



AzTech Consulting

UNMASKING CRIME

The Future of F.R.T.

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COURSE CODE: MMAI 5000 - S
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"The work we submitted as part of this assignment is original, and due credit is given to others where appropriate. We accept and acknowledge that each member of our team is equally responsible if the assignment found to be plagiarized in any way, and we will be subject to school's Academic Integrity policy."



Meet the Team



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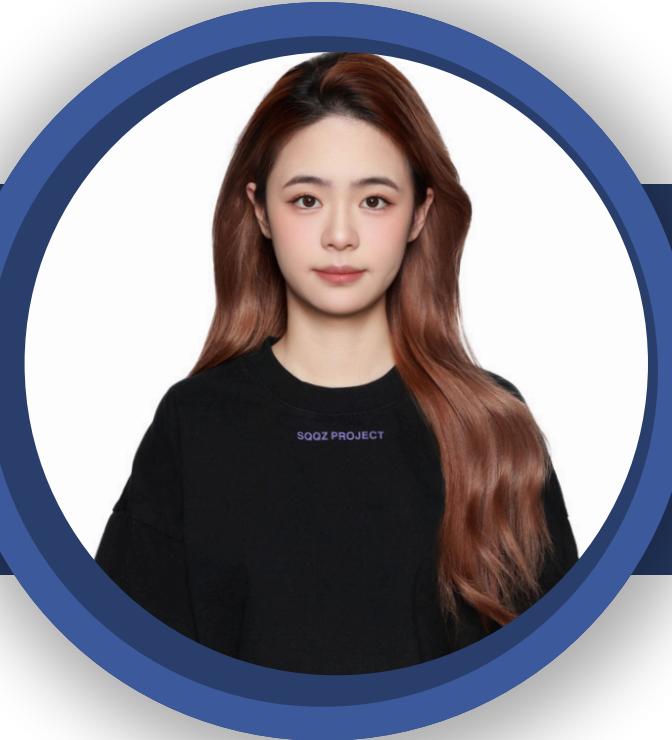
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Agenda

1 **Introduction**

2 **Background Information**

3 **Data Processing**

4 **Basic Analysis**

5 **Modeling & Analysis**

6 **Conclusion**

7 **Next Steps**



Introduction

Key Objective: Advising on the W5H of implementing FRT within law enforcement. This advice includes addressing ethical concerns and boosting public acceptance.

- AzTech consulting wants to help your company succeed in being first movers working with law enforcement in AI solutions.
- Analysis we will advise on who, what, when, where why, and how to implement FRT within law enforcement.



Addressing Ethical Concerns



First Movers



External Data



Analysis



Background Information



Current Regulatory Landscape

As for the FRT regulations, there have been ongoing efforts to standardize legislation for FRT, essentially looking for some sort of framework that could be applied uniformly across the country. However, each state appears to have its own governance structure, which significantly impacts its chance of adoption. For instance, some states do not allow the evidence from FRT to be admissible in court, given the black-boxed nature of the process.

**Bills S.681 and H.1401 sought to suspend usage of FRT and deny federal public safety grants for states & local governments that continued to use biometric surveillance.*



Improvements in Technology

In 2017, some of the top-performing facial recognition algorithms posted error rates of roughly between 20 to 50%. But just by 2021, these error rates have gone down to almost 0.1%, meaning that for every 1000 faces, it correctly identifies 999 people.

FRT has been expanded to consider special properties (e.g. chemical/burn damage, scars) of one's face

Data Processing

Feature Engineered 2 categorical variables derived from questions relevant to F.R.T. use in public space and for private asset protection.

First (based off answers to survey question 11)



Acceptable

Participants responded “ACCEPTABLE” to at least 2 out of the 3 questions by using the classification functions [acc_or_not() & check_acceptability()]. It's safe to assume that they are acceptable of FRT being used in a public setting like a concert or a protest by the police.

Second (based off answers
to survey question 12)



