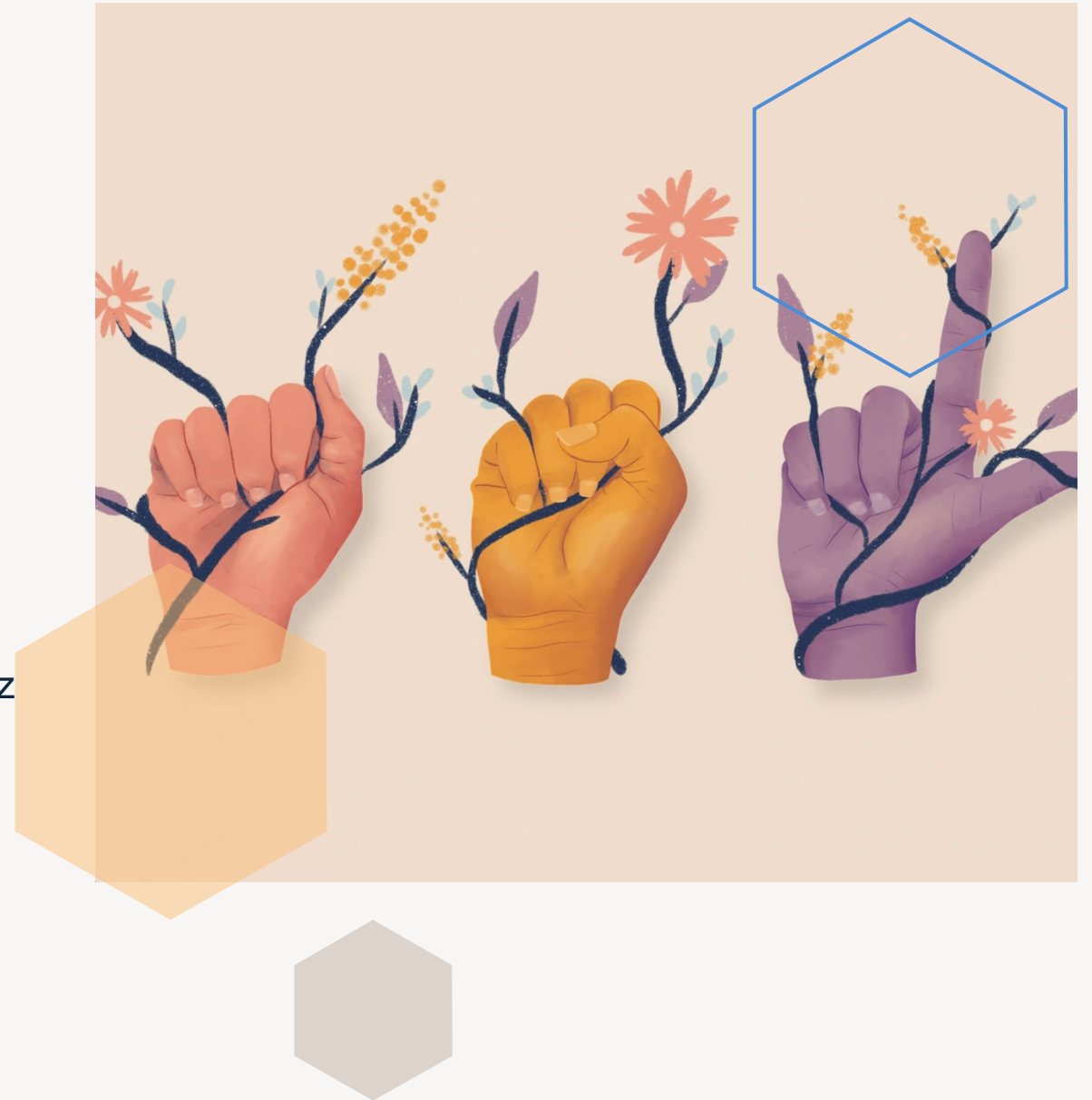


# Sign On!

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MIDS DATASCI 207 Summer '23  
Section 01



