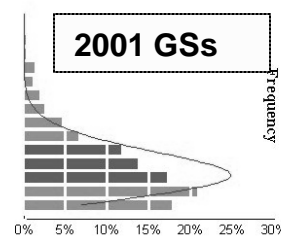
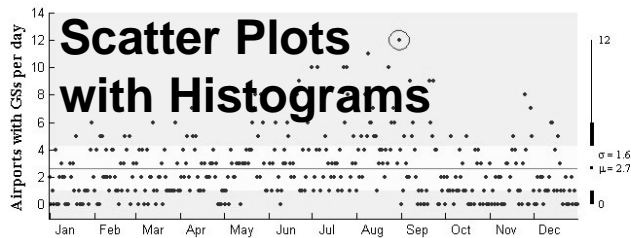
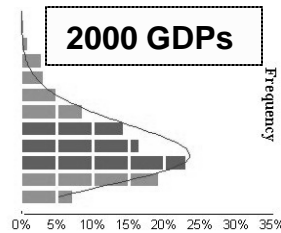
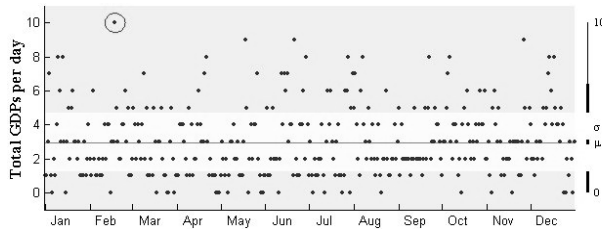
Anindya Roy, Ph. D.

Karlin Roth, Ph. D.

Overview

- Goal: select appropriate days for NAS-wide model validation.
- Data Collection: gather and present data from sources such as ASPM, OPSNET, ATCSCC, ETMS, BTS.
- Analysis:
 - Stage 1: use cluster analysis for variable reduction (i.e. partition variables into groups).
 - Stage 2: use cluster analysis to identify natural clusters of types of days (based on variance).

Example Historical Data Analysis Plots



AIAA Publication: Krozel, Hoffman, Penny, Butler, "Aggregate Statistics of the National Airspace System", AIAA Guidance, Navigation, and Control Conf., Austin, TX, Aug., 2003.

Stage 1 Clustering Results

Cluster	Cluster Name	Prominent Variable within Cluster	Members in Cluster
1	Gate Delays	Daily Count of OAG-Based Gate Delays	6
2	Overall Delays	Total Delay Count From OPSNET	14
3	On-time Performance	Daily Total OAG-Based Airport Departure Delay (minutes)	7
4	Traffic Volume	Daily Arrival Count	9
5	Airport Performance Metric	Std Dev of Airport Performance Score (21 ASPM Airports)	3
6	Cancellations	Daily Arrival Cancellations Count	2
7	Volume-related Delays	Total Operation Count From OPSNET	4
8	Weather and GDPs	Total Delay attributed to GDPs (minutes)	11