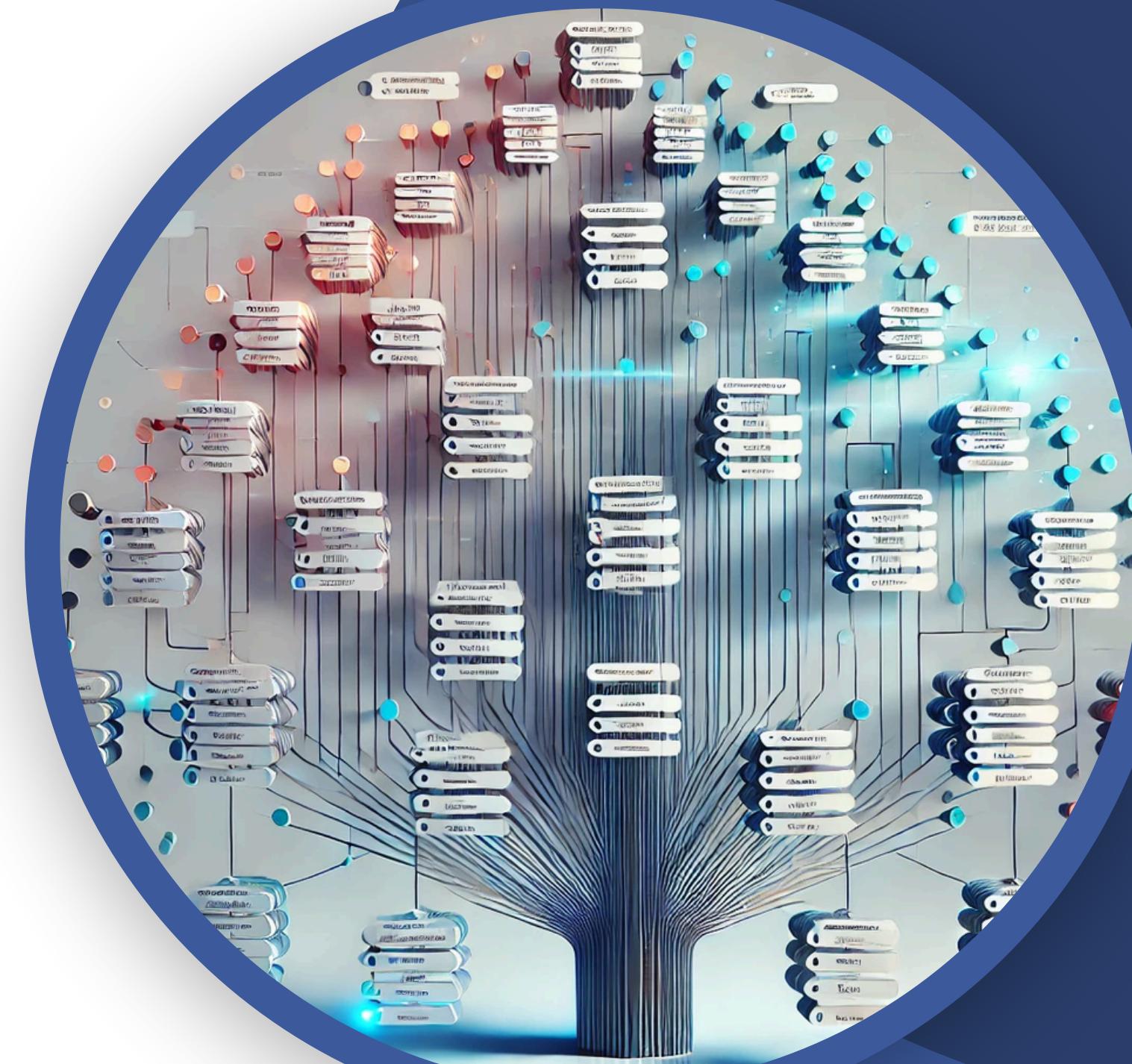
Favourable

Participants responded in “FAVOUR” for either both questions or were “NOT SURE” of just one of the questions.

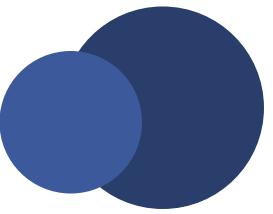
A circular blue icon with a white outline. Inside the circle are three white stars arranged in a triangle. A white hand is shown holding the bottom left corner of the circle.

Features

Feature set included PARTY, REGION, and EDUCATION for the participants.



Basic Analysis



We decided on three demographic predictor variables



Political Views

Indicating that the more educated populace prefers not to be surveilled, and the less educated participants are more inclined to accept the use of FRTs.