# Agenda

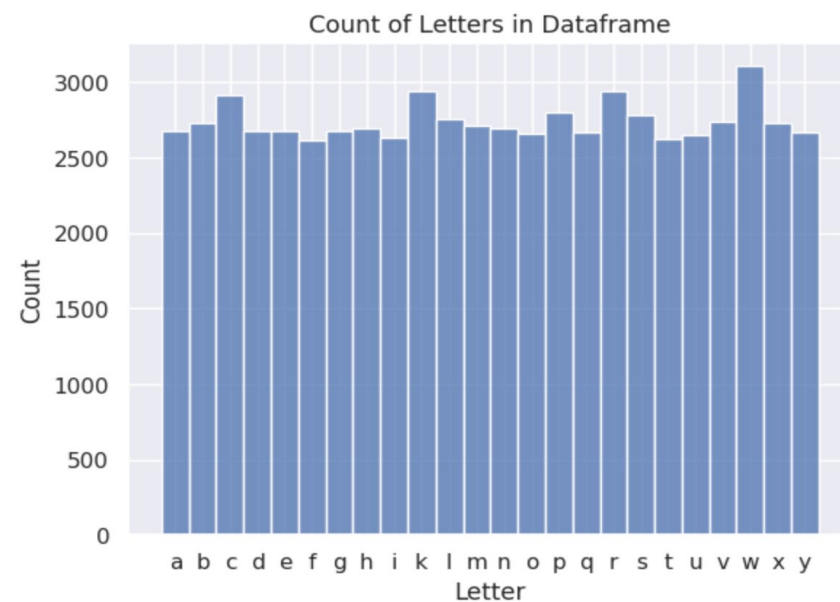


# Introduction





## Getting up to speed...





# Logistic Regression Baseline



True Label	a	b	c	d	e	f	g	h	i	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	
	-924	0	2	18	24	0	0	0	3	0	13	0	2	0	0	16	0	49	9	0	0	0	1	0	
	-13	842	4	13	58	6	0	0	0	0	18	0	0	0	0	62	0	3	0	120	0	3	12	0	
	-84	4	584	133	147	2	1	0	0	0	41	7	1	1	0	60	0	19	10	86	0	1	4	0	
	-4	0	0	981	7	0	0	0	0	0	14	0	0	1	0	21	0	3	0	17	0	0	7	0	
	-8	1	1	39	909	3	1	0	1	0	7	0	2	0	0	42	0	29	4	17	0	0	6	0	
	-2	9	4	80	147	67	1	0	2	0	9	0	0	0	0	108	0	1	0	29	0	4	7	0	
	-45	0	0	29	11	0	712	20	4	2	39	0	0	0	0	214	0	5	7	3	0	0	10	0	
	-21	0	0	24	28	0	106	548	5	0	33	0	0	0	0	262	0	4	4	2	0	0	11	0	
	-7	0	0	144	43	2	0	0	554	0	47	0	0	1	0	116	0	7	0	9	0	0	32	0	
	-43	0	2	207	14	4	20	2	232	481	97	0	0	0	0	132	0	8	1	225	2	22	44	0	
	-3	0	0	78	8	8	0	0	3	1	967	0	0	0	0	20	0	1	0	6	0	4	0	0	
	-54	0	5	421	59	0	1	2	2	0	6	444	6	0	0	124	0	21	421	2	0	8	0	0	
	-64	0	4	601	90	0	1	1	3	0	6	204	26	2	0	105	0	63	82	13	0	4	15	0	
	-50	0	13	392	27	0	1	0	2	0	36	4	7	207	0	126	0	25	628	33	0	1	2	0	
	-5	0	2	32	13	2	16	7	4	0	10	0	0	0	0	952	0	8	17	8	0	0	44	0	
	-0	0	0	17	0	1	0	0	2	1	5	0	0	0	0	06	0	1	0	0	0	0	9	0	
	-14	0	1	535	25	14	1	1	6	0	44	0	0	0	0	119	0	12	0	248	3	3	26	0	
	-24	0	2	5	60	0	3	4	6	0	3	0	0	2	0	47	0	370	17	7	0	1	2	0	
	-51	0	2	171	16	0	0	0	7	0	5	7	9	2	0	51	0	137	519	0	0	3	8	0	
	-4	1	0	47	5	1	2	0	0	0	6	0	0	0	0	40	0	1	0	942	2	2	9	0	
	-9	2	1	247	2	5	0	0	0	0	27	0	0	0	0	65	0	2	0	432	751	1	0	0	
	-2	7	0	108	19	2	0	0	0	0	35	0	0	0	0	91	0	8	0	115	0	356	6	0	
	-2	4	0	112	11	8	0	0	4	1	36	0	2	0	0	122	0	7	5	32	1	6	749	0	
	y	-124	0	1	63	91	3	1	0	112	0	35	0	2	0	0	438	0	127	20	1	0	0	20	74
		a	b	c	d	e	f	g	h	i	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y
Predicted Label																									

