AN ANALYSIS OF HUMAN CRANIAL CAPACITY, ANATOMY, AND DENTAL STRUCTURE THROUGH TIME AND LOCATION

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AGENDA

Introduction

Exploratory Data Analysis

Analysis of Anatomical Data

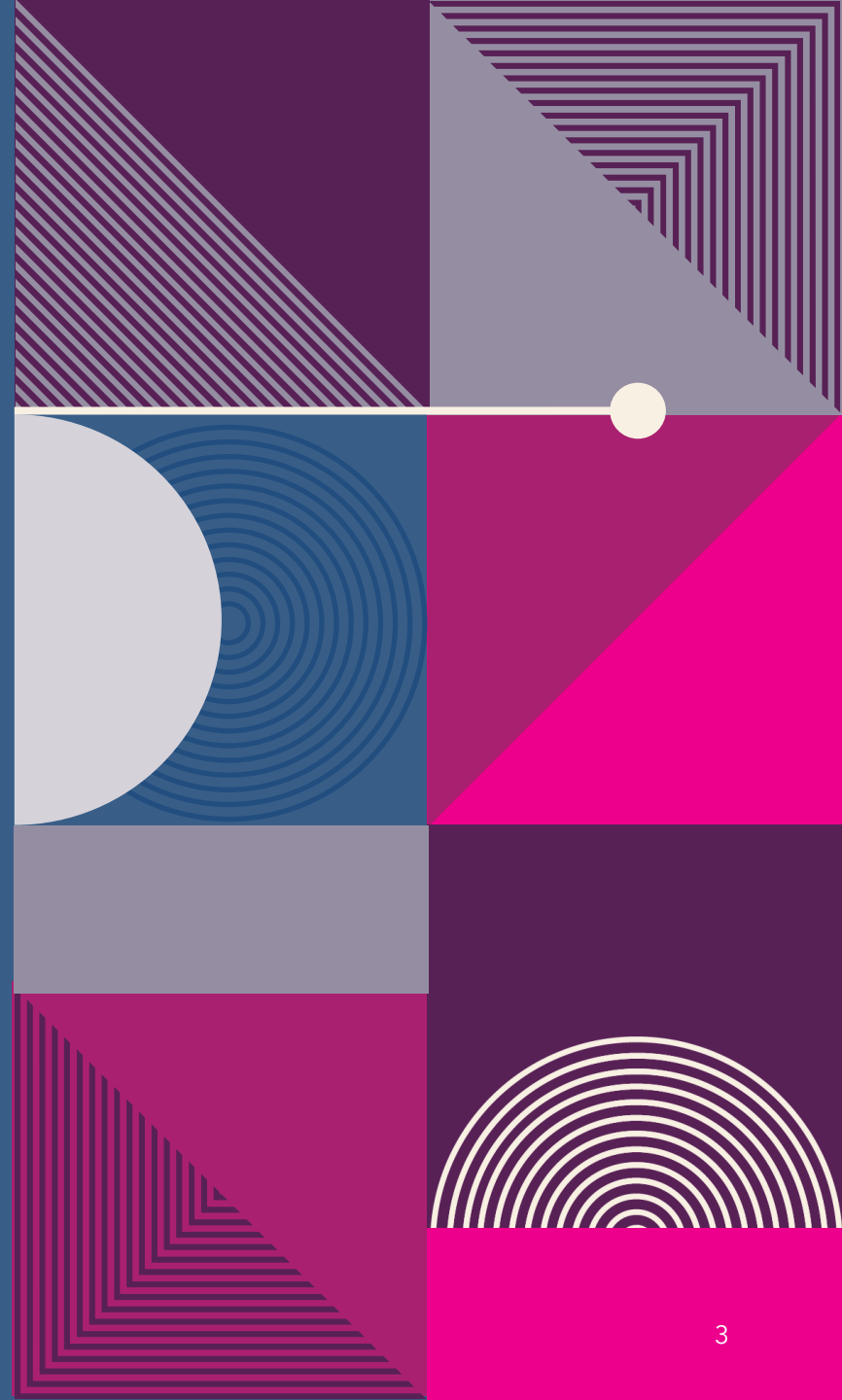
ML Methods to Predict Cranial Capacity and Height

Final takeaways

AIM OF THE PROJECT

Various factors and their interrelationships were investigated and analyzed for human origins and evolution process. Exploratory Data Analysis (EDA) and simple machine learning algorithms were employed to explore the correlations among height, bipedality, cranial capacity, diet, and technological development.

In particular, the study examined the relationships between cranium size and technological advancement, as well as bipedality and its