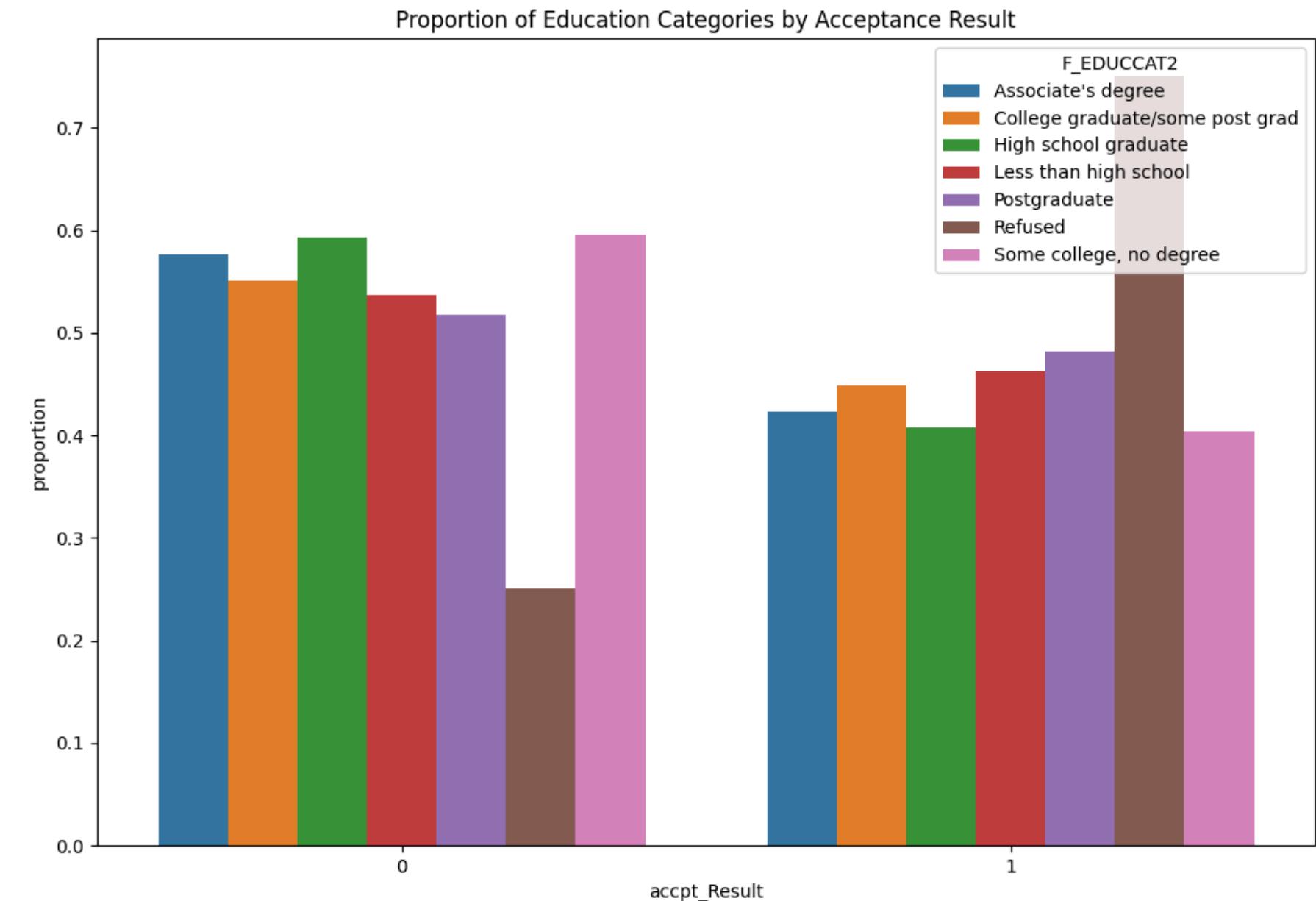
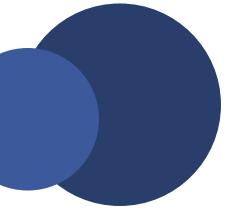


Fig 1. Associate's degree, Some college & no degree, High school graduates are in the most favour; three groups combined represent 45% of the population (2357/5153).

Basic Analysis



Within the United States, the group most in favour of FRT is the South.