# Multiclass Logistic Regression Confusion Matrix

	loss	binary_accuracy	val_loss	val_binary_accuracy
0	13621.426758	0.920041	3449.434814	0.956434
1	10365.086914	0.930965	2142.287354	0.967579
2	4153.743652	0.946506	1126.017456	0.950355
3	3059.573730	0.951236	3066.929443	0.960486
4	5803.154297	0.946056	24940.355469	0.956434

# Binary Logistic Regression Accuracies



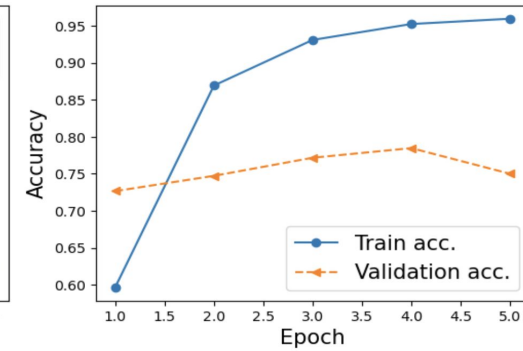
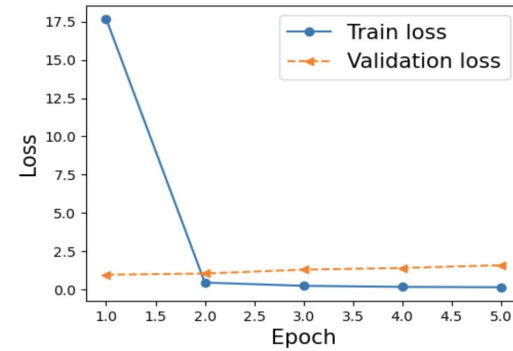
# CNN Baseline

	1	2	3	4	5
	Conv2D + MaxPooling2D+ Flatten + Dense	+Conv2D	+MaxPooling2D	+Dense	+ Conv2D + MaxPooling2D
Training Accuracy	0.9593	0.9720	0.9585	0.9673	0.9678
Validation Accuracy	0.7501	0.8947	0.9021	0.9260	0.9458

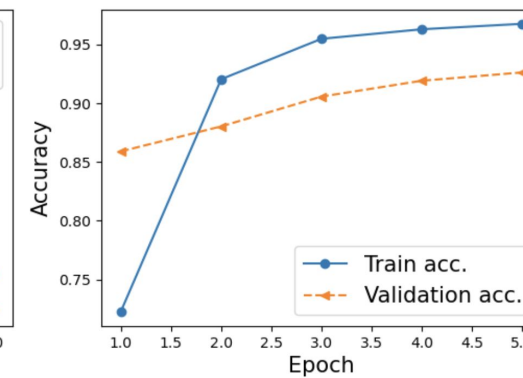
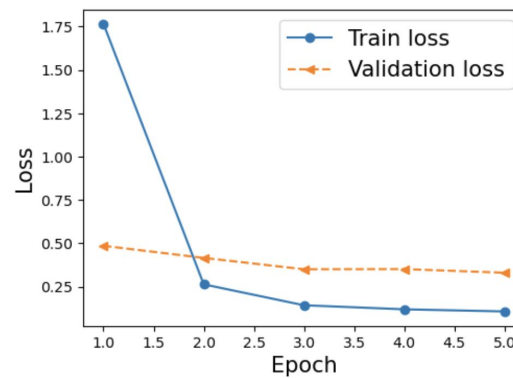