evolution over time. Additionally, the connections between jaw size, diet, teeth structure, skeleton, and overall anatomy were thoroughly explored.



EXAMPLES FROM THE DATASET

	Genus_&_Specie	Time	Location	Zone	Current_Country	Habitat	Cranial_Capacity	Height	Incisor_Size	Jaw_Shape	...	biped	Arms	Foots	Diet	Sexual_Dimorphism	Hip	Vertical_
0	hominino Orrorin tugenencin	6.041124	Africa	oriental	Kenya	forest	144.51410	110.24323	small	conical	...	low probability	climbing	climbing	dry fruits	high	wide	
1	hominino Ardipithecus ramidus / kabadda	4.383910	Africa	oriental	Ethiopia	mixed	293.96021	107.69018	small	conical	...	high probability	climbing	climbing	soft fruits	medium-high	wide	
2	Australopithecus Afarensis	3.749413	Africa	oriental	Kenya	mixed	264.79849	123.76644	big	U shape	...	yes	climbing	walk	dry fruits	high	slim	
3	Australopithecus Anamensis	4.595606	Africa	oriental	Kenya	forest-gallery	403.28047	111.40831	big	U shape	...	yes	climbing	climbing	dry fruits	high	wide	
4	Australopithecus Africanus	3.614060	Africa	south	South Africa	forest-gallery	679.15233	111.59004	small	conical	...	yes	climbing	climbing	dry fruits	high	wide	

5 rows × 28 columns

STATS AND INFORMATION OF DATASET

	Time	Cranial_Capacity	Height
count	12000.000000	12000.000000	12000.000000
mean	2.532665	616.824303	131.452198
std	1.776998	356.275762	24.539191
min	0.000529	0.074910	80.009030
25%	1.050566	334.430993	112.986802
50%	2.317031	511.320200	125.508305
75%	3.656959	919.807697	153.877355
max	7.699417	1448.397470	184.981450

```
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    1   Time                        12000 non-null  float64
