

Facial Recognition Model

Team Alan Turing



**Andy
Ezar Resha
Firza Muhammad Salim
Khusnul Muchlisin
Melvin Tan
Sassi Ummikalsum**

Team Alan Turing



Why ?

Personalisasi

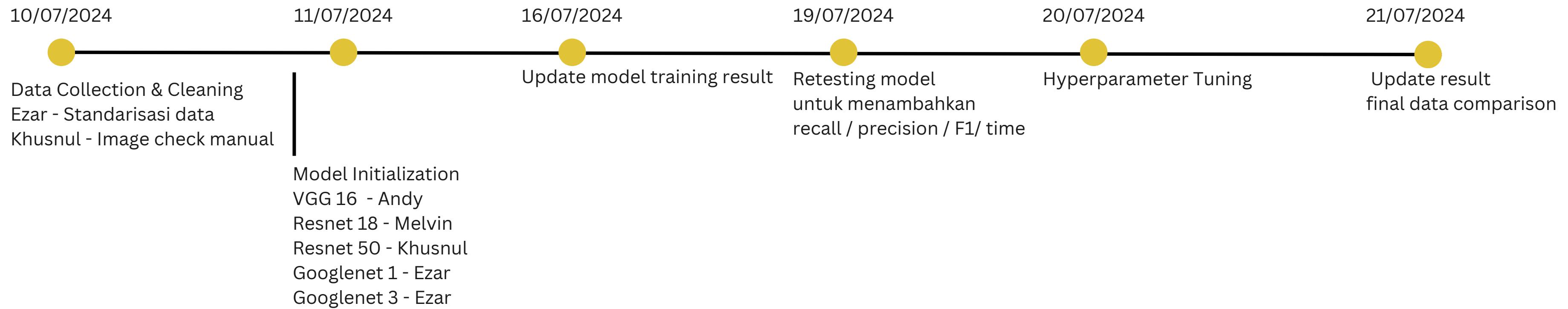
Penyesuaian Konten dan Rekomendasi terhadap Produk berdasarkan Gender

Marketing

Segmentasi Pasar berdasarkan Gender

Project Timeline

A dorm room idea turned start-up, the very first ScoutNotes was started as an on-campus app.



Exploratory Data Analysis

- **Data diambil dari CelebA Dataset**
CelebA dataset memiliki lebih dari 200.000 data gambar dengan 40 attribute per gambar.
- **Total data yang digunakan adalah 5000**
pembagian distribusi dataset 2047:2953
- **Total gambar data awal adalah 5017**
ada 17 gambar duplikasi yang tidak dipakai

Data Preparation

- **Nama gambar disambungkan dengan kolom [202599] dari file list_attribute**

Untuk menggunakan label dari dataset Celeb A

- **Label Male / Female dipilih dengan field Male**

Akan dikategorisasikan male jika valuenya 1, dan female jika -1

- **Data Dibagi kedalam 4 folder**

Clean - tanpa duplikat, dan Train, Test, Val

Data Anomaly

— Ada beberapa data yang mismatch

Ada beberapa data gambar yang ketika dilihat adalah pria, tetapi menurut label adalah wanita. Kami melakukan 1 random test dengan resnet50 untuk mengecek apakah pensortiran data secara manual untuk mengecek apakah ada dampak terhadap hasil. Hasil test ini membuat accuracy yang cukup **rendah**. Mungkin bisa dieksplor lagi kedepannya, tetapi kami memutuskan untuk **mengikuti kesimpulan label attribute_list**.

Data Preparation

Train

3000

1225:1775

Validation

1000

424:576

Test

1000

398:602

Data Augmentation

— **Image Augmentation**

Resize, random rotation (45), random resized crop (225), Horizontal Flip, to Tensor, dan normalisasi gambar. Data test & validation mirip, hanya tidak di rotate, dan center crop.