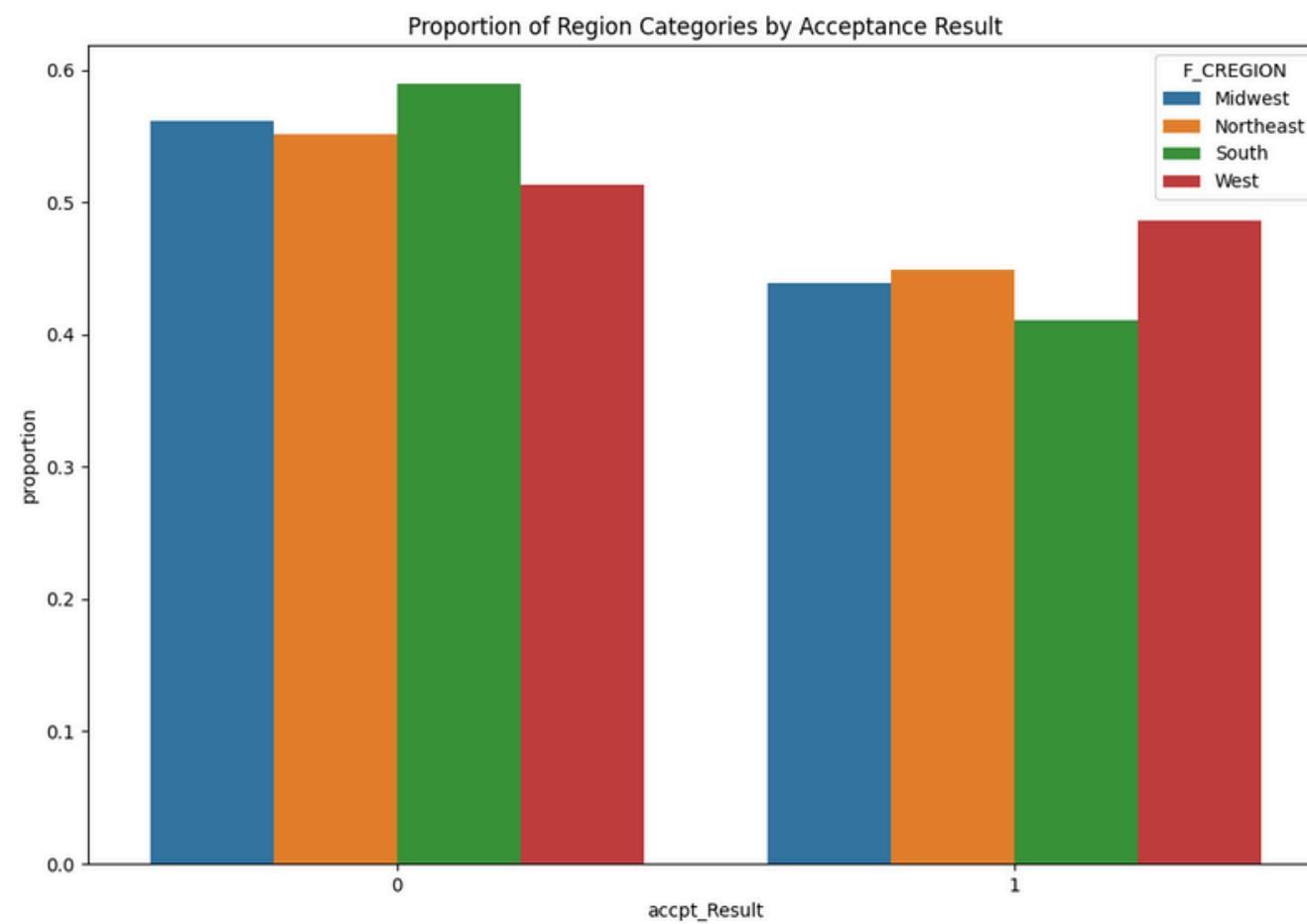


Fig 2. South is in the most favour, and this group is 39% representative of the whole population (2026/5153).

Among political groups, Republicans are the most in favour of FRT.