    2   Location                    12000 non-null  object
    3   Zone                        12000 non-null  object
    4   Current_Country             12000 non-null  object
    5   Habitat                     12000 non-null  object
    6   Cranial_Capacity            12000 non-null  float64
    7   Height                      12000 non-null  float64
    8   Incisor_Size                12000 non-null  object
    9   Jaw_Shape                   12000 non-null  object
    10  Torus_Supraorbital          12000 non-null  object
    11  Prognathism                 12000 non-null  object
    12  Foramen_Mágnum_Position     12000 non-null  object
    13  Canine Size                 12000 non-null  object
    14  Canines_Shape               12000 non-null  object
    15  Tooth_Enamel                12000 non-null  object
    16  Tecno                       12000 non-null  object
    17  Tecno_type                  12000 non-null  object
    18  biped                       12000 non-null  object
    19  Arms                        12000 non-null  object
    20  Foots                       12000 non-null  object
    21  Diet                        12000 non-null  object
    22  Sexual_Dimorphism           12000 non-null  object
    23  Hip                         12000 non-null  object
    24  Vertical_Front              12000 non-null  object
    25  Anatomy                     12000 non-null  object
    26  Migrated                    12000 non-null  object
    27  Skeleton                    12000 non-null  object
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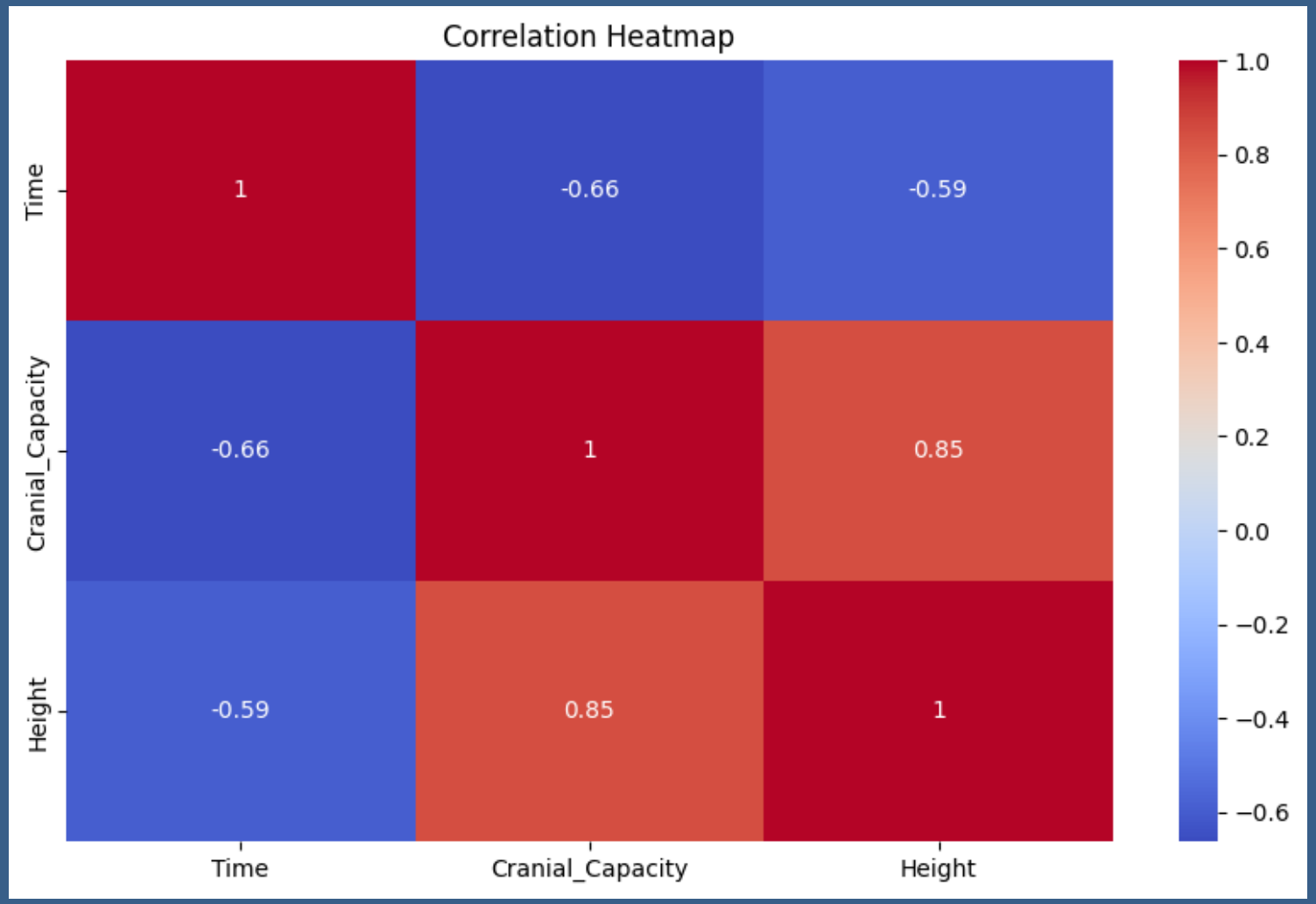
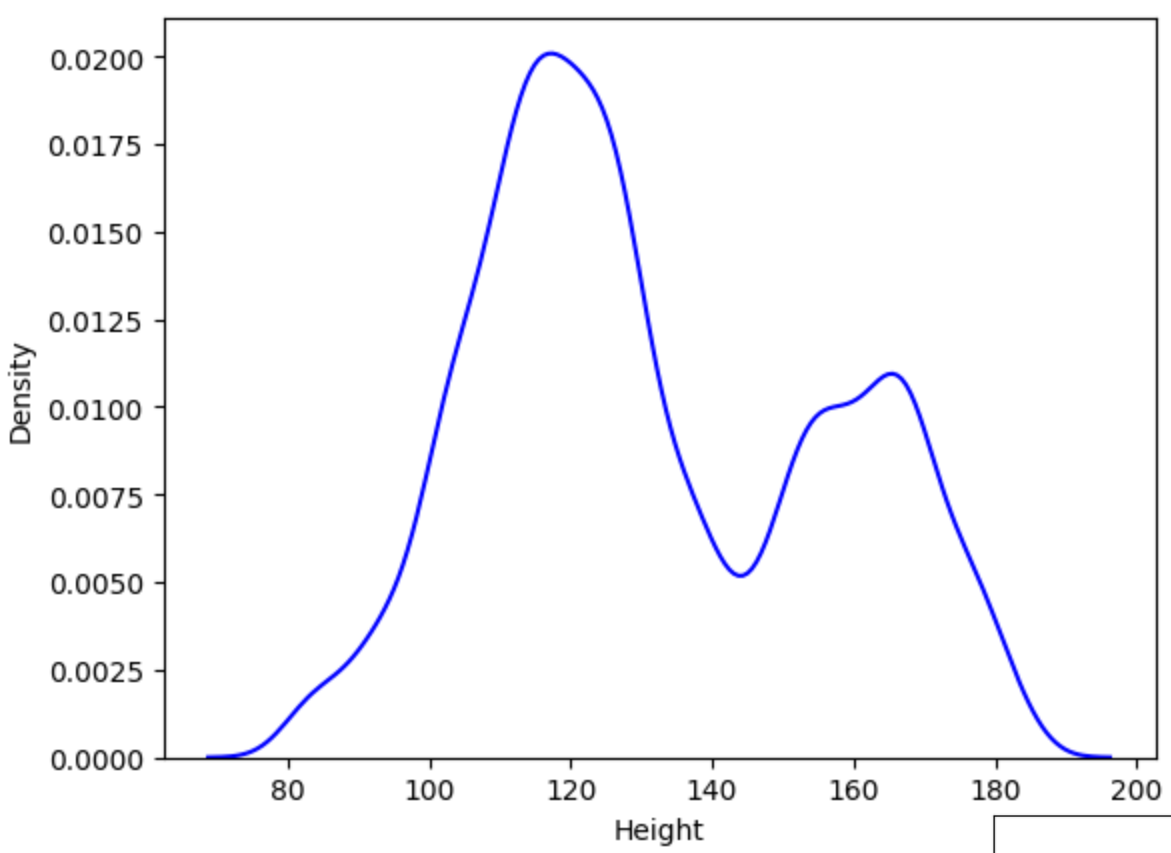
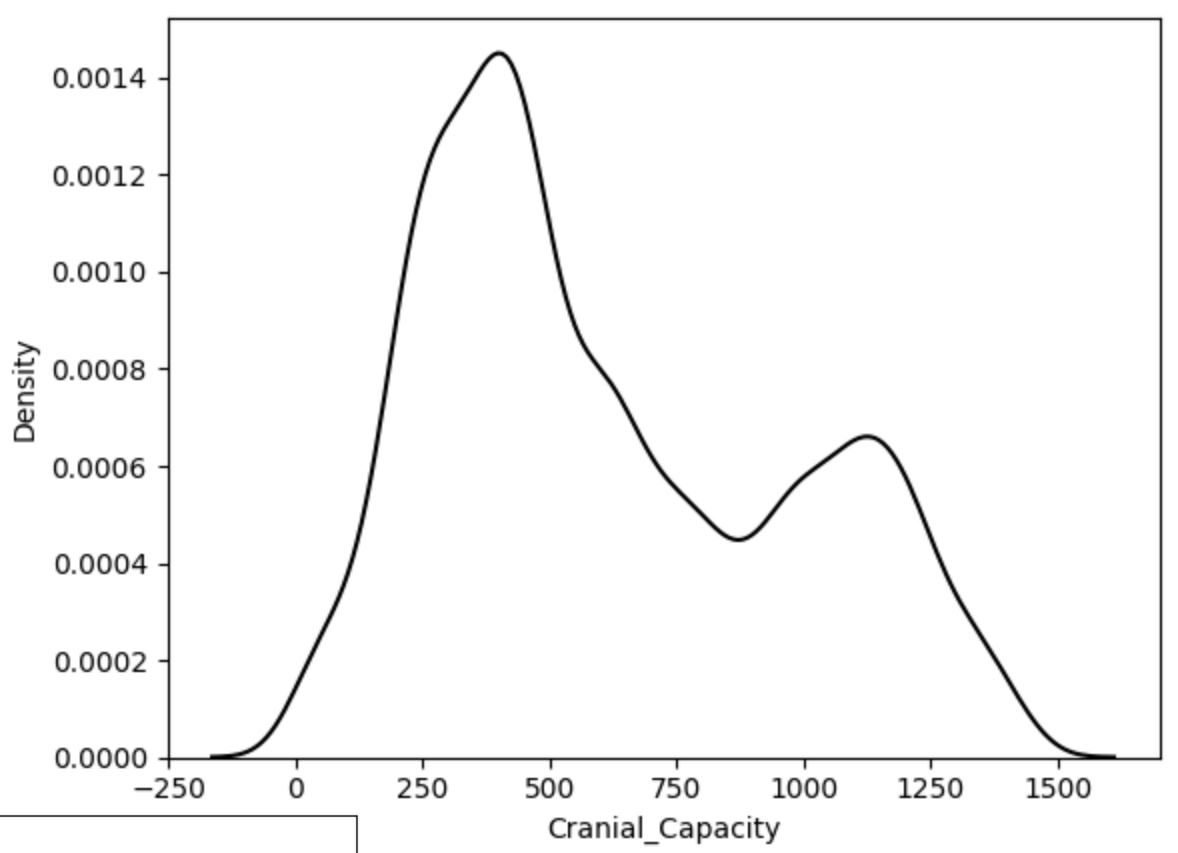
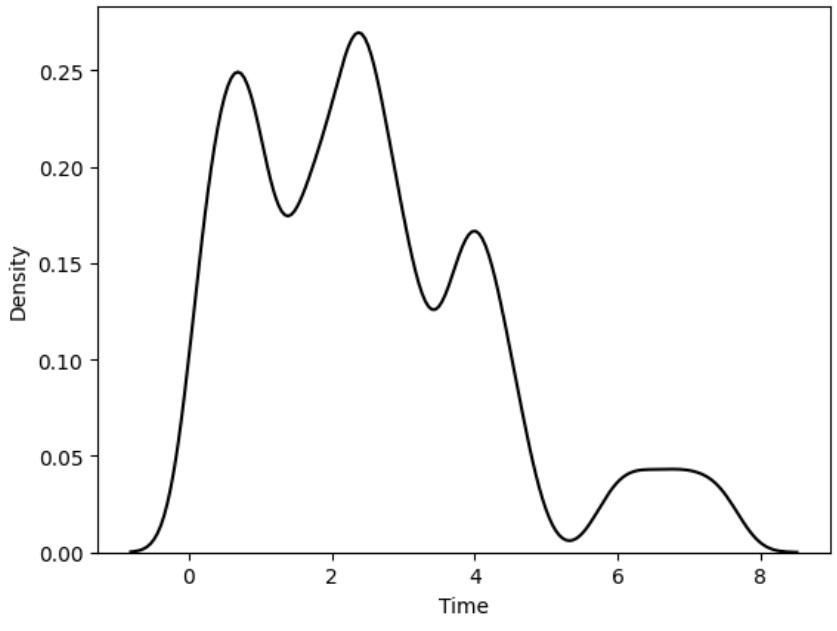
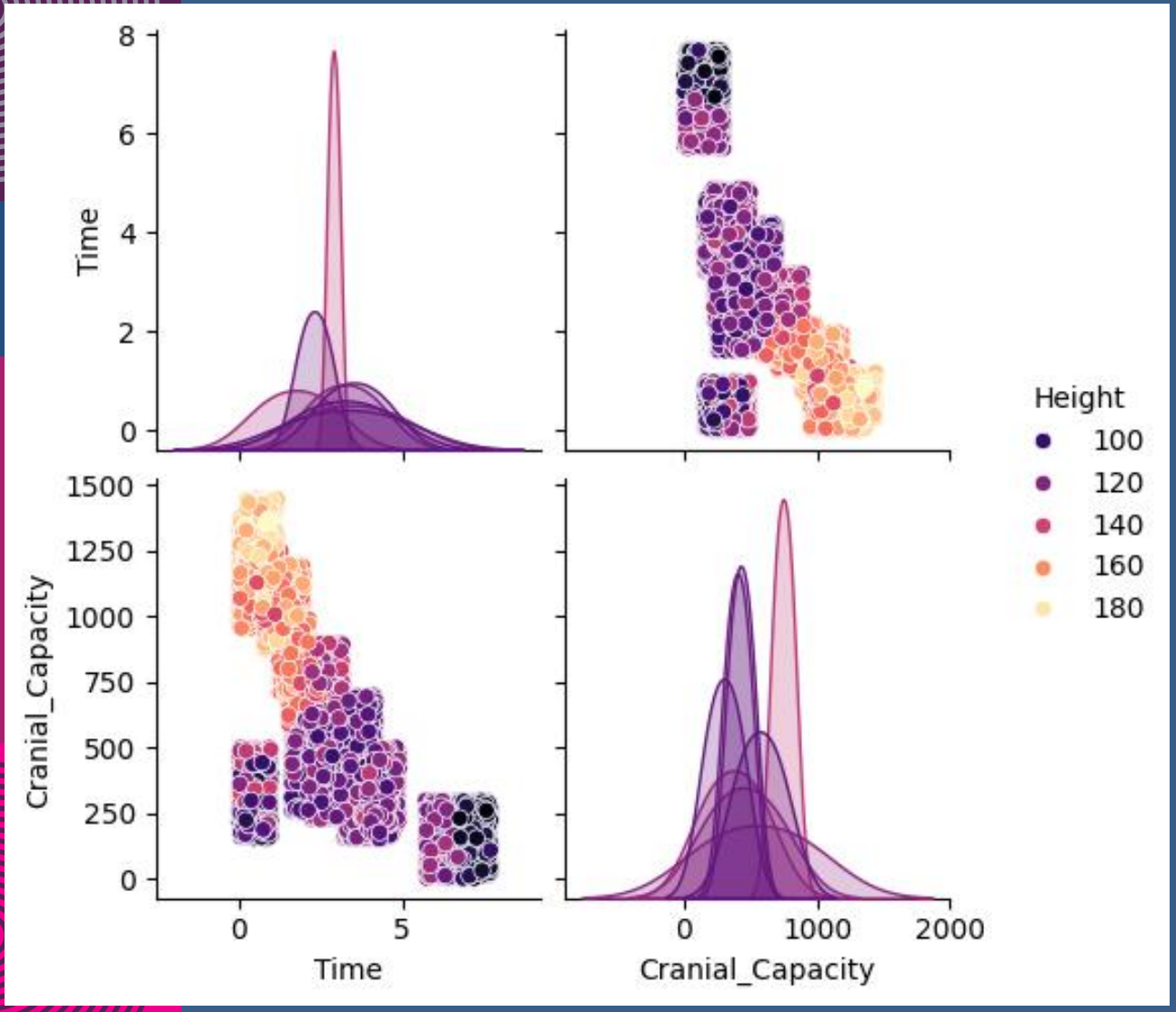
CORRELATION MATRIX OF CRANIAL CAPACITY, HEIGHT AND TIME

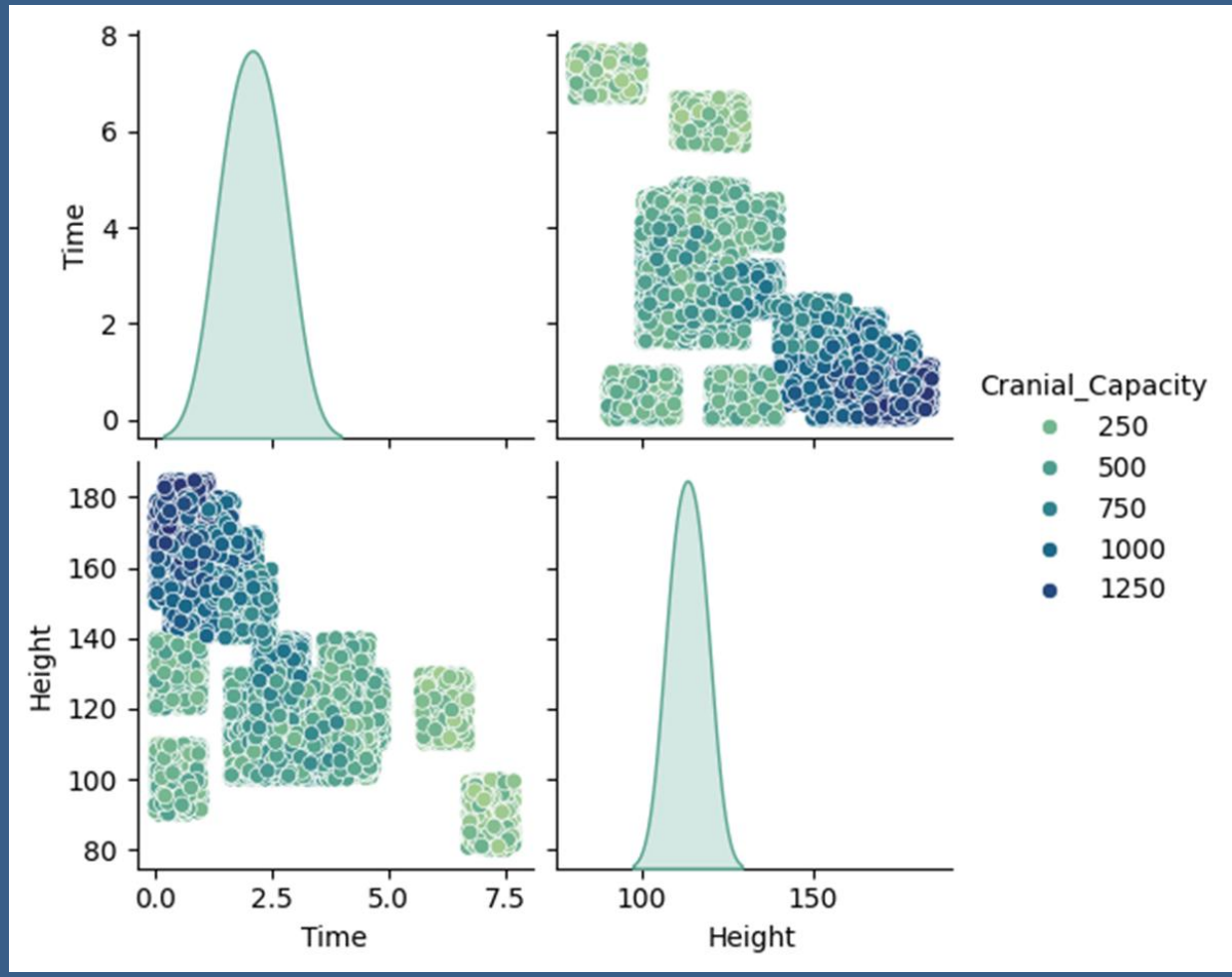



Density
Height
0.0200
0.0175
0.0150
0.0125
0.0100
0.0075
0.0050
0.0025
0.0000
80
100
120
140
160
180
200

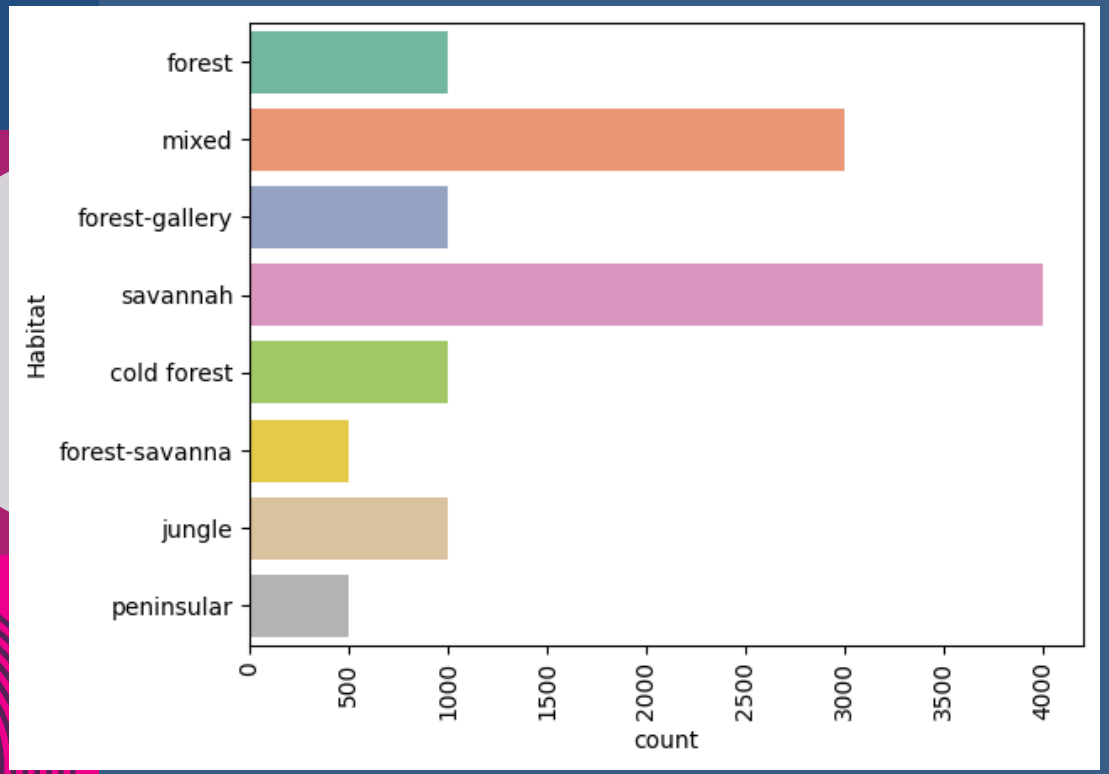

Density
Cranial_Capacity
0.0014
0.0012
0.0010
0.0008
0.0006
0.0004
0.0002
0.0000
−250
0
250
500
750
1000
1250
1500

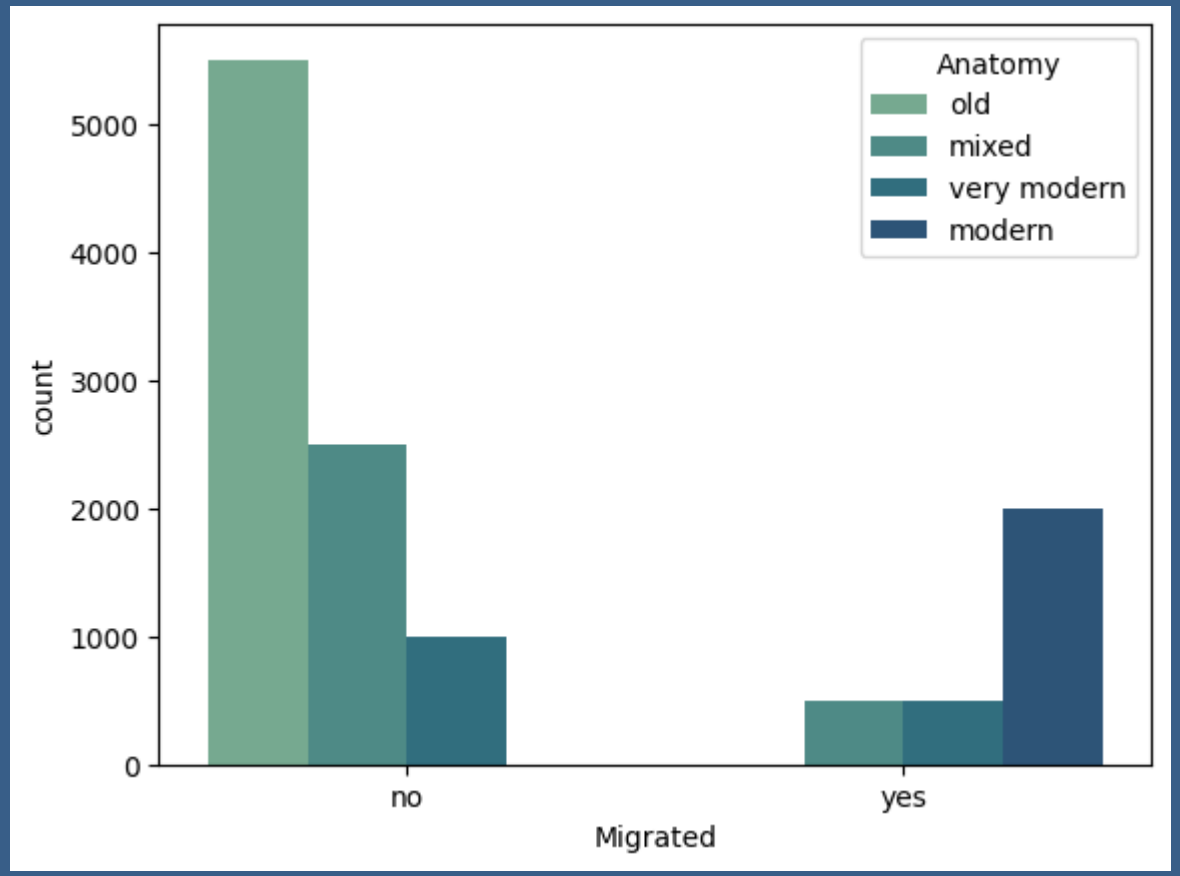

Density
Time
0.25
0.20
0.15
0.10
0.05
0.00
0
2
4
6
8

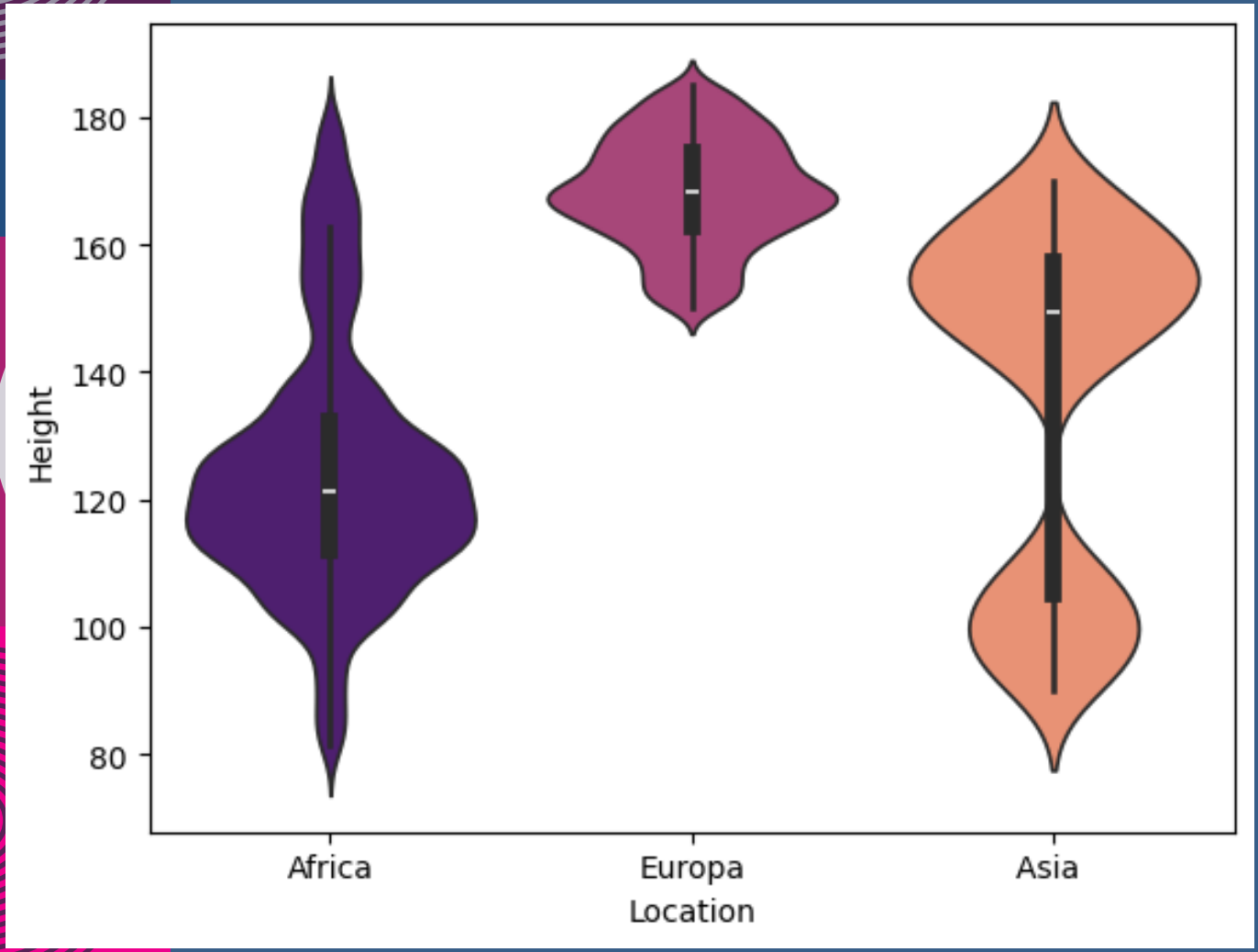

Time
Cranial_Capacity
Height
100
120
140
160
180
0
5
1000
2000

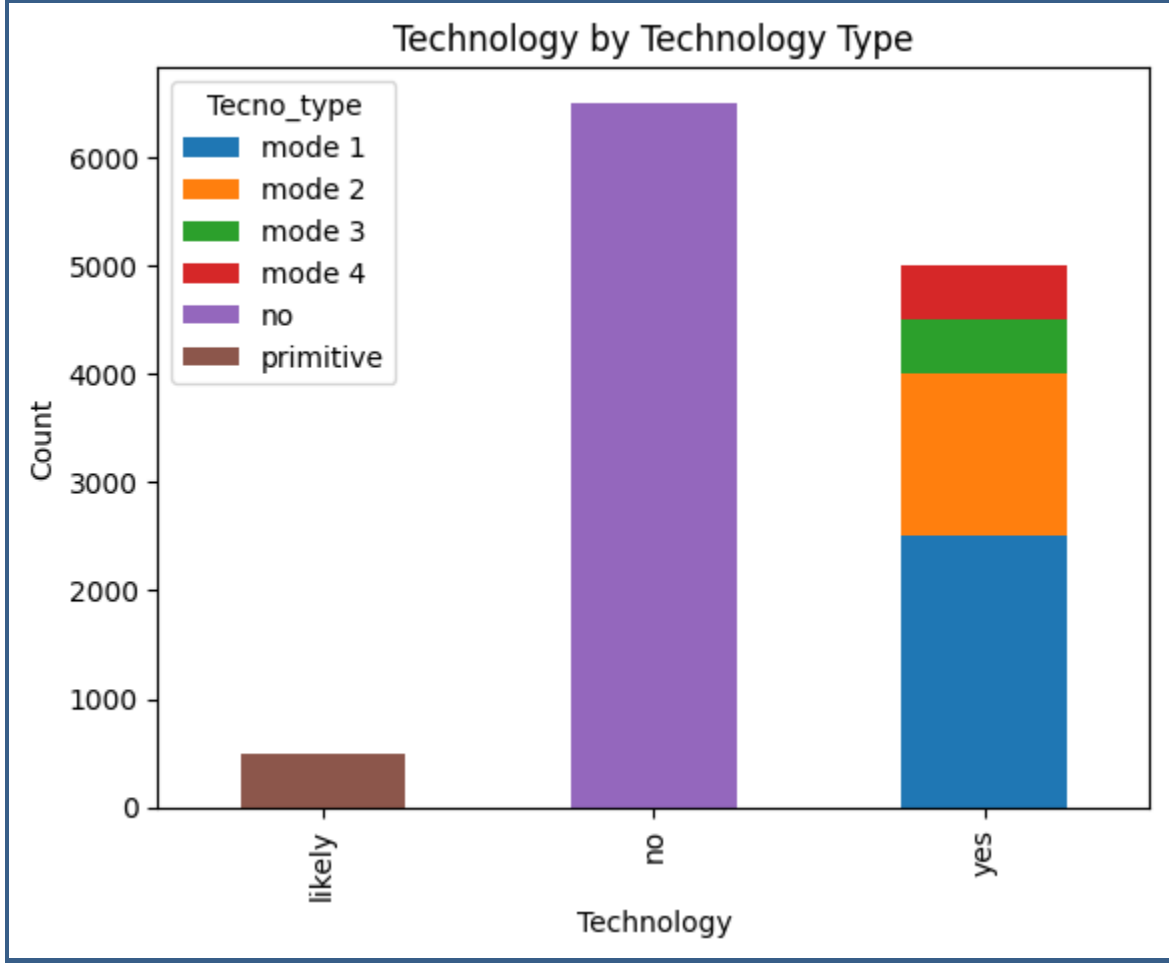