— **Googlenet V3**

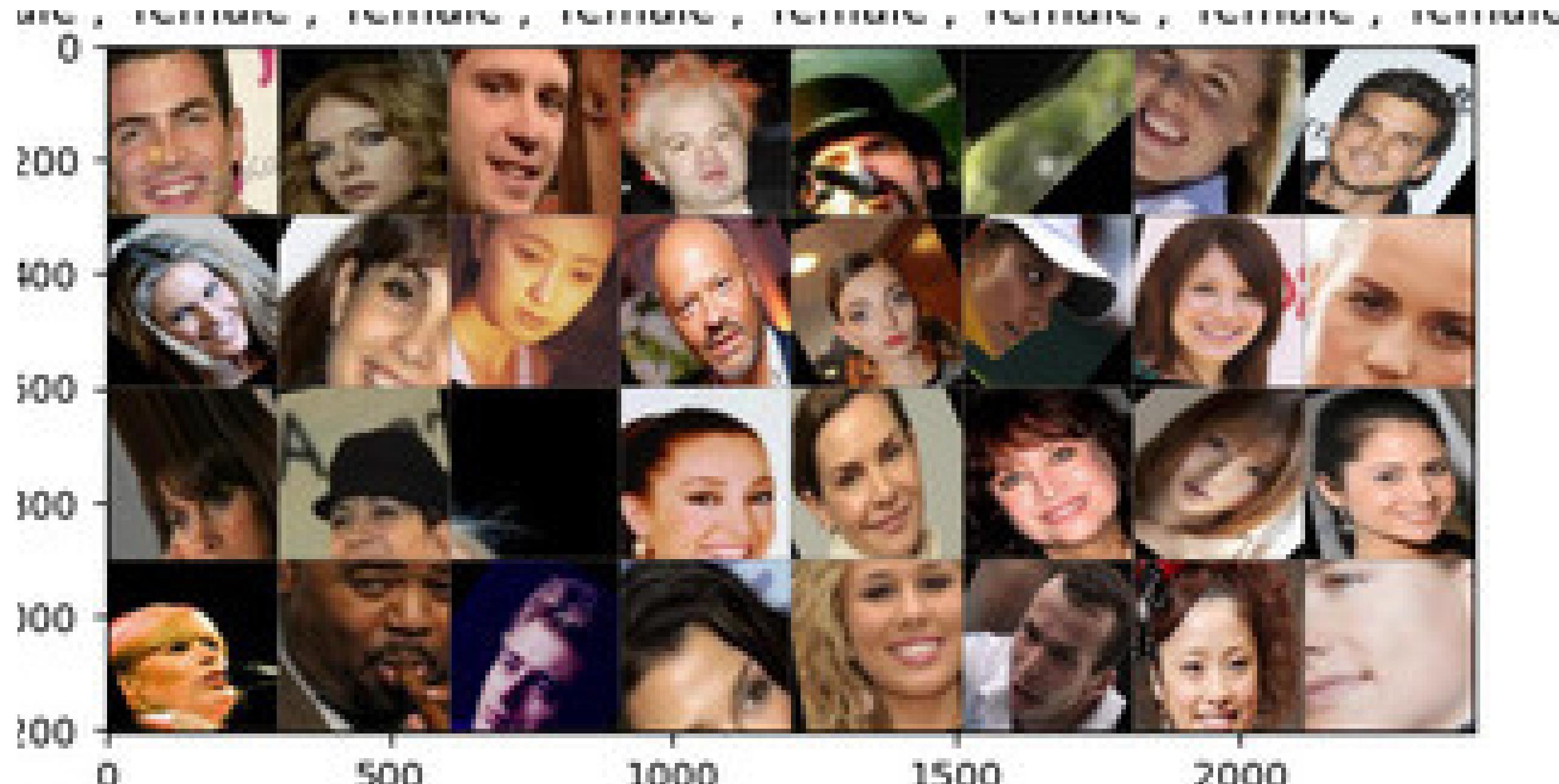
Diubah random resized crop menjadi 299 karena ukuran minimum