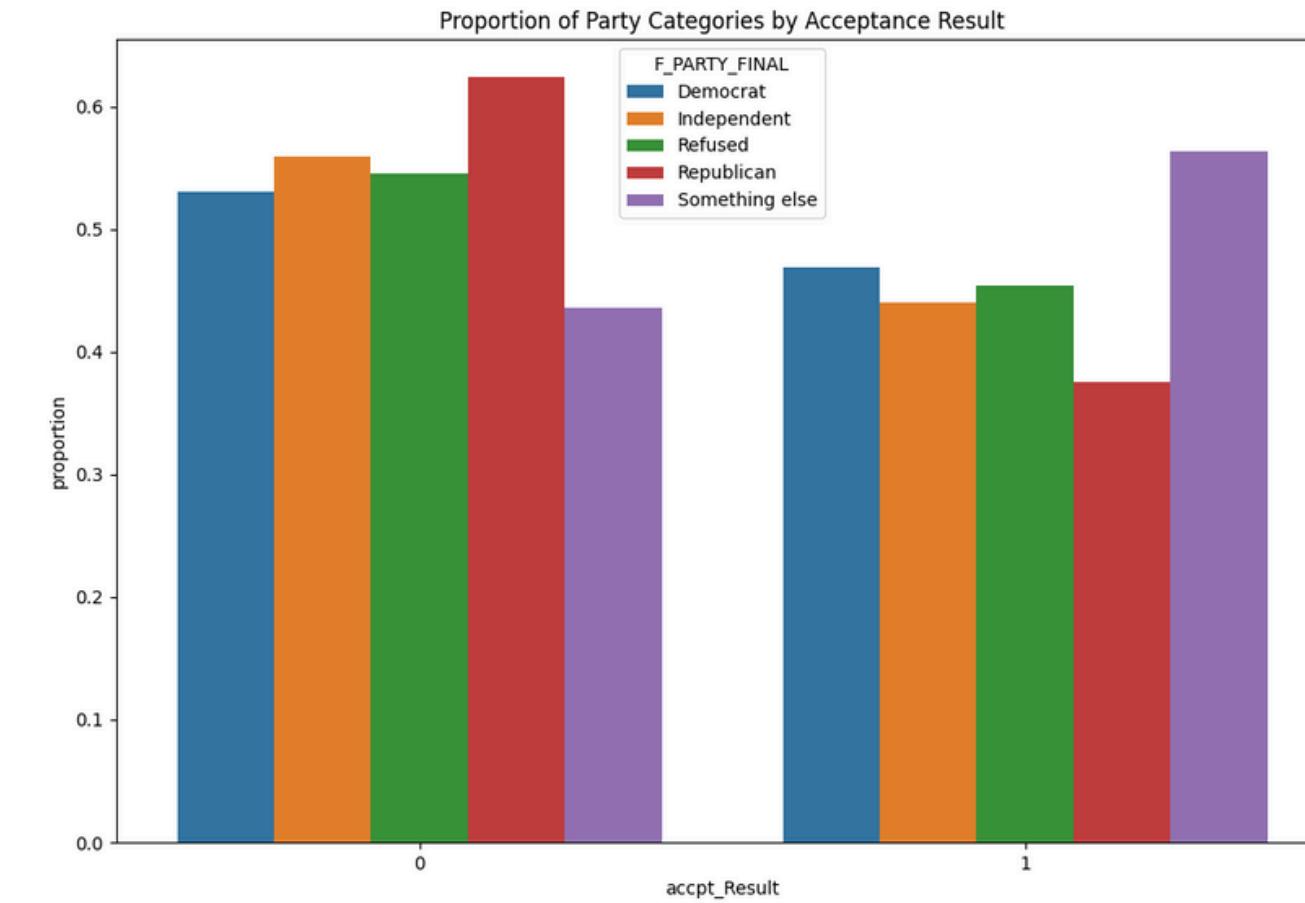


Fig 3. Republican group is in the most favour; Republicans are 30% representative of the whole population (1612/5153).

These metrics alone are not sufficient to derive insight, so further analysis is needed

Logistic Regression

PREDICTS THE PROBABILITY OF THE PARTICIPANT'S PREFERENCE FOR THE USAGE OF F.R.T. IN PRIVATE SETTINGS.