Time
Height
Cranial_Capacity
250
500
750
1000
1250
0.0
2.5
5.0
7.5
100
150

HABITAT AND ANATOMY

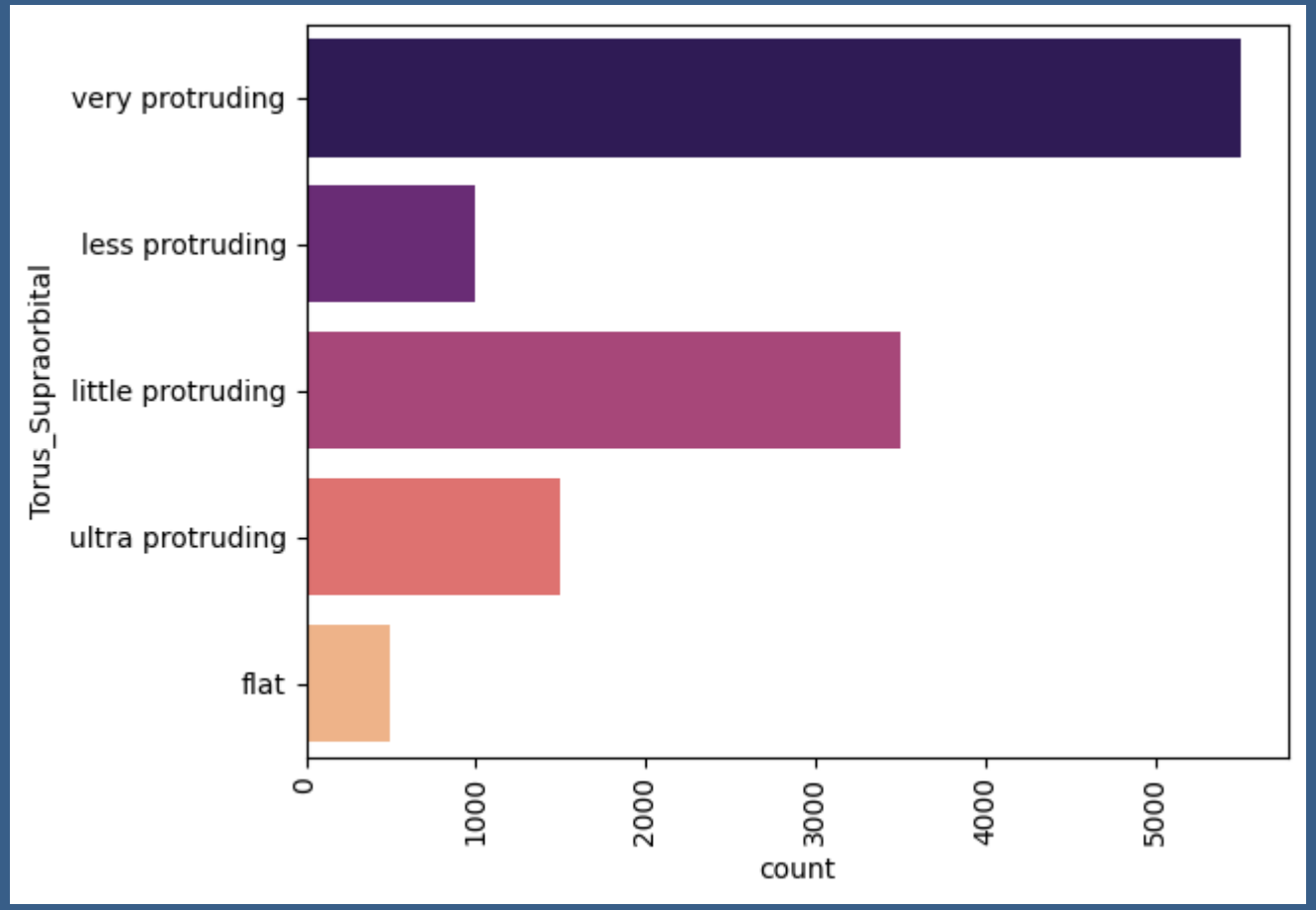




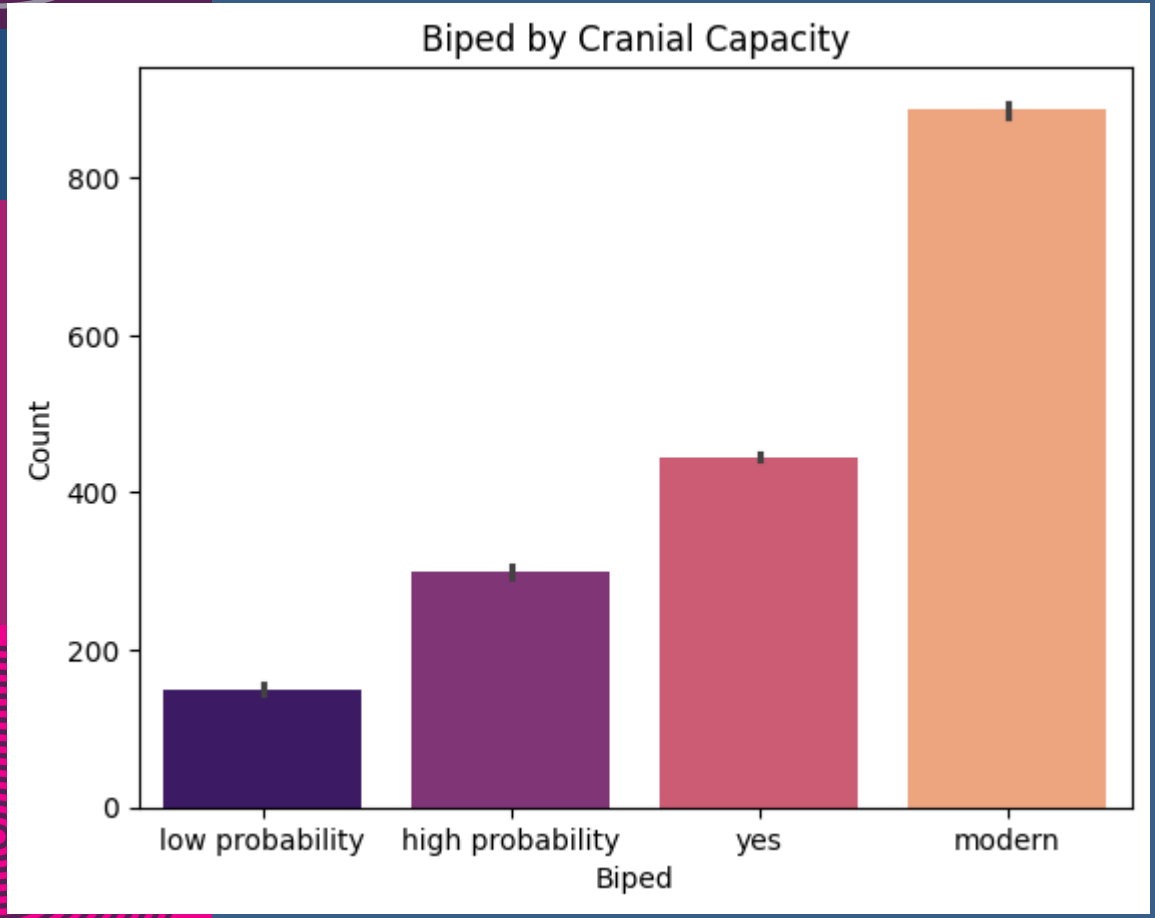

180
160
140
120
100
80
Height
Africa
Europa
Asia
Location

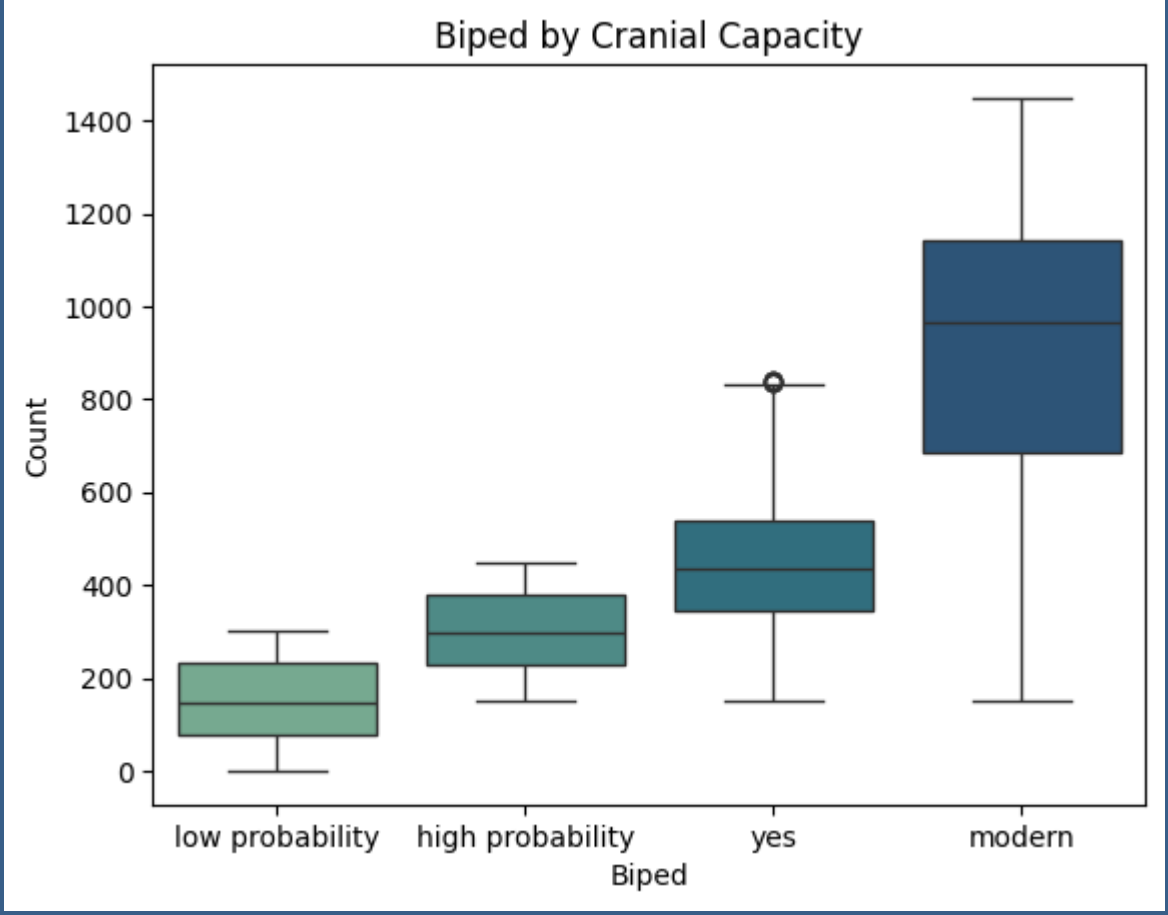

Technology by Technology Type
Tecno_type
mode 1
mode 2
mode 3
mode 4
no
primitive
6000
5000
4000
3000
2000
1000
0
Count
likely
no
yes
Technology

TORUS SUPRAORBITALIS

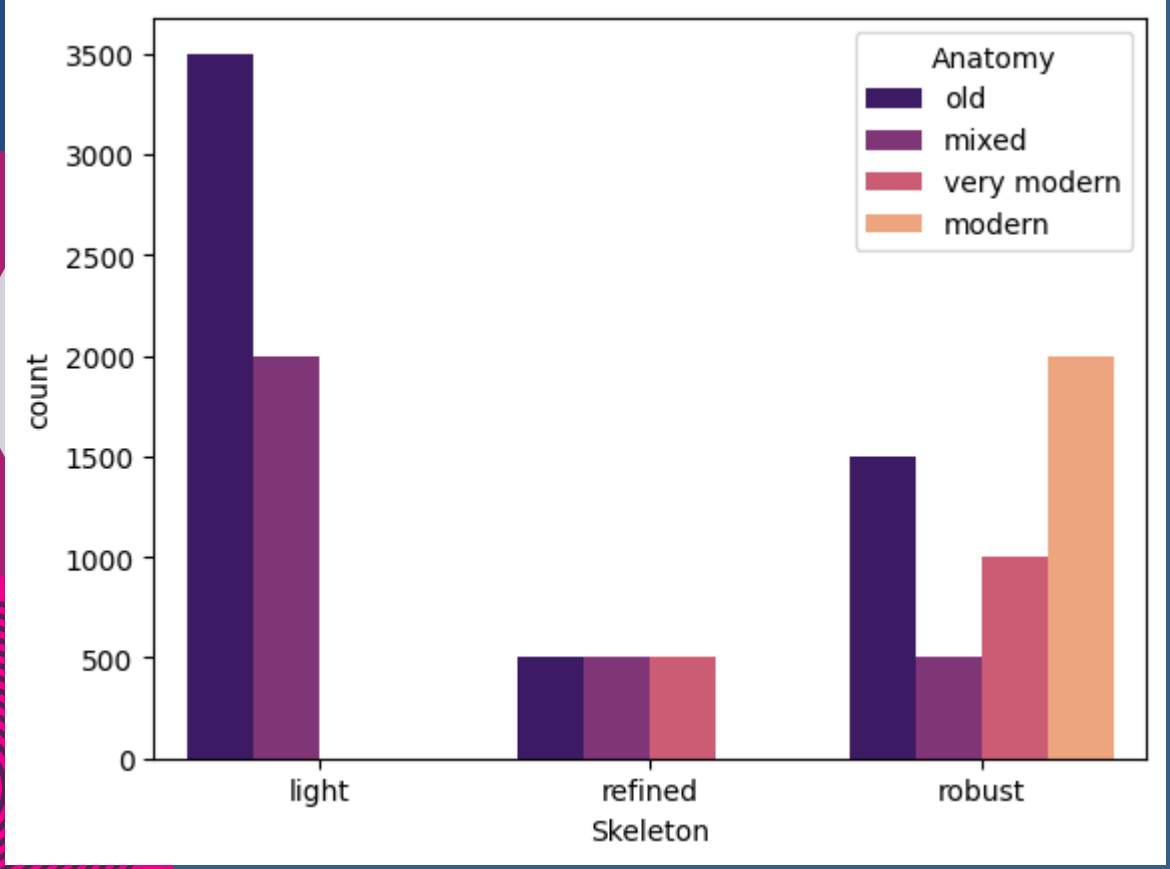


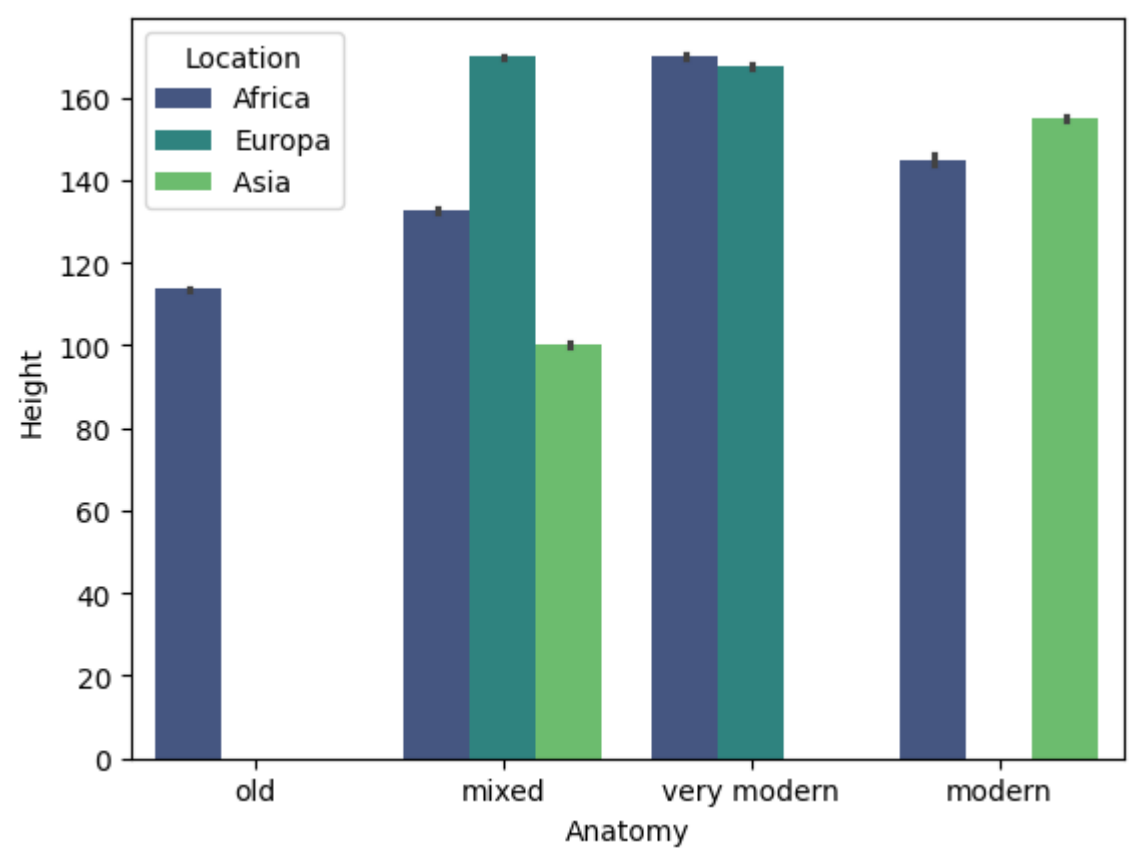
BIPED VS CRANIAL CAPACITY



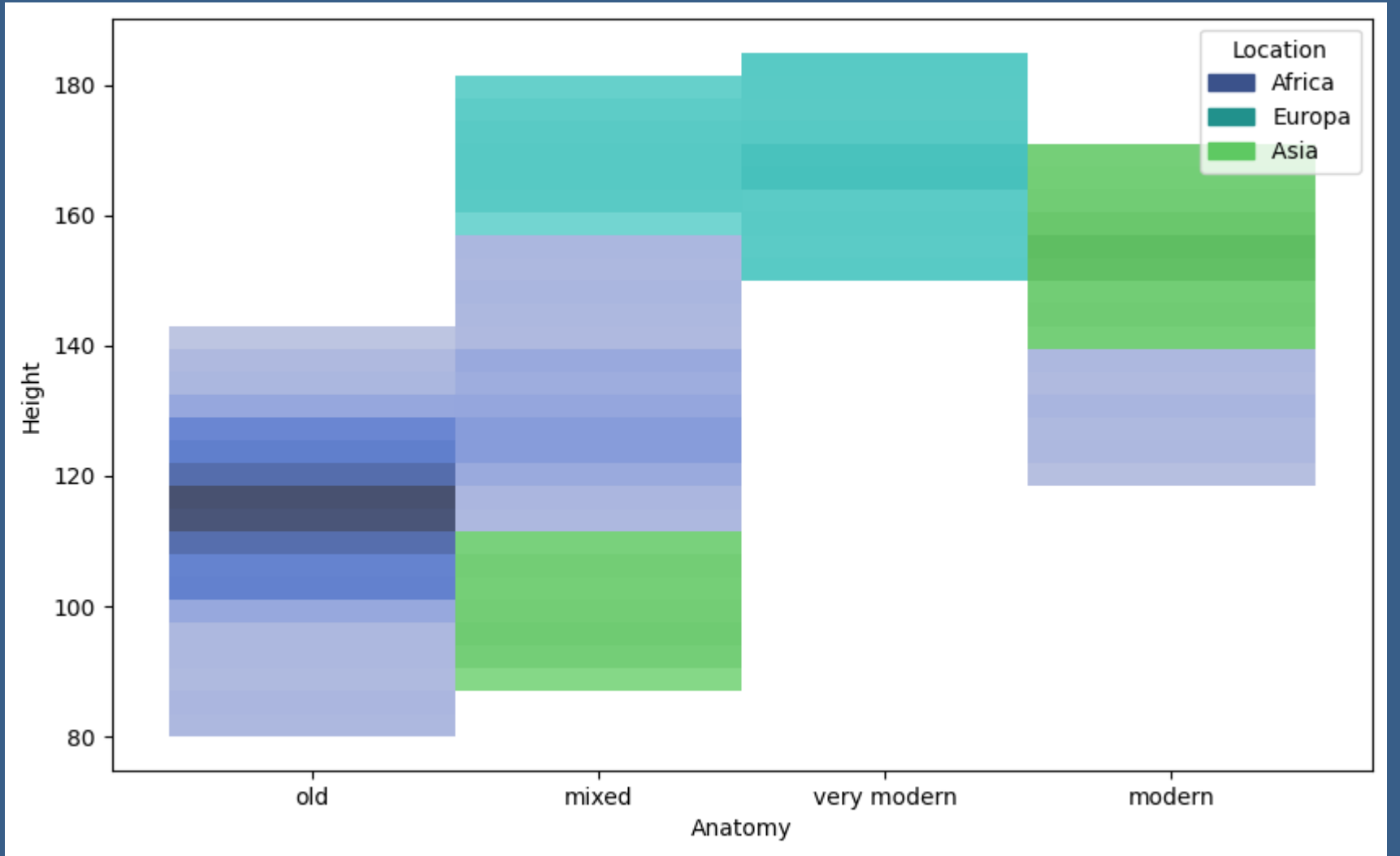


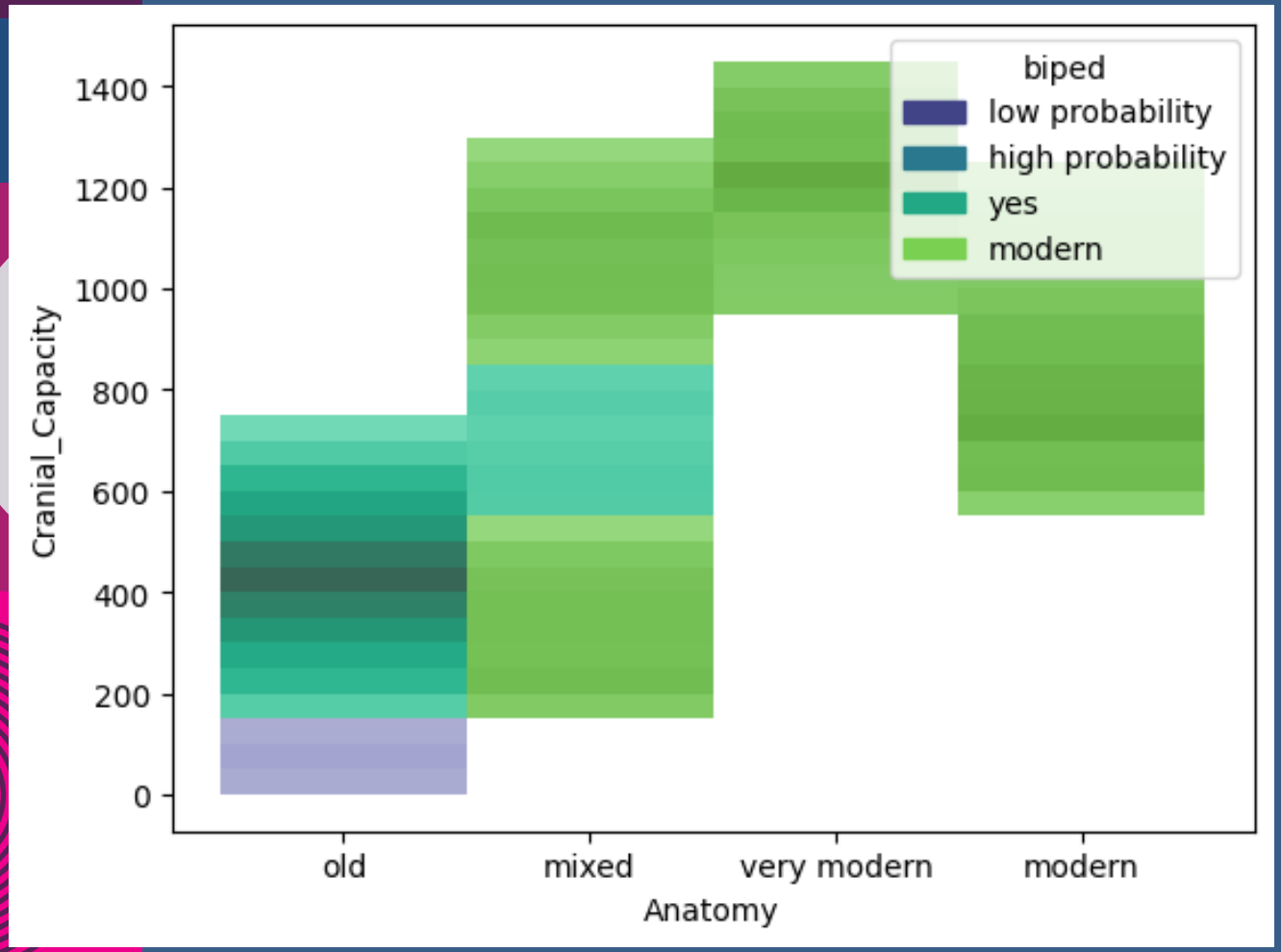
ANATOMY AND SKELETON

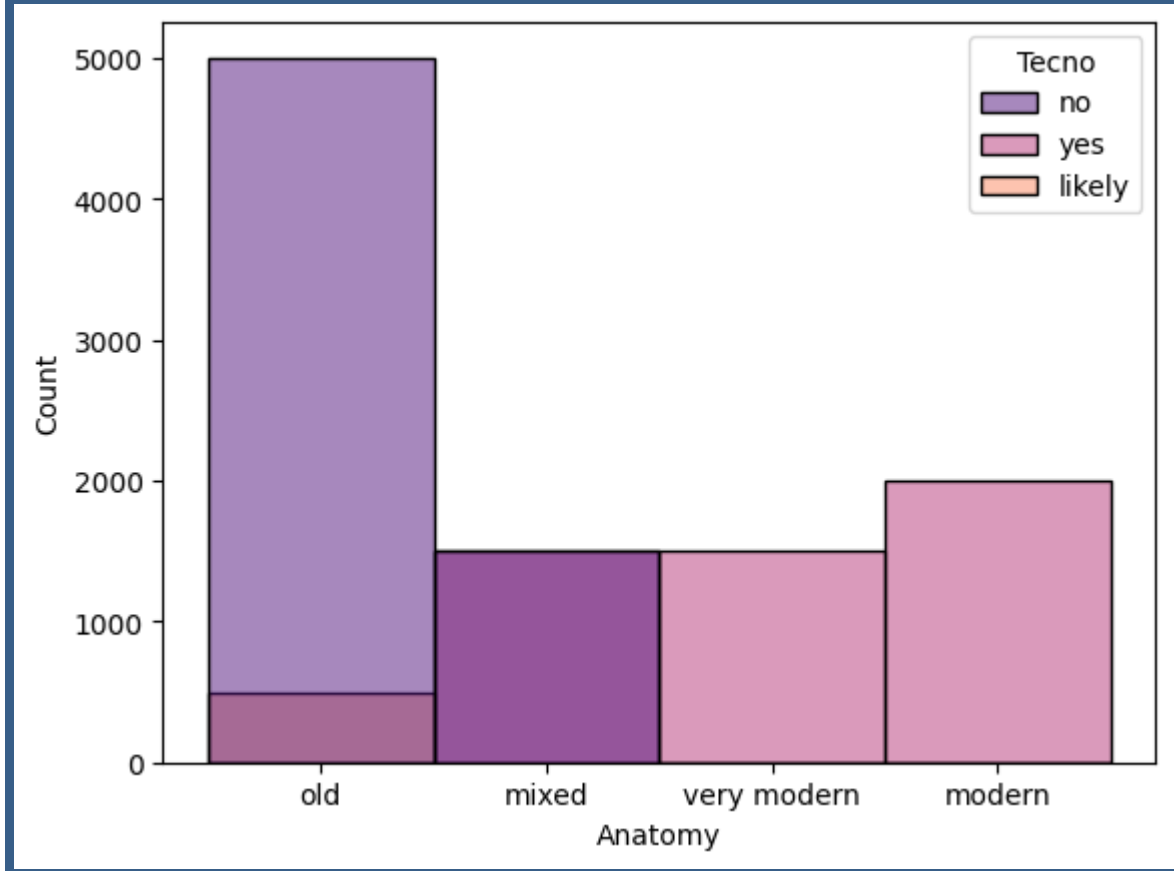




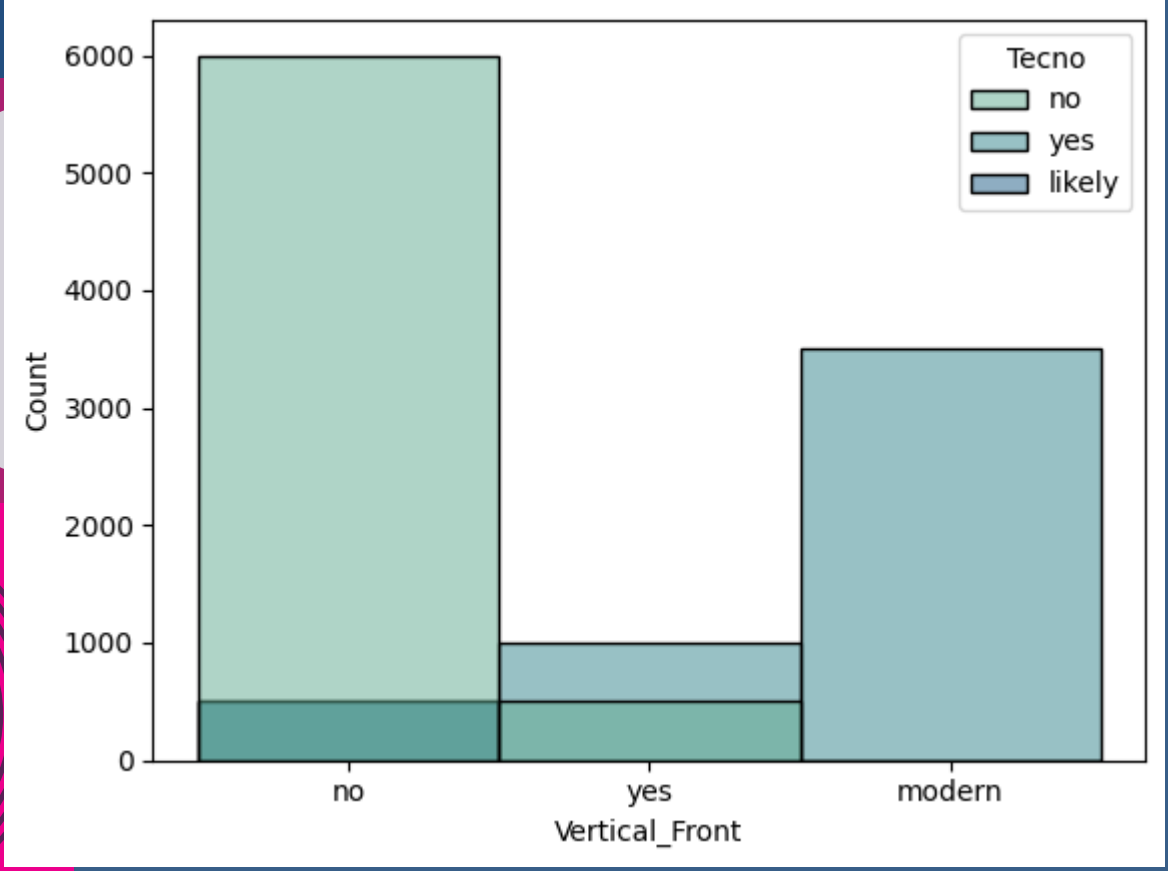
ANATOMY AND LOCATION