Data Augmentation

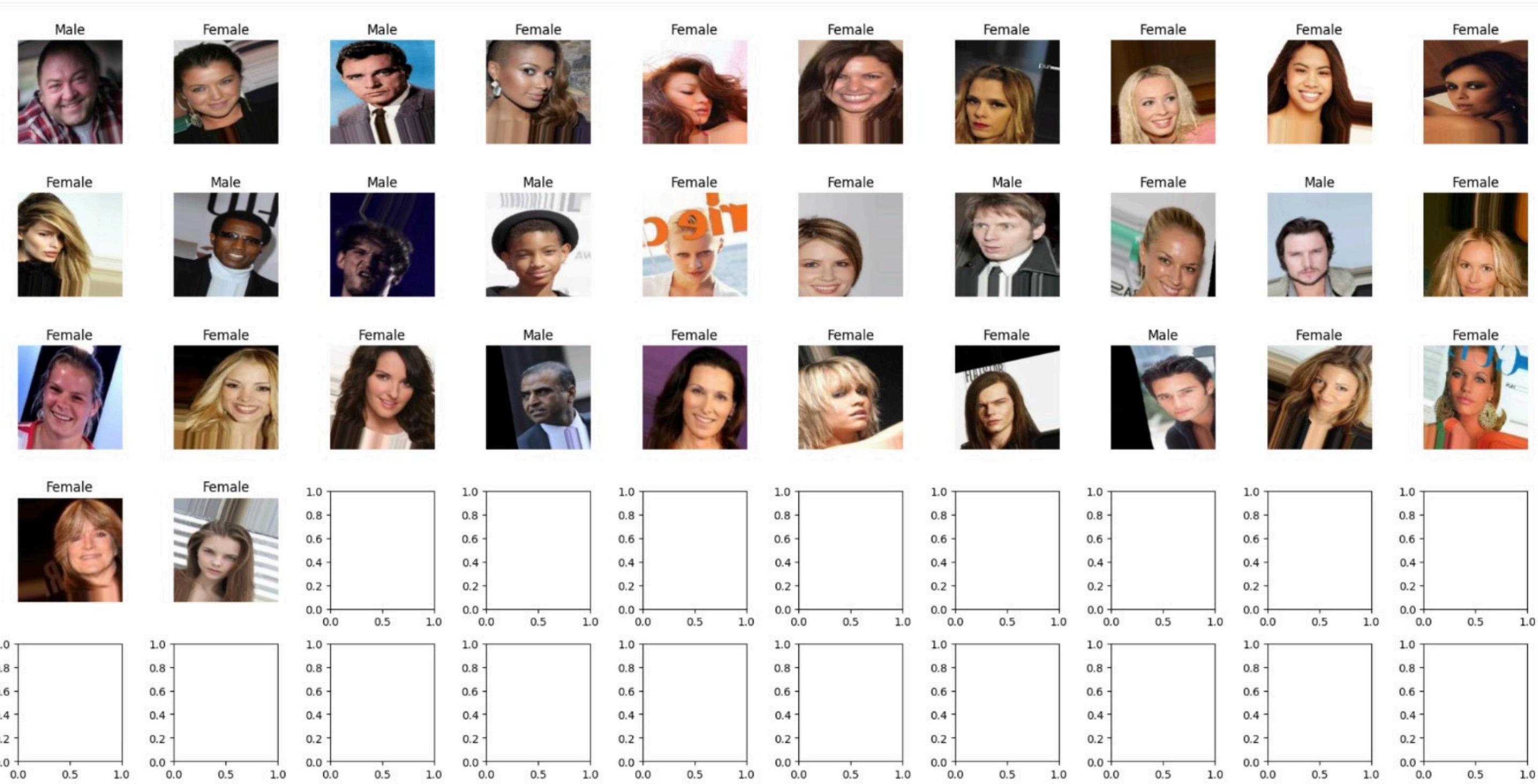
— VGG16

- Melakukan Augmentasi tambahan untuk menghindari overfitting dengan rescale, rotation, width_shift, height_shift, shear_range, zoom_range, horizontal_flip.
- VGG16 hanya menggunakan bagian awal saja sedangkan bagian atas dihilangkan. (include_top=False)
- VGG16 menggunakan input shape size 224,224 dan 3 (RGB)

Googlenet & Resnet Augmentation



VGG16 Augmentation



Model Training



Data Prep. Cont. (Batch Size)

— **Pembuatan Dataloader imageset torch**

- Dilakukan saat mulai prepare model training karena ada tuning batch size.