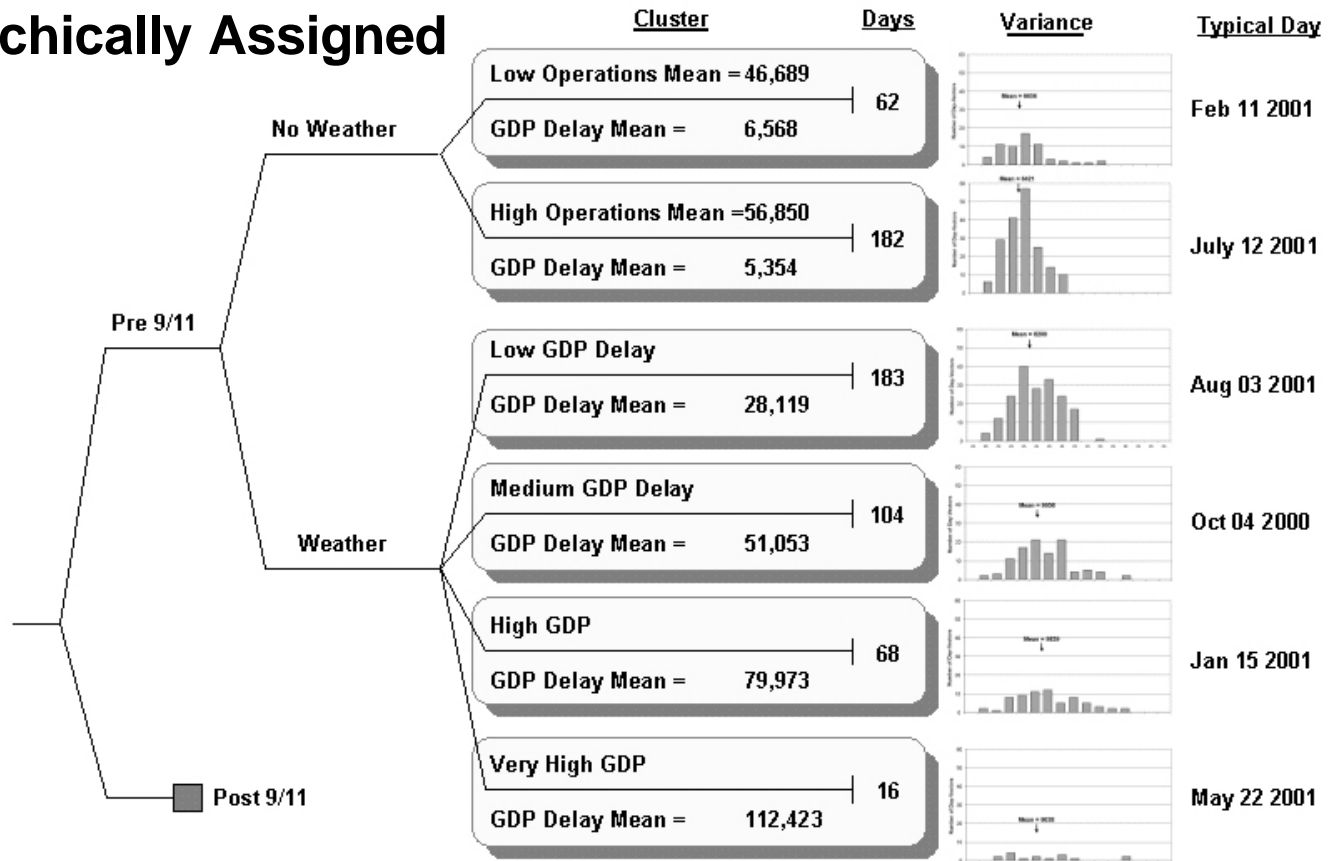
Example Feature Vector

<i>Gate Delays</i>	<i>Overall Delays</i>	<i>On-Time Performance</i>	<i>Traffic Volume</i>	<i>Airport Performance Metric</i>	<i>Cancellations</i>	<i>Volume-Related Delays</i>	<i>GDPs</i>
3490 flights	190 flights	14,500 min.	20,081 flights	5.474	471 flights	47,600 flights	7,480 min.

Feature vector for February 11, 2001.

K-Means Cluster Analysis (Stage 2 Results)

- Each Day's Feature Vector is Hierarchically Assigned



AIAA Publication: Hoffman, Krozel, Penny, et al, "A Cluster Analysis to Classify Days in the NAS", *AIAA Guidance, Navigation, and Control Conf.*, Austin, TX, Aug., 2003.

Further Research Questions

- What is the most natural decomposition of the NAS into regions for performance metrics?
- Can a region of the NAS serve as an indicator of overall NAS behavior?
- What is the smallest set of airports that can be studied with the greatest representation of NAS-wide airport performance?

Questions -

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