Accuracy



Mean Squared Error



Mean Cross-Validation Error



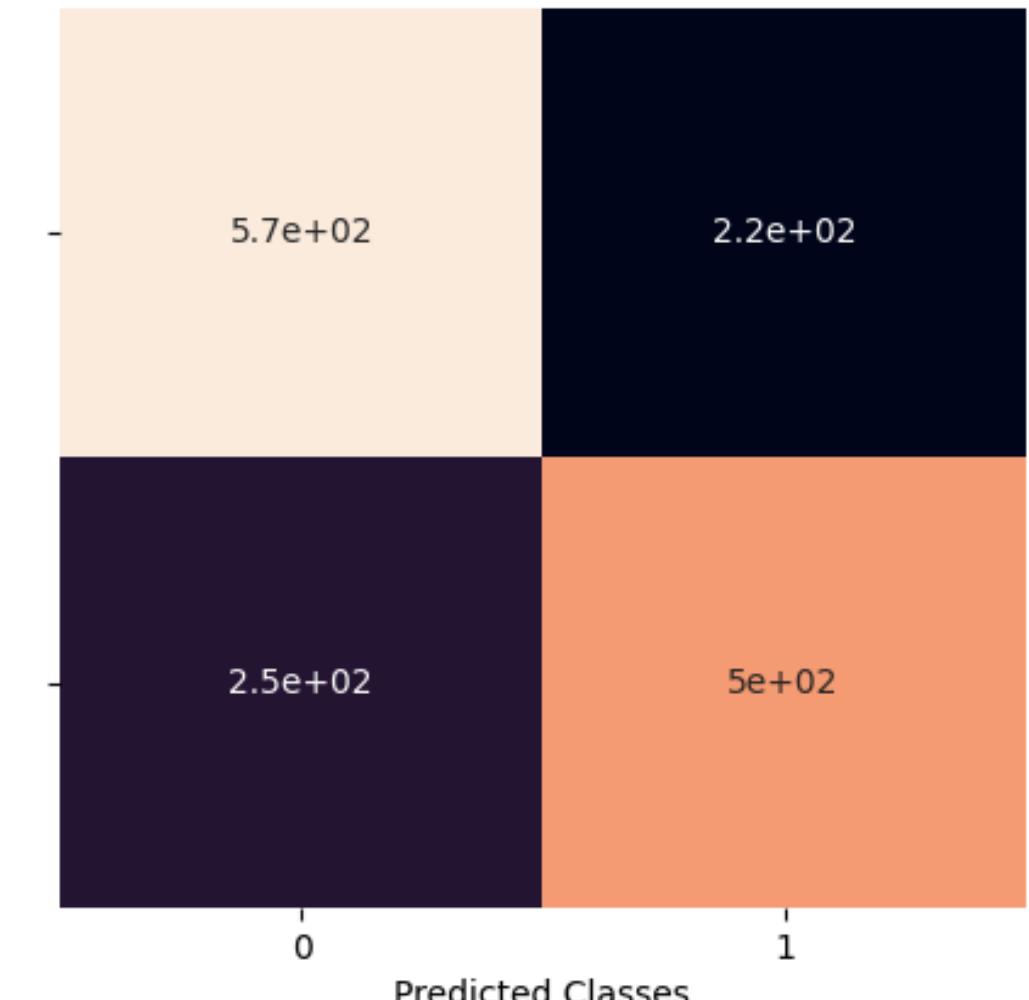
F1 Score



Precision



Recall



classification result:					
	precision	recall	f1-score	support	
0	0.69	0.72	0.71	792	
1	0.70	0.67	0.68	754	
accuracy			0.70	1546	
macro avg	0.70	0.70	0.70	1546	
weighted avg	0.70	0.70	0.70	1546	
confusion matrix: [[574 218] [252 502]]					

Limitations:

It assumes that the errors are independent of each other, and if this assumption is violated, the standard errors and significance tests may be invalid, while also struggling to model complex non-linear relationships between variables, making it less suitable when the predictors and the outcome have a non-linear relationship.

This model didn't produce any actionable insights for us.

Hierarchical Clustering

Alongside classification we also wanted to explore clustering. Since the idea was to find clusters of demographics that have different sentiments towards facial recognition use, the features we concentrated on for clustering were the three demographic columns for region, education and political alignment as well as the feature engineered sentiment columns we generated of acceptance and favor. We used the Hierarchical clustering model since most of the data was categorical. Using the agglomerative clustering approach, we explored Hamming as well as the Euclidean method for our similarity measure. Constructing the dendrogram for these two methods we chose a threshold of 6 for the Hamming distance and 20 for Euclidean since we wanted at least 10 clusters to explore. We got 11 clusters for Hamming and 14 for Euclidean. The silhouette scores we got are below, which tells us that the Hamming method is marginally better in terms of establishing clusters in the data. But the scores also show that even though we got clusters from the data they are not too distinct and the clusters aren't too well defined, since it's preferred if the silhouette scores are over 0.5. However, we still see some level of clustering in the data which is sufficient for us to draw some conclusions.