# CNN Baseline Loss and Accuracy

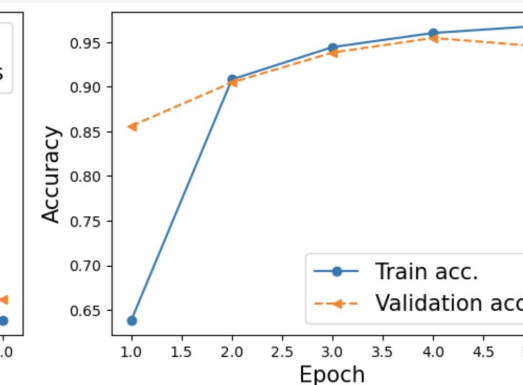
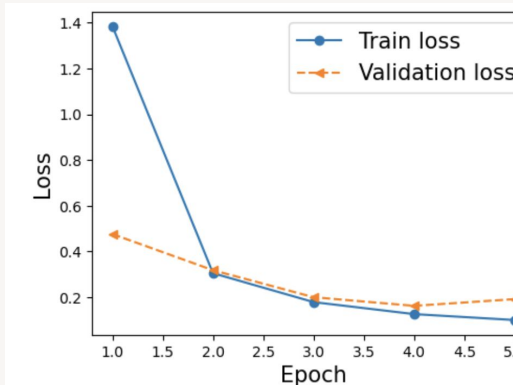
Model 1



After adding layers (Model 4)



Add two more layers, Conv2d + MaxPooling2D (Model 5)



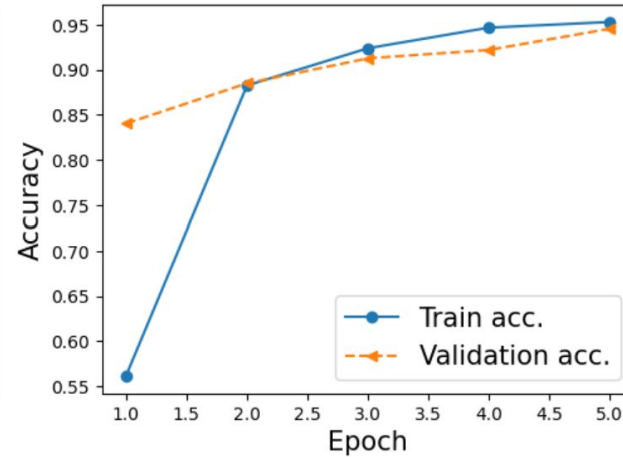
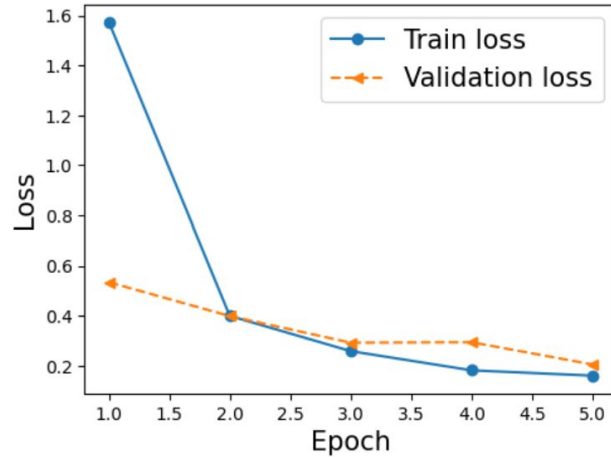