Model Training

— Pelatihan menggunakan manual selection

- Epoch 10 , 20, 50
- Optimizer Adam / SGD
- Learning Rate 0.001 , 0.001, 0.1

— VGG16

- Penambahan bagian Custom seperti Lapisan Flatte, Dense , Dropout.
- Pembekuan Lapisan Awal dalam model dasar VGG16
(layer.trainable = False)

— Googlenet

Perubahan fully connected original (softmax) menjadi 2

Training Result

Training Result

Model	Pretrained	Hyperparameter			Optimizer	Tuning Method	Result							use GPU	Recall	Precision	F1	Inference Time
		Epoch	Batch Size	Learning Rate			Train Loss	Train Accuracy	Val Loss	Val Accuracy	Test Loss	Test Accuracy	Time					
GoogleNet V1	YES	10	8	0.001	Adam	-	0.0397	0.8953	0.0168	0.9840	0.0178	0.9540	2m12s	YES	0.9240	0.9240	0.9237	0.003s
		20	8	0.001			0.0303	0.8947	0.0133	0.9850	0.2170	0.9350	4m 27s		0.9350	0.9351	0.9347	0.003s
		50	8	0.001			0.0218	0.9210	0.0132	0.9580	0.0149	0.9590	18m41s		0.9590	0.9598	0.9591	0.003s
		10	16	0.001			0.0162	0.8790	0.0084	0.9520	0.0097	0.9350	2m18s		0.9310	0.9312	0.9307	0.003s
		10	32	0.001			0.0075	0.8887	0.0033	0.9620	0.0043	0.9520	2m13s		0.9140	0.9187	0.9125	0.004s
		10	8	0.01			0.0783	0.6293	0.0756	0.6550	0.0680	0.6750	3m5s		0.6750	0.7083	0.6217	0.003s
		10	8	0.0001	SGD	Bayesian Opt	0.0238	0.9200	0.0111	0.9660	0.0107	0.9720	2m15s		0.9570	0.9650	0.9570	0.003s
		45	16	0.083			0.0054	0.9617	0.0063	0.9680	0.0088	0.9640	13m16s		0.9640	0.9649	0.9641	0.003s
		50	16	0.01			0.0038	0.9550	0.0030	0.9640	0.0048	0.9470	13m44s		0.9470	0.9481	0.9466	0.003s
GoogleNet V3	YES	10	8	0.001	Adam	-	0.0849	0.5877	0.0853	0.5820	0.0884	0.6050	4m23s	YES	0.6050	0.6292	0.4645	0.004s
		20	8	0.001			0.0792	0.8447	0.0886	0.5730	0.0877	0.5800	9m28s		0.5800	0.6047	0.5843	0.003s
		50	8	0.001			0.0262	0.9143	0.0163	0.9510	0.0217	0.9320	24m28s		0.9320	0.9363	0.9325	0.005s
		10	16	0.001			0.0183	0.8877	0.0118	0.9210	0.0184	0.8730	3m58s		0.8730	0.8795	0.8698	0.003s
		10	32	0.001			0.0070	0.8960	0.0052	0.9300	0.0086	0.9220	4m10s		0.9250	0.9295	0.9255	0.004s
		10	8	0.01	SGD	Bayesian Opt	0.0852	0.5853	0.0852	0.5850	0.0859	0.6010	4m35s		0.6010	0.4950	0.4538	0.003s
		10	8	0.0001			0.0238	0.9527	0.0131	0.9640	0.0140	0.9640	5m29s		0.9640	0.9640	0.9639	0.004s
		50	32	0.0121			0.0044	0.9390	0.0027	0.9780	0.0030	0.9640	7m15s		0.9640	0.9645	0.9641	0.003s
		20	8	0.01			0.0207	0.9760	0.0101	0.9760	0.0120	0.9650	7m33s		0.9650	0.9650	0.9650	0.003s
Resnet18	YES	10	8	0.0001	Adam	-	0.0785	0.6579	0.0756	0.6752	0.0757	0.6837	1m 22s	YES	0.6837	0.6806	0.6749	5s
		20	8	0.0001			0.0746	0.6672	0.0735	0.7037	0.0855	0.6171	2m 44s		0.6171	0.6559	0.5328	5s
		50	8	0.0001			0.0623	0.7527	0.0582	0.7934	0.0599	0.7805	7m 9s		0.7805	0.7796	0.7798	5s
		10	16	0.0001			0.0385	0.6858	0.0380	0.6838	0.0388	0.6578	1m 20s		0.6578	0.6533	0.6448	4s
		10	32	0.0001			0.0200	0.8750	0.0208	0.6638	0.0226	0.6338	1m 20s		0.6338	0.6452	0.5849	4s
		10	8	0.01			0.0956	0.5877	0.0834	0.6182	0.0919	0.5795	1m 22s		0.5795	0.3359	0.4253	5s
		10	8	0.001			0.0911	0.5681	0.0820	0.6368	0.0909	0.5518	1m 22s		0.5518	0.4775	0.4568	5s
Resnet50	YES	10	8	0.0001	Adam	-	0.0737	0.6879	0.0652	0.7154	0.0823	0.6786	10m 5s	YES	0.7357	0.7361	0.7250	0.0704 s
		20	8	0.0001			0.0410	0.8471	0.0253	0.9109	0.0271	0.9110	6m 41s		0.8898	0.8909	0.8885	0.0716 s
		50	8	0.0001			0.0236	0.9183	0.0203	0.9548	0.0231	0.9349	16m 40s		0.9309	0.9323	0.9312	0.0703 s
		10	16	0.0001			0.0363	0.6959	0.0310	0.7527	0.0375	0.7410	3m 2s		0.7437	0.7408	0.7392	0.0708 s
		10	32	0.0001			0.0181	0.7027	0.0184	0.7168	0.0153	0.7663	3m 10s		0.7437	0.7534	0.7459	0.1194 s
		10	8	0.001			0.0814	0.6287	0.0791	0.6888	0.0800	0.6295	3m 20s		0.6268	0.6826	0.5224	0.0743 s
		10	16	0.001			0.0397	0.6375	0.0401	0.6622	0.0388	0.6773	3m 0s		0.7158	0.7134	0.7048	0.0756 s
		10	32	0.001			0.0187	0.6848	0.0162	0.7766	0.0178	0.7158	3m 10s		0.6999	0.7042	0.7014	0.1221 s
VGG16	YES	10	32	0.0001	Adam	--	0.0067	1.0000			0.0058	1.0000	5m 1s	YES				
VGG16	YES	10	32	0.0001	Adam	--	0.2258	0.9070	0.2049	0.9120	0.2032	0.9200	6m 54s	YES				
VGG16	YES	10	8	0.0001	Adam	--	0.1768	0.9323	0.2109	0.9079	0.2066	0.9179	3m 12s	YES				
VGG16	YES	50	64	0.0001	Adam													