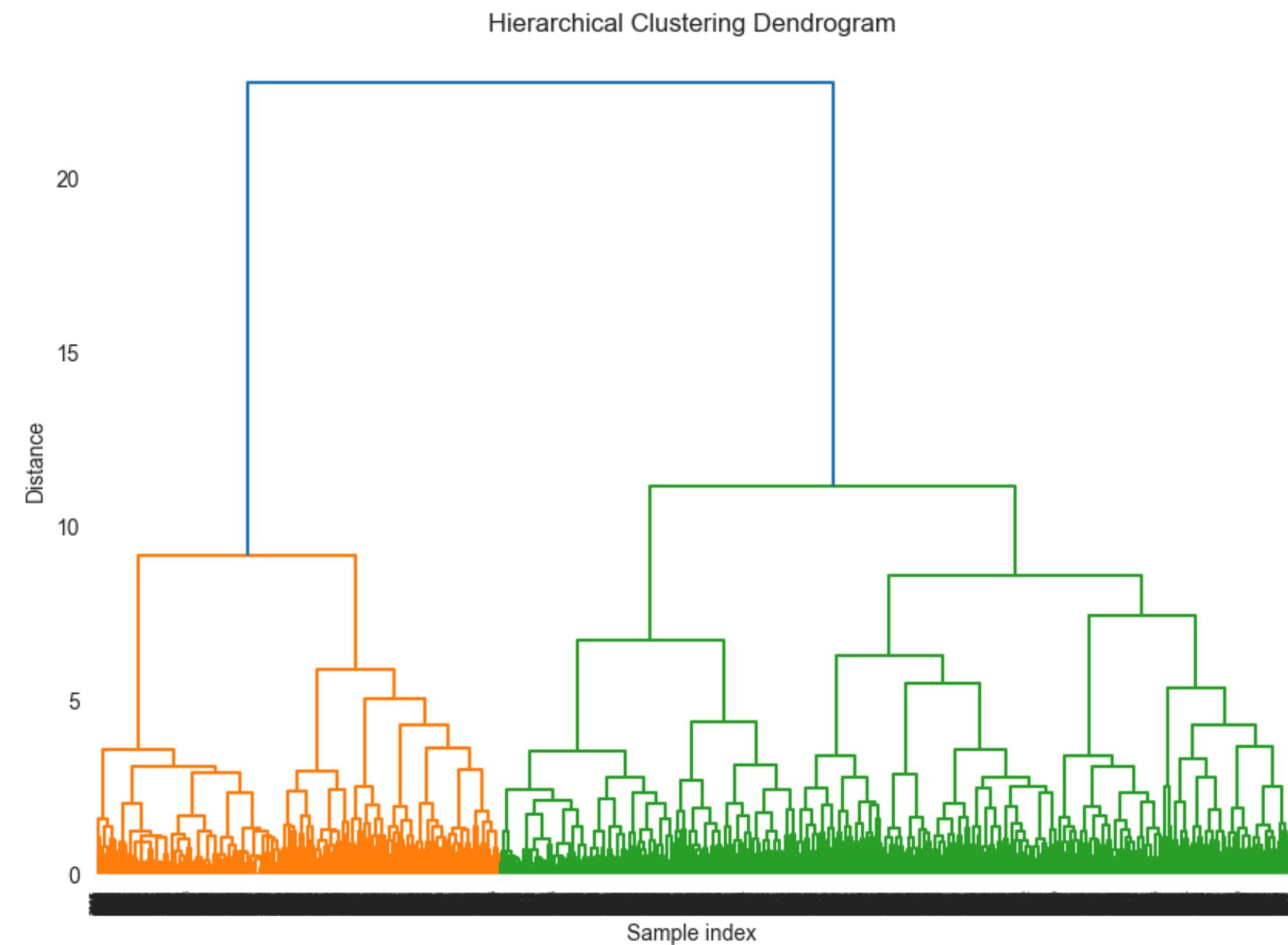
Hamming Distance (Silhouette Score = 0.191)

It is the count of differing positions.

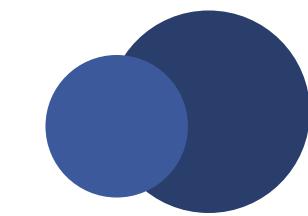


Euclidean Distance (Silhouette Score = 0.137)

It is the straight-line distance between the points in the 2D plane.



Hierarchical Clustering



Clusters accepting both public and private uses (Acceptable & Favor) are mainly in the South and predominantly Republican. Opposition towards facial recognition usage in other regions in the US is higher within Independent and Democratic leaning communities.

F_CREGION	F_EDUCCAT2	F_PARTY_FINAL	FACEREC_ACCEPT	FACEREC_FAVOR	Cluster_hamming	size
South	College graduate/some post grad	Democrat	Not Acceptable	Favor	1	660
Northeast	Postgraduate	Democrat	Not Acceptable	Oppose	2	641
West	College graduate/some post grad	Independent	Not Acceptable	Oppose	3	316
South	Some college, no degree	Republican	Not Acceptable	Oppose	4	302
Midwest	College graduate/some post grad	Republican	Not Acceptable	Oppose	5	331
South	College graduate/some post grad	Republican	Acceptable	Oppose	6	813
South	College graduate/some post grad	Independent	Acceptable	Favor	7	502
South	Postgraduate	Democrat	Acceptable	Favor	8	447
South	Some college, no degree	Something else	Acceptable	Favor	9	168
South	College graduate/some post grad	Republican	Acceptable	Favor	10	510
South	High school graduate	Republican	Acceptable	Favor	11	463

Limitations:

It can be sensitive to outliers and may also struggle to identify clusters with varying sizes and shapes, favouring spherical or compact clusters while potentially missing elongated or irregularly shaped clusters. Hence why the silhouette scores are also low and the clusters aren't too well separated.

Conclusion

1

Hierarchical clustering helps identify which clusters (groups) can be targeted, though some clusters are split in terms of public versus private surveillance.