## Final CNN Model

# Parameter Testing Outcomes

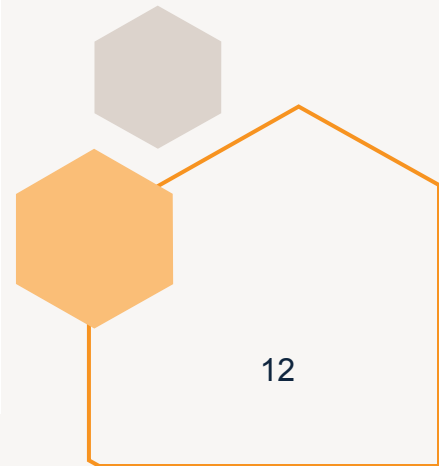
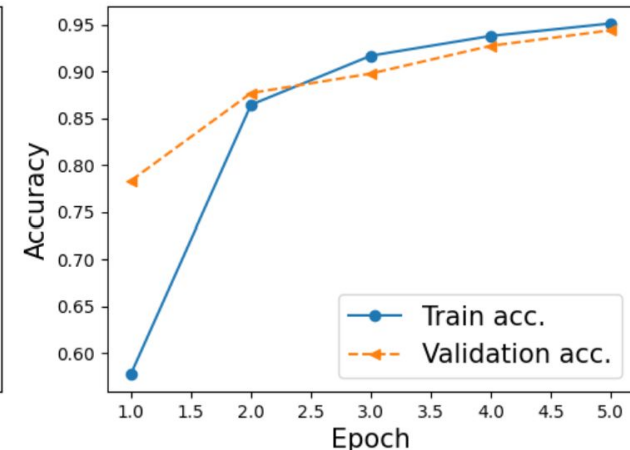
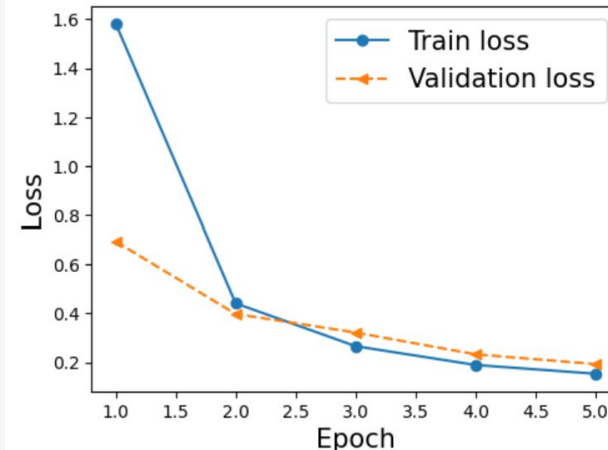
Training accuracy	Validation accuracy	kernel size	pool size	strides	learning rate	optimizer
0.9644	0.9252	3,3	2,2	1,1	0.001	Adam
0.9528	0.9454	5,5	2,2	1,1	0.001	Adam
0.9512	0.9439	3,3	3,3	1,1	0.001	Adam
0.8852	0.8800	3,3	2,2	2,2	0.001	Adam
0.0468	0.0452	3,3	2,2	1,1	0.01	Adam
0.9110	0.6461	3,3	2,2	1,1	0.001	SGD
0.9551	0.9246	5,5	3,3	1,1	0.001	Adam
error	error	5,5	3,3	2,2	0.001	Adam
error	error	3,3	3,3	2,2	0.001	Adam
error	error	5,5	2,2	2,2	0.001	Adam

# Best Performing Models



```
model_1 = cnn_model(kernel_size = (5,5),  
                    pool_size = (2,2),  
                    strides = (1,1),  
                    learning_rate = 0.001,  
                    optimizer = 'adam')
```

```
model_2 = cnn_model(kernel_size = (3,3),  
                    pool_size = (3,3),  
                    strides = (1,1),  
                    learning_rate = 0.001,  
                    optimizer = 'adam')
```



