

**Spatial Data Management Lab** 



# MetroScope: An Advanced System for Real-Time Detection and Analysis of Metro-Related Threats and Events via Twitter

Jianfeng He, Syuan-Ying Wu, Abdulaziz Alhamadani, Chih-Fang Chen, Wen-Fang Lu, Chang-Tien Lu, David Solnick, Yanlin Li

→] Login

### Introduction

To ensure the safety of the Washington D.C. metro system, we've developed MetroScope - a real-time threat/event detection system. MetroScope utilizes Twitter to detect, monitor, and analyze metro-related threats and events. By offering decision support to the Washington Metropolitan Area Transit Authority (WMATA), MetroScope significantly improves the safety of the system, which is vital to any major city serving countless passengers daily.

## System Architecture





#### MetroScope: http://orion.nvc.cs.vt.edu:5000/

**Emergency email notification** 





Storytelling shows event development. Users can select a time in the time range selection panel. The blue rectangle region displays a series of tweets (a story) in chronological order, and the key phrases of each story are listed in the red rectangle.

## **Tweet History**

interesting and second	NUCLA CO TRUCCO DE		are than 0 to to the mild	2		



Storytelling shows safety-related events.

#### **Efficient Content Retrieval**

Date	Category	Sentiment	Text	Link
2/9/2023, 1:06:25 PM	security	Fairly Positive	There is no way to safely protect the entirety of Metro. Not with <mark>gun</mark> s flowing from Virginia or other states. Not with the size of the system. Not	Source
2/9/2023, 10:45:39 AM	security	Fairly Negative	@nerdy_reads They have tactical shot <mark>gun</mark> s in their vehicles, carry 9mm sigs and tasers. They also carry pepper ball guns. They only get 24 hours of	Source

An example of efficient content retrieval using "gun" as a query.

### **Emergency Email Notification**

#### 

All events	Sentir	nent Cat	egory	X		
Filter by start date	Filter by en	d date 🔶 static	on category Extremely Negative × murder			
Date	Category	Sentiment	Text Sentiment Filter Content Filter	Link		
2/9/2023, 6:40:41 AN	l security	Extremely Negative	After a number of recent violent incidents, including the murder of an employee, Metro and D.C. Mayor Muriel Bowser announced a joint effort to get	Source		
2/9/2023, 5:38:20 AN	security	Extremely Negative	@MayorBowser @DCPoliceDept @MetroTransitPD So it took the horrible murder of an WMATA employee for you to increase police presence? All the increa			
2/9/2023, 1:56:03 AN	security	Extremely Negative	The suspect has been booked and was taken to the Juvenile Correction Center and is facing murder charges. MORE 🚺 https://t.co/ATFXq16nqg	Source		
2/8/2023, 2:32:17 PN	security	Extremely Negative	Today's announcement comes as Metro has seen a number of violent incidents in the past few months, the most recent the murder of a #wmata employee	Source		
2/7/2023, 1:57:41 PM	security	Extremely Negative	BREAKING: A judge orders Potomac Avenue Metro murder suspect Isaiah Trotman to remain in custody on no bond, finding substantial probable cause of	Source		

Tweet History shows the contents, categories, and sentiments of historic tweets. Users can prioritize tweets by the sentiment filter.

= M Gm	ail	Q Search mail	12 12	(?)	<b>(9</b> 3	
Compose		□• C :	1–50 of 1,	473	< :	>
🖬 Inbox	1,249	Primary	Promotions 2 new 2, Social Rapid Experience, MongoDB			
☆ Starred		🗌 🚖 me	[Emgerency Event Detected] - {'when': '02/09/2023, 15:06:25', 'message': 'There is no way to safely protect the entirety of Metro. Not with guns flowin		3:06 P	PM
<ul> <li>Snoozed</li> <li>Sent</li> <li>Drafts</li> <li>More</li> <li>+</li> </ul>	🗆 👌 me	[Emgerency Event Detected] - {'when': '02/09/2023, 12:45:39', 'message': '@nerdy_reads They have tactical shotguns in their vehicles, carry 9mm si		12:45 P	PM	
	🗌 🕁 me	[Emgerency Event Detected] - {'when': '02/09/2023, 09:33:44', 'message': '@babesandballers @RealTimeNews10 @DCCelebrity And Wes Moore just	Å	9:33 A	M	
	🗆 🛧 me	[Emgerency Event Detected] - {'when': '02/09/2023, 05:15:00', 'message': "A fire broke out inside the Araneta Center Cubao's Christmas On Display	Ŕ.	5:15 A	AM	
	□ ☆ me	[Emgerency Event Detected] - {'when': '02/08/2023, 23:53:39', 'message': 'Passengers disarm gunman who killed Washington, D.C., Metro The Gl		Feb	b 8	
	🗌 🏠 me	[Emgerency Event Detected] - {'when': '02/08/2023, 19:34:42', 'message': 'New: @ArlingtonVaFD arriving minutes ago at the Rosslyn Metro station c		Feb	b 8	
	🗌 🕁 me	[Emgerency Event Detected] - {'when': '02/08/2023, 14:56:02', 'message': "@eastbank_dc @VinceGrayWard7 CM Gray's staff attended a neighborho	j.	Feb	8 8	

MetroScope detected tweets with the keyword "gun" and the emergency notifications were delivered to an authority's Gmail.