2

The conflicted groups are valuable in their own right, but for now, the pilot program will focus on Southern, Republican, and less-educated cities.

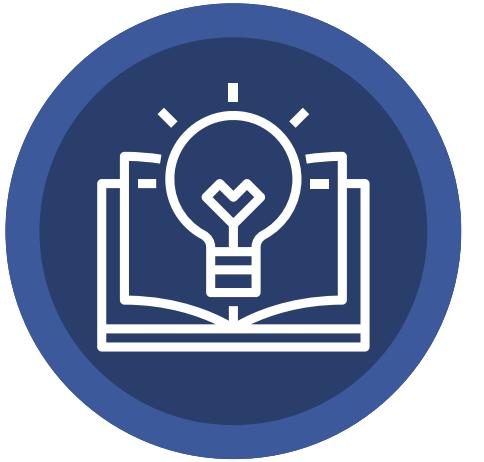


Next Steps



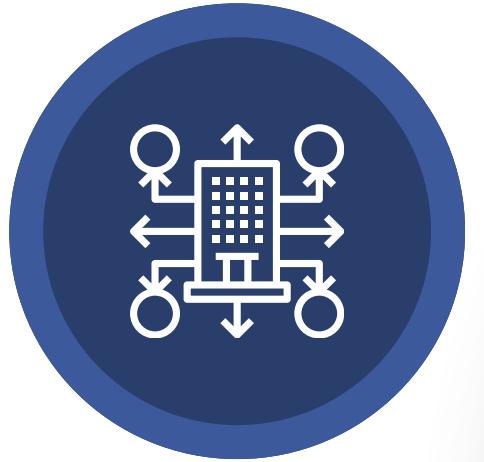
Southern Republican

Based on the results, it is recommended to target municipalities in the southern part of the country that are predominantly composed of Republican voters, avoiding college towns (i.e. Dallas, Fort Worth, Oklahoma City, Mesa, Omaha...). Approaching police departments and municipal bodies and getting subcontracted to run surveillance programs would be our immediate goal.



Educate Opposed

Populations that oppose public surveillance but are willing to accept private surveillance can be targeted by partnering with private companies for their asset protection, such as Walmart, Target, and Chase. As we assist these corporate bodies with loss prevention in private sectors, we will establish ourselves in private security, too.



Post Results

Results of the pilot program will make it easier to persuade hesitant groups with evidence-based reasoning, demonstrating that crime rates have decreased as a result of adopting FRT.





Executive Summary

Advising on the W5H of implementing FRT within law enforcement. This advice includes addressing ethical concerns and boosting public acceptance.

Hierarchical clustering extracts targetable clusters, though some are divided on public versus private surveillance. While these conflicted groups are valuable, the pilot program will initially focus on Southern, Republican, and less-educated cities.

Through our analysis we were able to create a potential pilot program. It is recommended to target Southern municipalities with a less-educated Republican population avoiding college towns, partner with private companies to reach people favouring private over public surveillance, and use the pilot program's success in reducing crime rates to persuade hesitant groups with evidence-based reasoning.



AzTech Consulting

THANK YOU!

**we hope you will chose AzTech to guide your FRT
firm in working with law enforcement**



Appendix A: Citations

- Fidler, M., & Hurwitz, J. (Gus). (2024). An overview of facial recognition technology regulation in the United States. *The Cambridge Handbook of Facial Recognition in the Modern State*, 214–227. <https://doi.org/10.1017/9781009321211.018>
- Facial Recognition and Biometric Technology Moratorium Act of 2023. S.681. 118th Cong. (2023). <https://www.congress.gov/bill/118th-congress/senate-bill/681>
- Haddad, G. M. (2021). Confronting the Biased Algorithm: The Danger of Admitting Facial Recognition Technology Results in the Courtroom. *Vanderbilt Journal of Entertainment and Technology Law*, 23(4), 890+. <https://scholarship.law.vanderbilt.edu/jetlaw/vol23/iss4/5/>
- Imaoka, H., Hashimoto, H., Takahashi, K., Ebihara, A. F., Liu, J., Hayasaka, A., Morishita, Y., & Sakurai, K. (2021). The future of biometrics technology: From face recognition to related applications. *APSIPA Transactions on Signal and Information Processing*, 10(1). <https://doi.org/10.1017/atsip.2021.8>
- Maslej, N. (2022, June 9). *Facial Recognition Technology (FRT) in 2022*. MaslejNestor-e. <https://www.ourcommons.ca/Content/Committee/441/ETHI/Brief/BR11882158/br-external/MaslejNestor-e.pdf>

Appendix B: Link to Code

<https://github.com/lanmei0612/MMAI-5000.git>