# Test Data Results

```
1 # Evaluate model_baseline on test data
2 test_model_baseline = model_baseline.evaluate(X_test, Y_test_onehot)
3
4 # Print accuracy result
5 print('\nTest Acc. {:.2f}%'.format(test_model_baseline[1]*100))
```

617/617 [=====] - 13s 22ms/step - loss: 0.3234 - accuracy: 0.9218

Test Acc. 92.18%

```
1 # Evaluate model_1 on test data
2 test_model_1 = model_1.evaluate(X_test, Y_test_onehot)
3
4 # Print accuracy result
5 print('\nTest Acc. {:.2f}%'.format(test_model_1[1]*100))
```

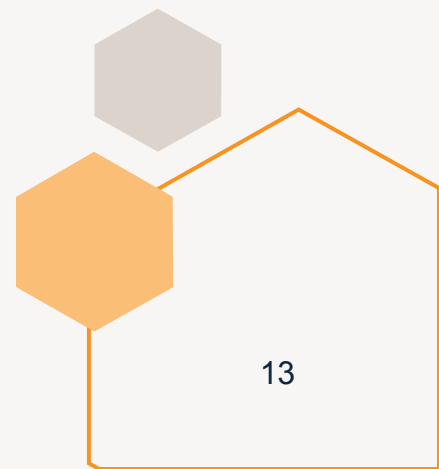
617/617 [=====] - 22s 35ms/step - loss: 0.2228 - accuracy: 0.9439

Test Acc. 94.39%

```
1 # Evaluate model_2 on test data
2 test_model_2 = model_2.evaluate(X_test, Y_test_onehot)
3
4 # Print accuracy result
5 print('\nTest Acc. {:.2f}%'.format(test_model_2[1]*100))
```

617/617 [=====] - 8s 12ms/step - loss: 0.1977 - accuracy: 0.9434

Test Acc. 94.34%



# What if we had more time...



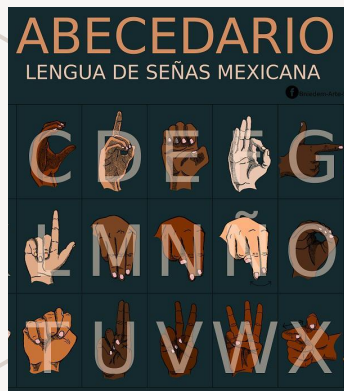
## More training

Train model on new signs from more people with various skin tones



## Decoding ASL in movement

Translate video



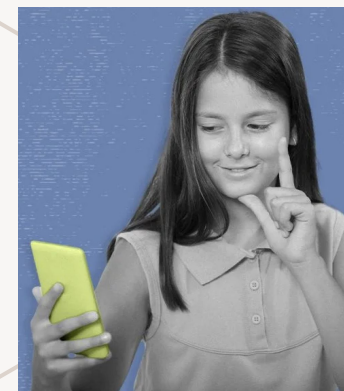
## Other Sign Languages

Translate British, Australian, Mexican Sign Language alphabets



## Teach ASL

Create AI that could teach ASL to promote accessibility and education



## Real time Translation

Use camera device with app that could translate ASL in real time





# Thank you

## References:

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<https://www.mcdaniel.edu/academics/departments/american-sign-language/american-sign-language-asl-studies>

[https://www.reddit.com/r/coolguides/comments/cnbyxf/poster\\_with\\_alphabet\\_in\\_mexican\\_sign\\_language/?rdt=56144](https://www.reddit.com/r/coolguides/comments/cnbyxf/poster_with_alphabet_in_mexican_sign_language/?rdt=56144)