Contoh Prediction

Hasil Prediksi menggunakan Batch size 64, 50 epoch, Hyperparameter Tune : Bayesian Opt (Trial 7x), Learning rate 0.0001



```
L/1 [=====] - 0s 17ms/step  
L/1 [=====] - 0s 18ms/step  
L/1 [=====] - 0s 18ms/step  
L/1 [=====] - 0s 17ms/step  
L/1 [=====] - 0s 17ms/step
```



```
L/1 [=====] - 0s 19ms/step  
L/1 [=====] - 0s 18ms/step  
L/1 [=====] - 0s 18ms/step  
L/1 [=====] - 0s 18ms/step  
L/1 [=====] - 0s 17ms/step  
L/1 [=====] - 0s 18ms/step  
L/1 [=====] - 0s 17ms/step  
L/1 [=====] - 0s 18ms/step
```

Top 2 Model

	Accuracy	Recall	Precision	F1	Inference Time
Googlenet V1	0.9720	0.9570	0.9650	0.9570	0.003s
Googlenet V3	0.9650	0.9650	0.9650	0.9650	0.003s

Best Performing Model

Accuracy	Recall	Precision	Time
Googlenet V1 0.9720	Googlenet V3 0.9650	Googlenet V3 0.	Googlenet 0.03s

Kesimpulan

Model terbaik untuk melakukan Gender recognition adalah Googlenet

- Perbedaan performa googlenet V1 dan V3 untuk akurasi sekitar 1%, tetapi V3 mempunyai recall, precision, dan F1 yang lebih tinggi (1%)
- Kecepatan prediksi juga cukup bagus, dengan .003s per gambar