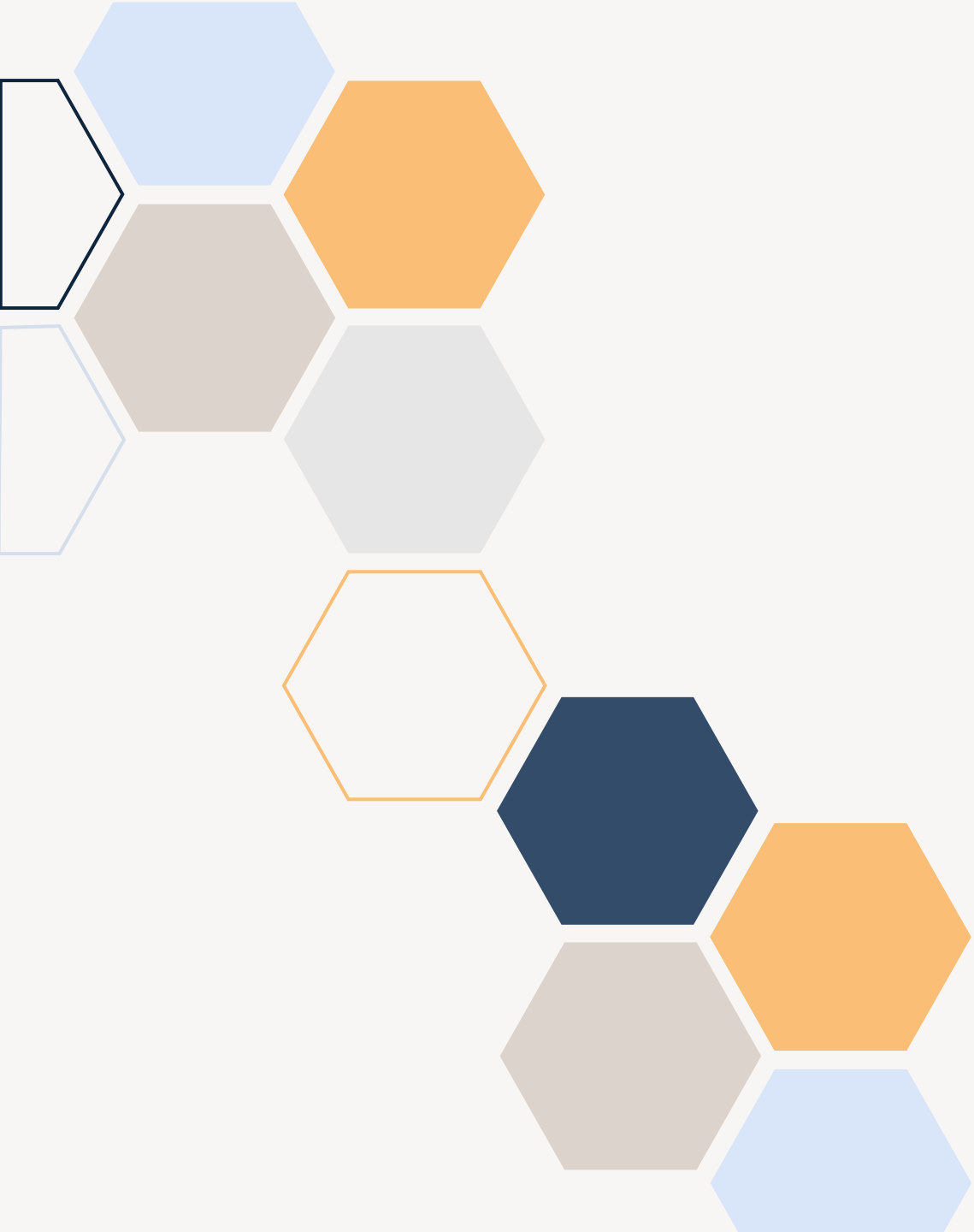
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<https://www.etsy.com/listing/937857530/american-sign-language-asl-digital>

<https://www.3playmedia.com/blog/deaf-culture-black-asl/>



# Questions?

Link to GitHub repo:

[https://github.com/UC-Berkeley-I-School/DataSci207FinProj\\_Deonizio\\_Schuele\\_Fairooz](https://github.com/UC-Berkeley-I-School/DataSci207FinProj_Deonizio_Schuele_Fairooz)