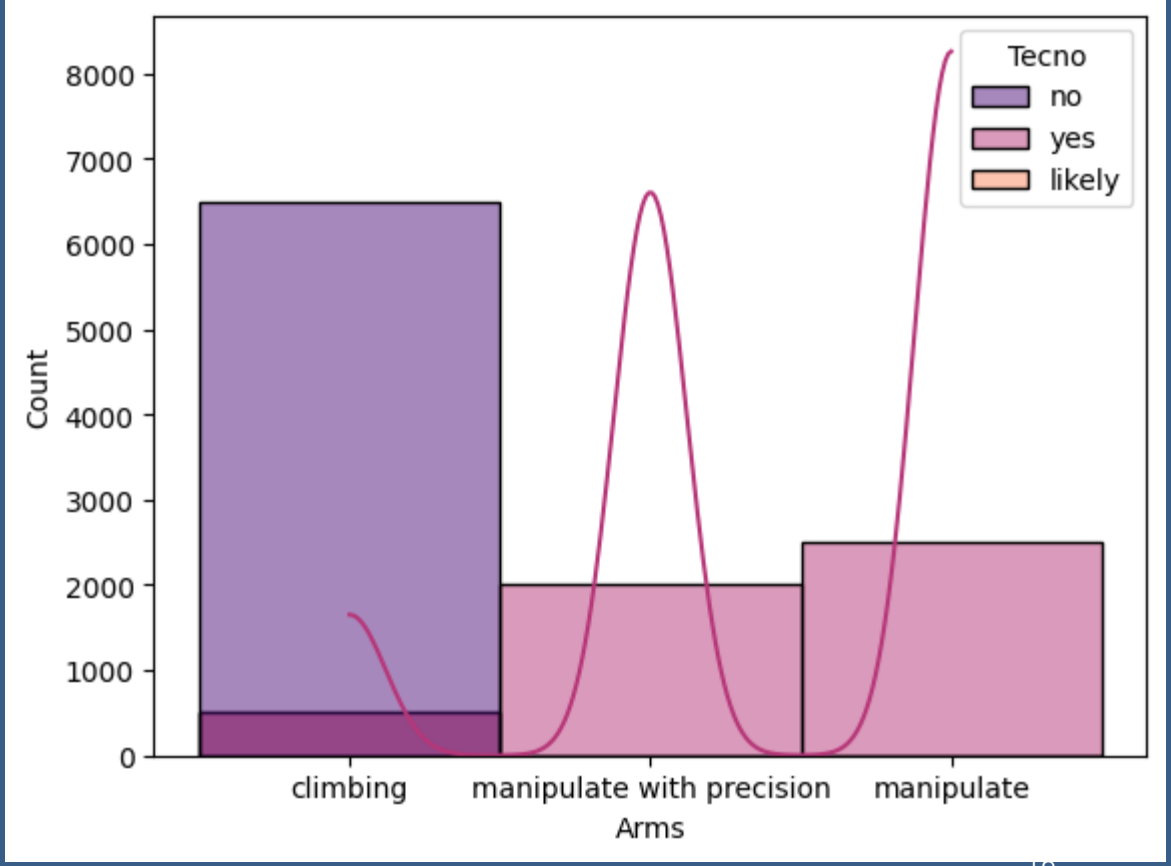



biped
low probability
high probability
yes
modern
Cranial_Capacity
1400
1200
1000
800
600
400
200
0
old
mixed
very modern
modern
Anatomy

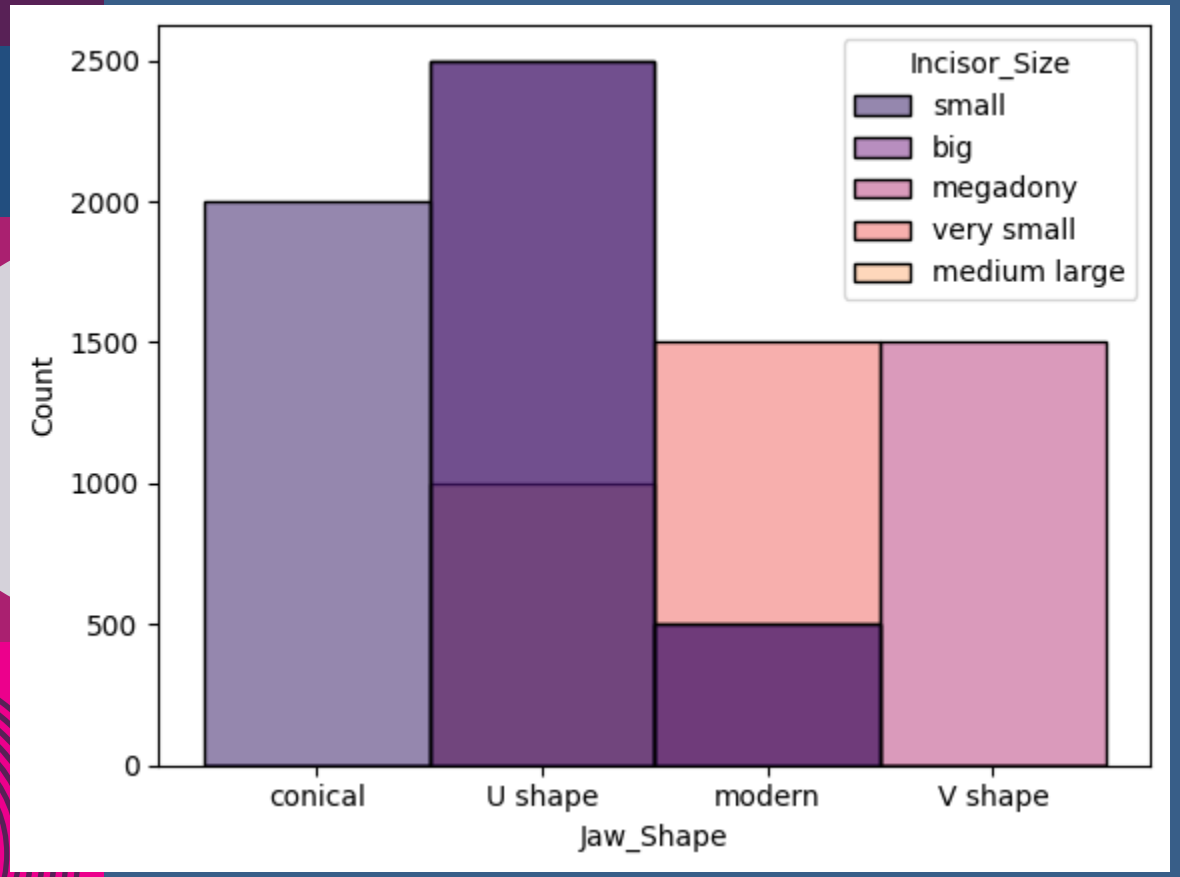

Tecno
no
yes
likely
Count
5000
4000
3000
2000
1000
0
old
mixed
very modern
modern
Anatomy

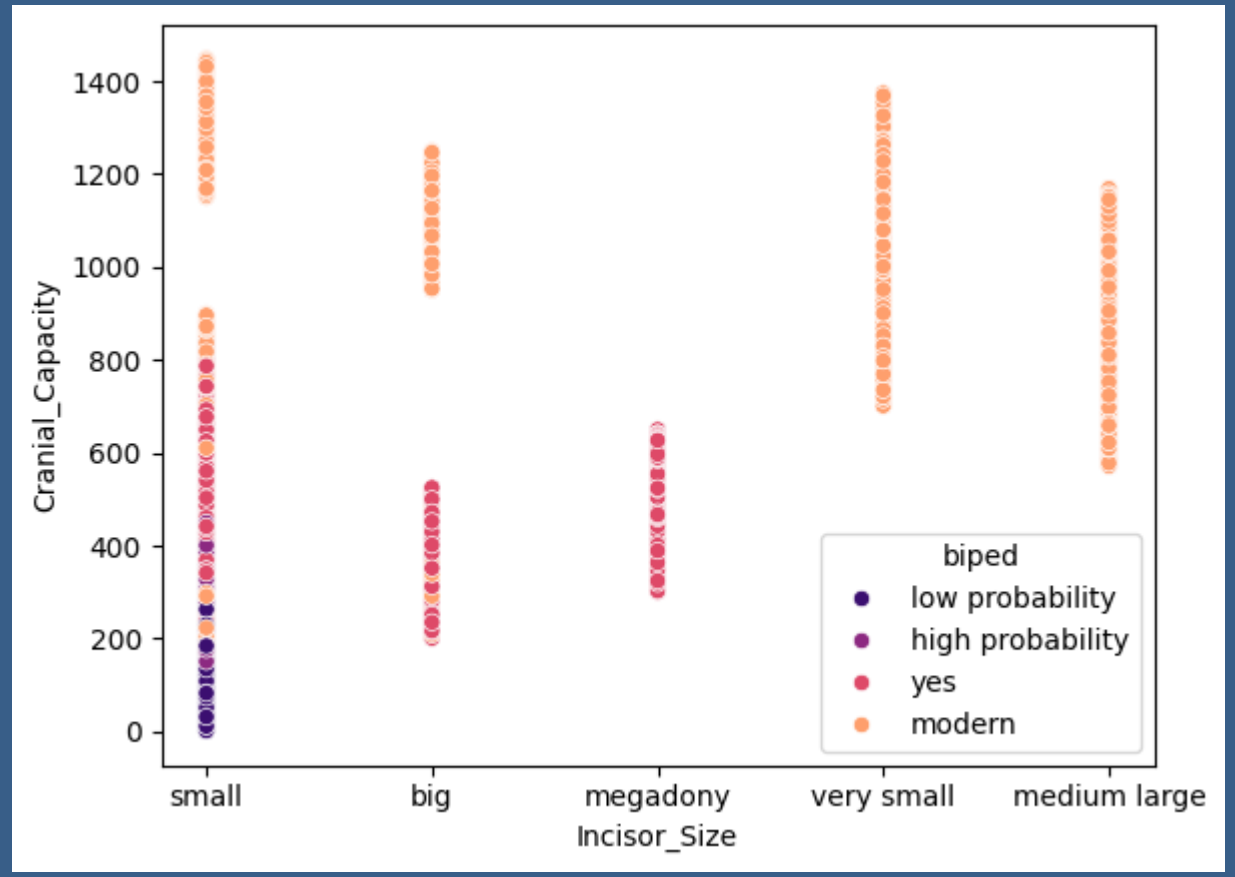
VERTICAL FRONT AND ARMS



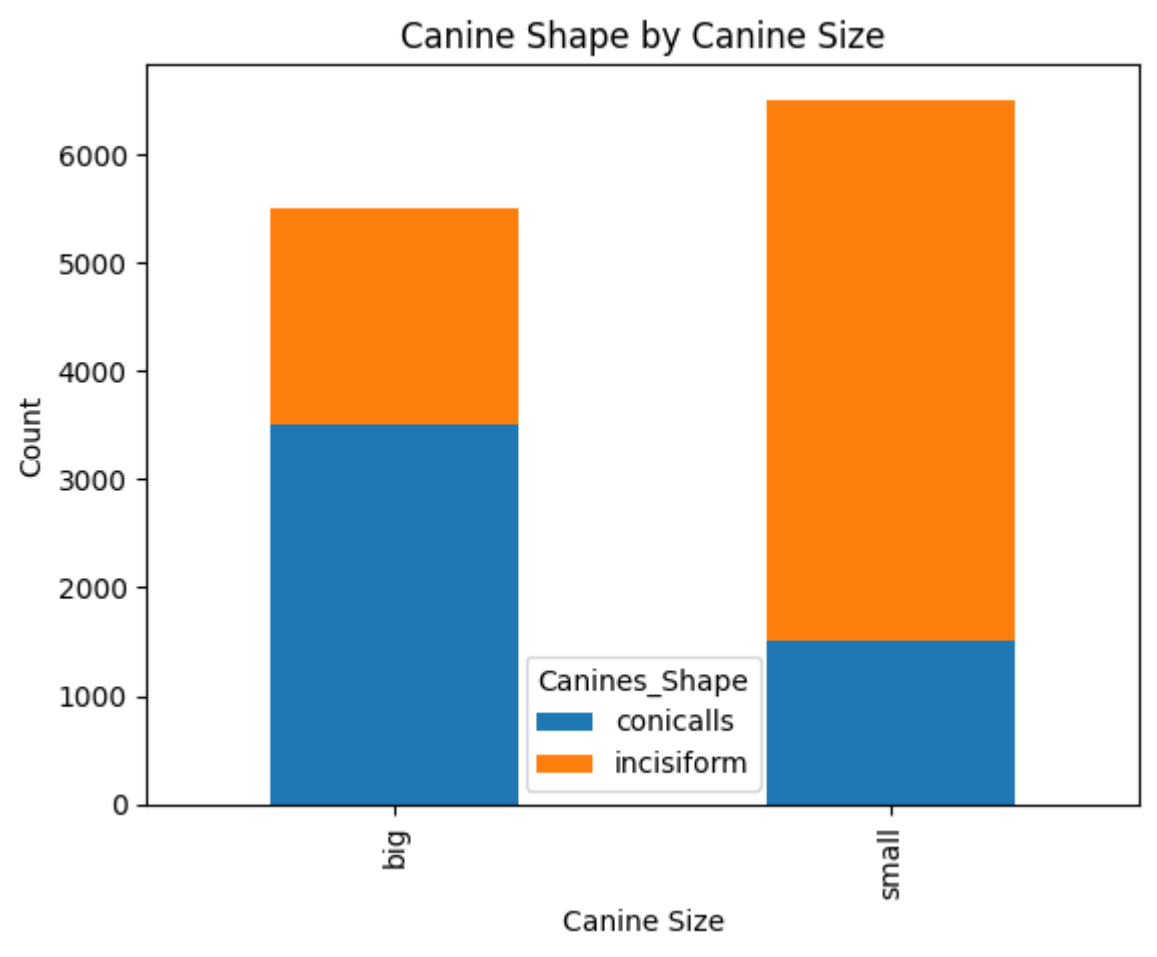


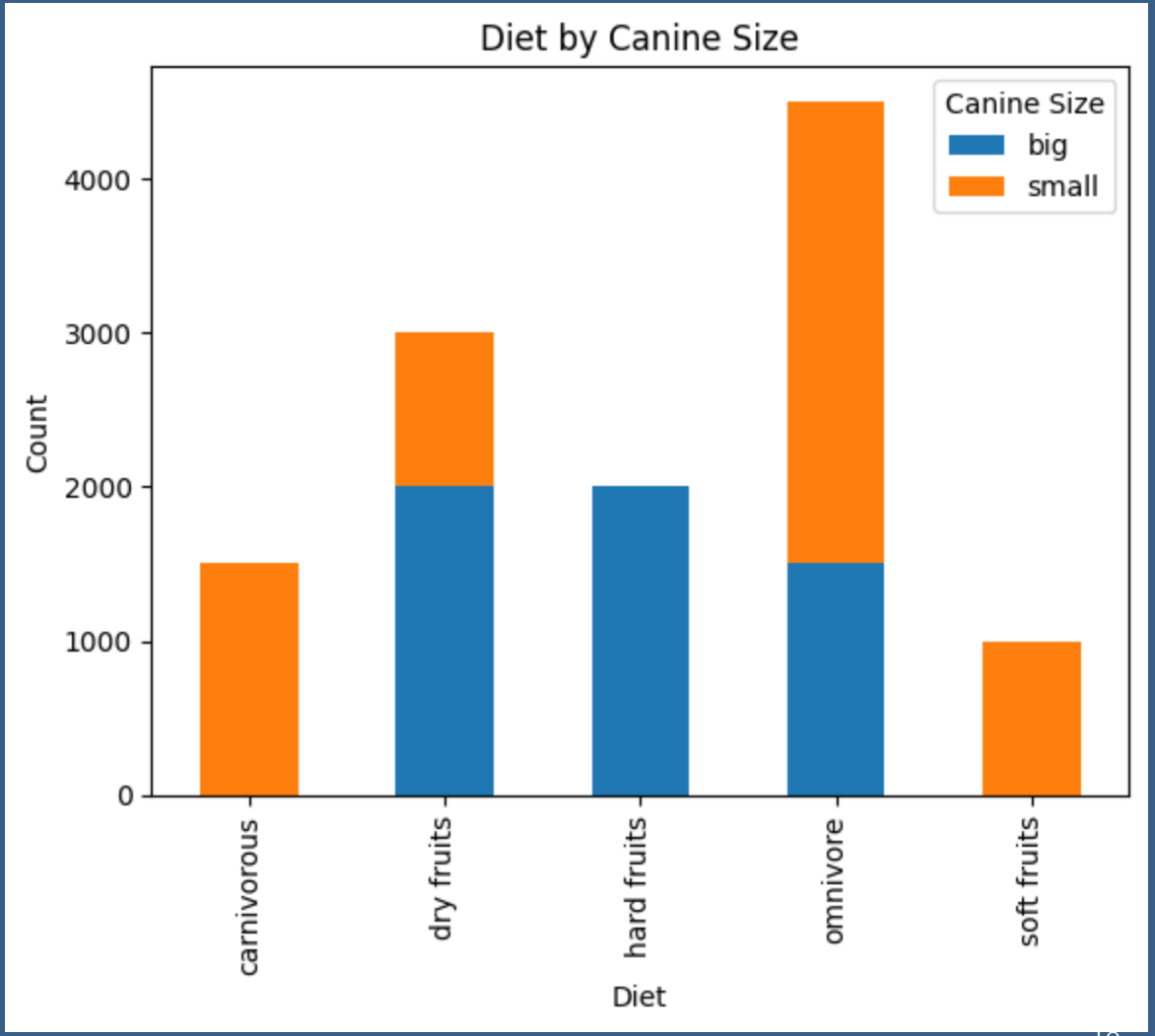
DENTAL STRUCTURES



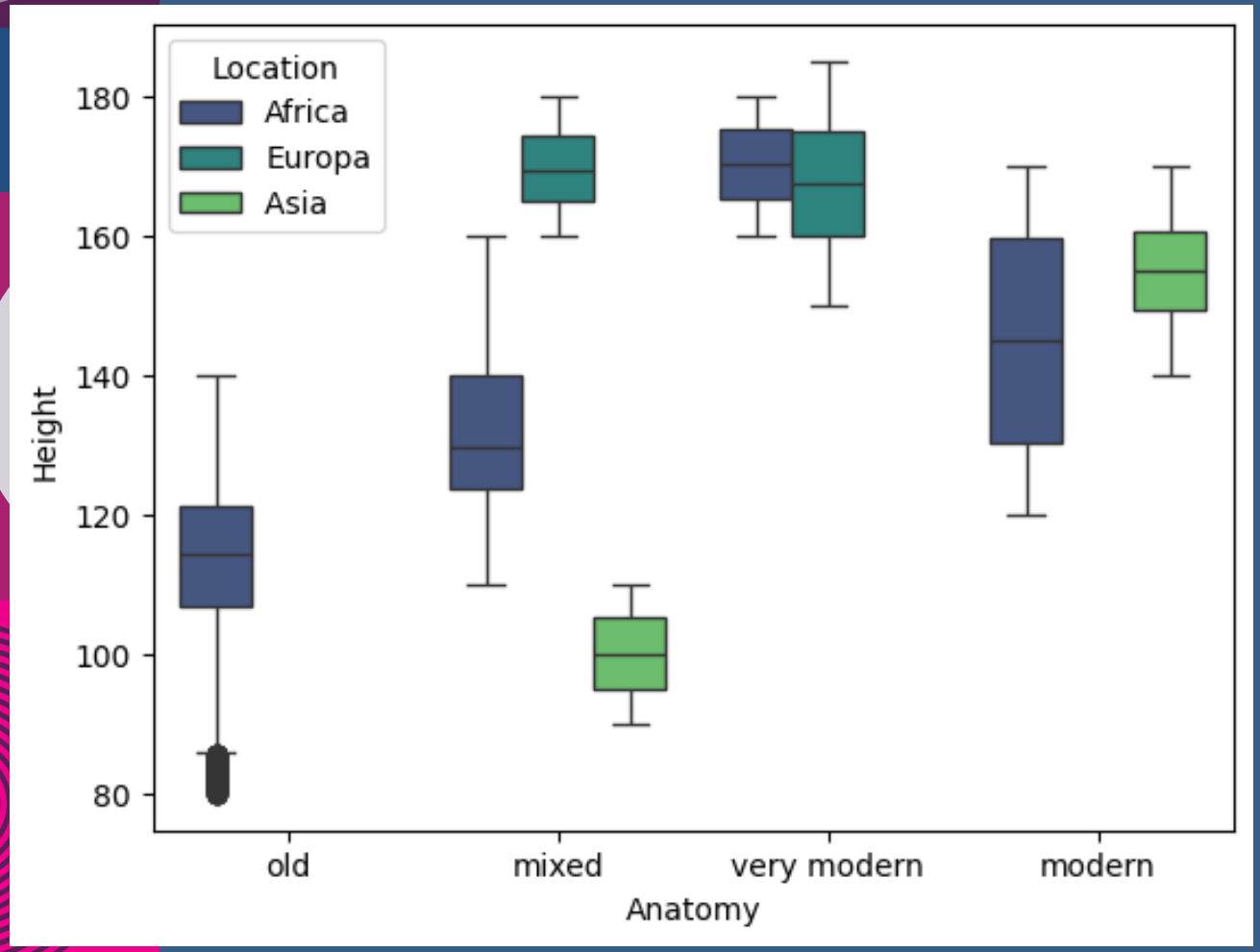


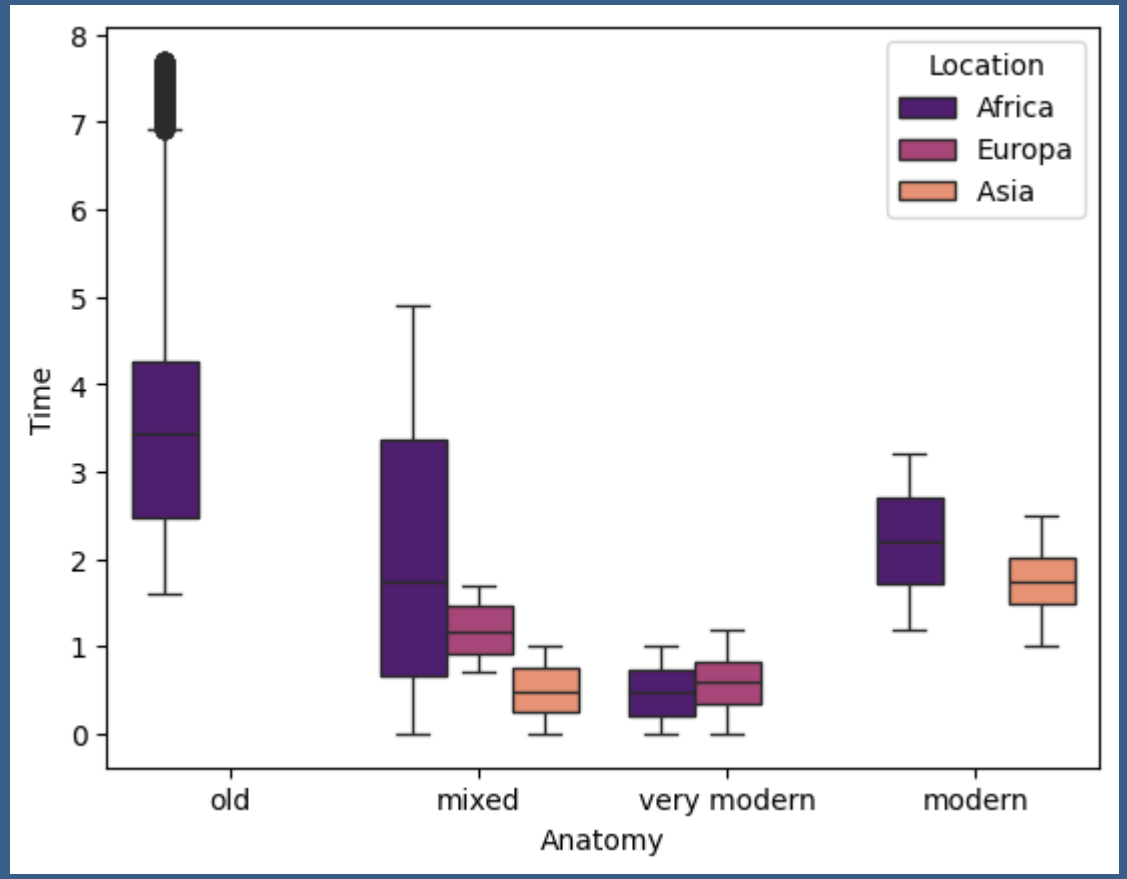
CANINE SHAPE,SIZE AND DIET



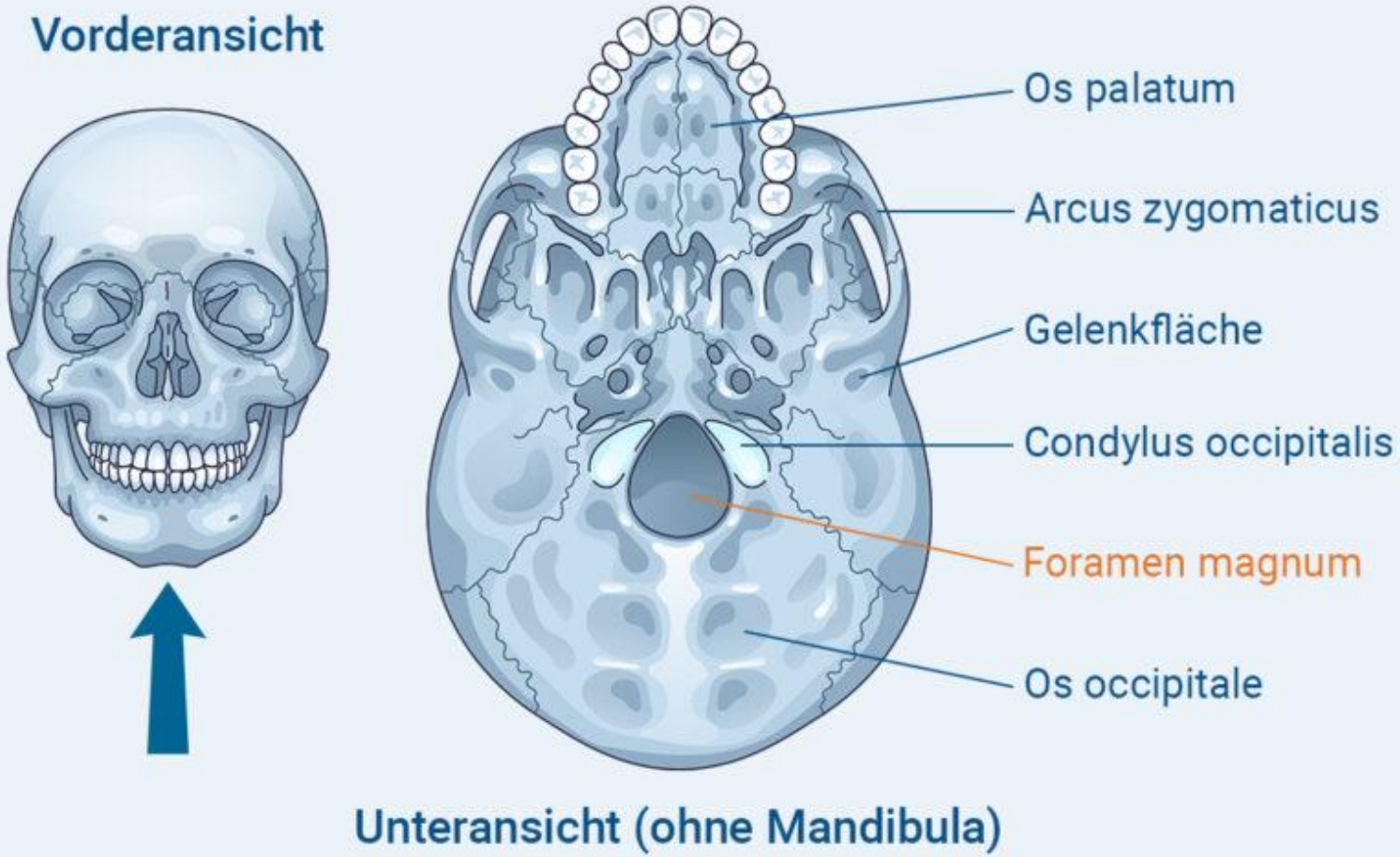


ANATOMICAL ANALYSIS



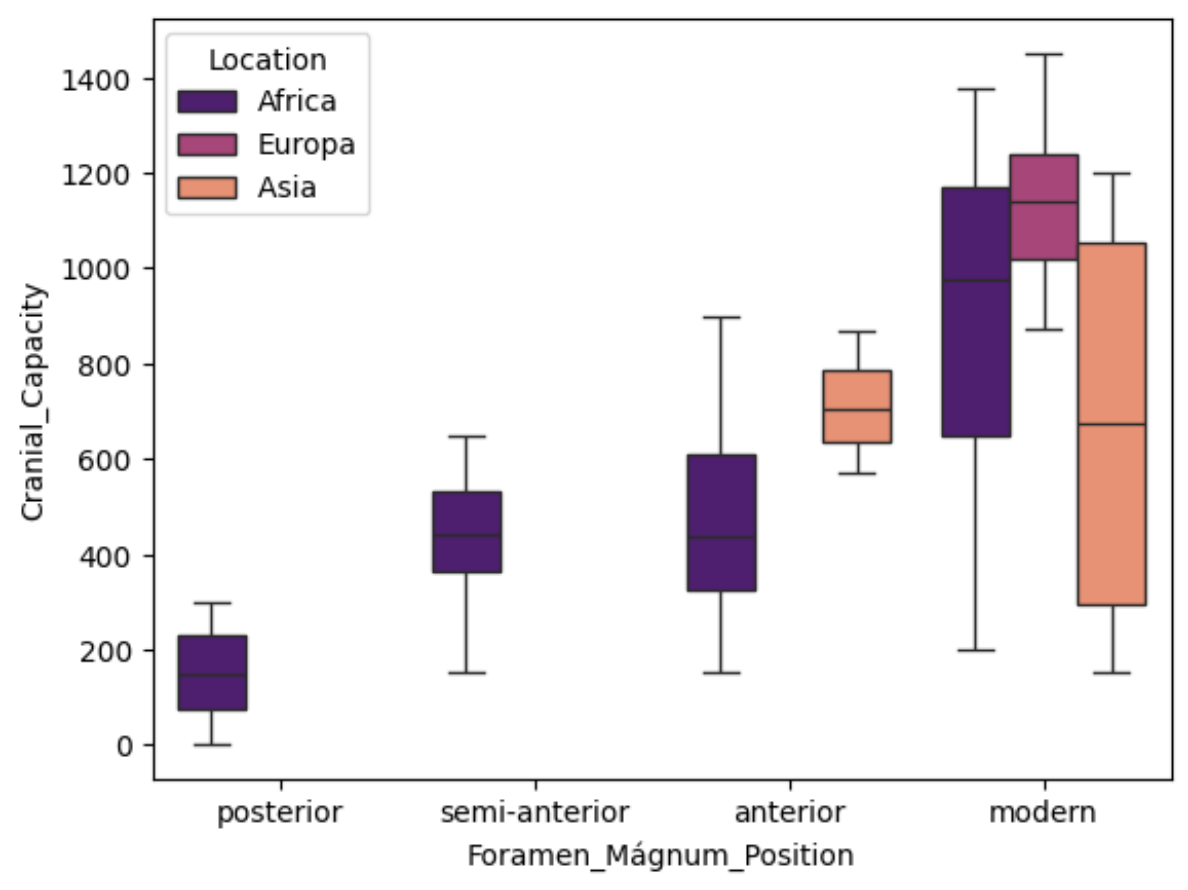


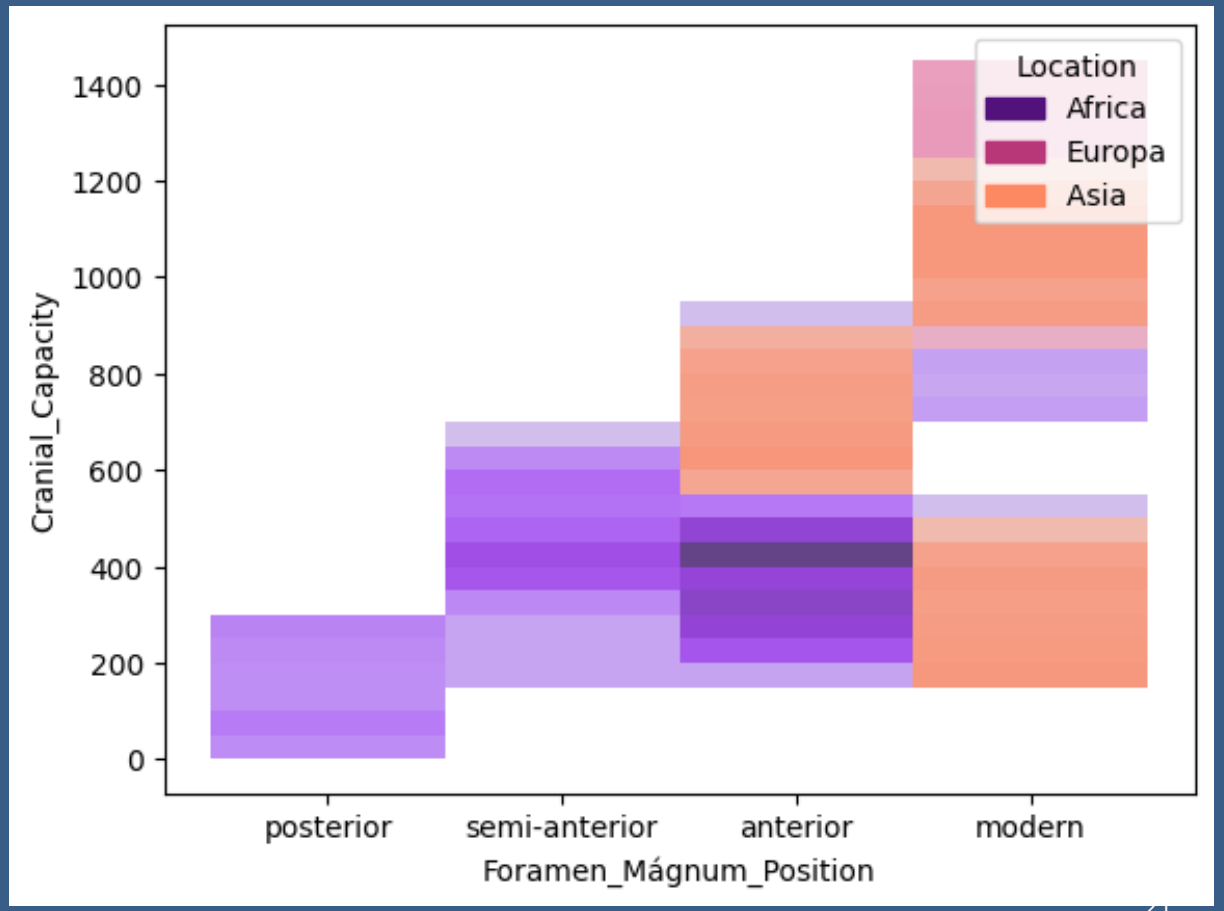
Foramen magnum

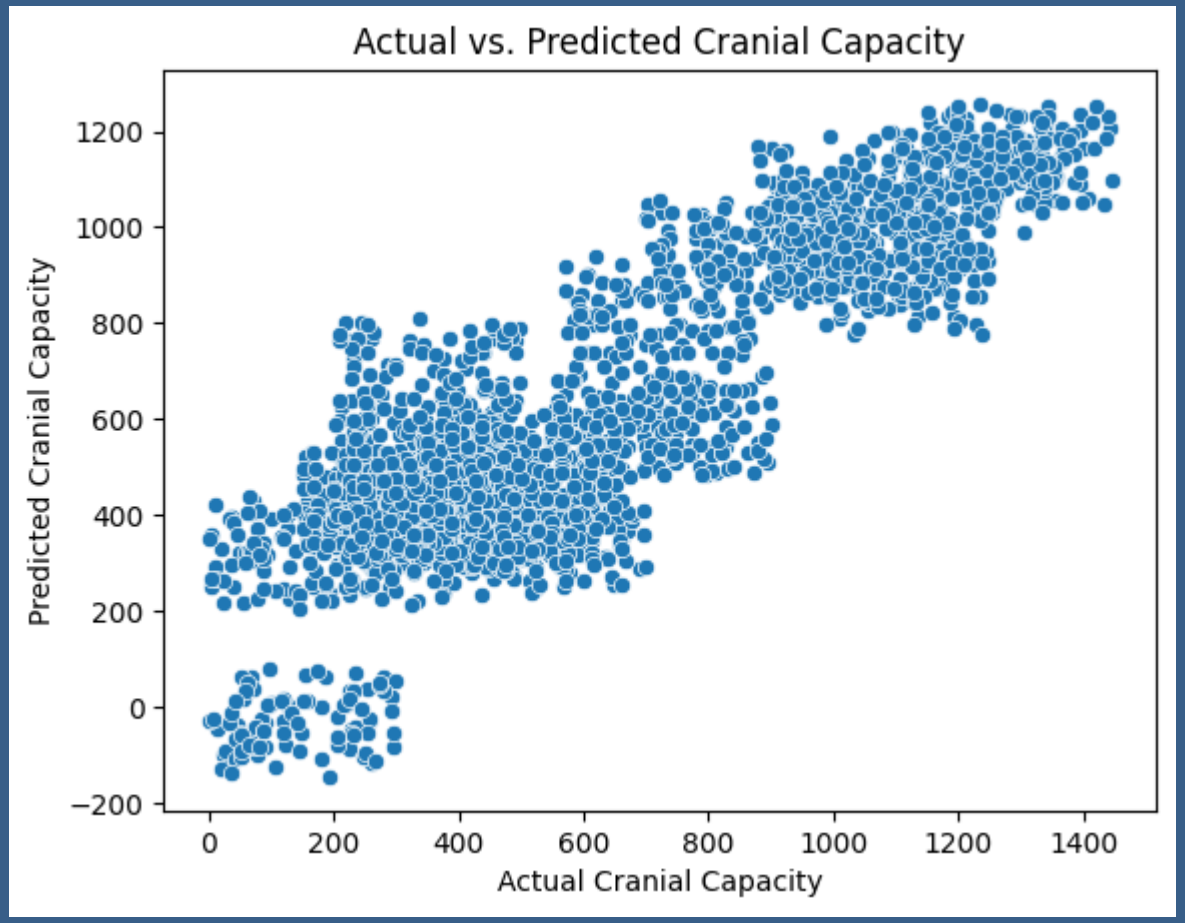


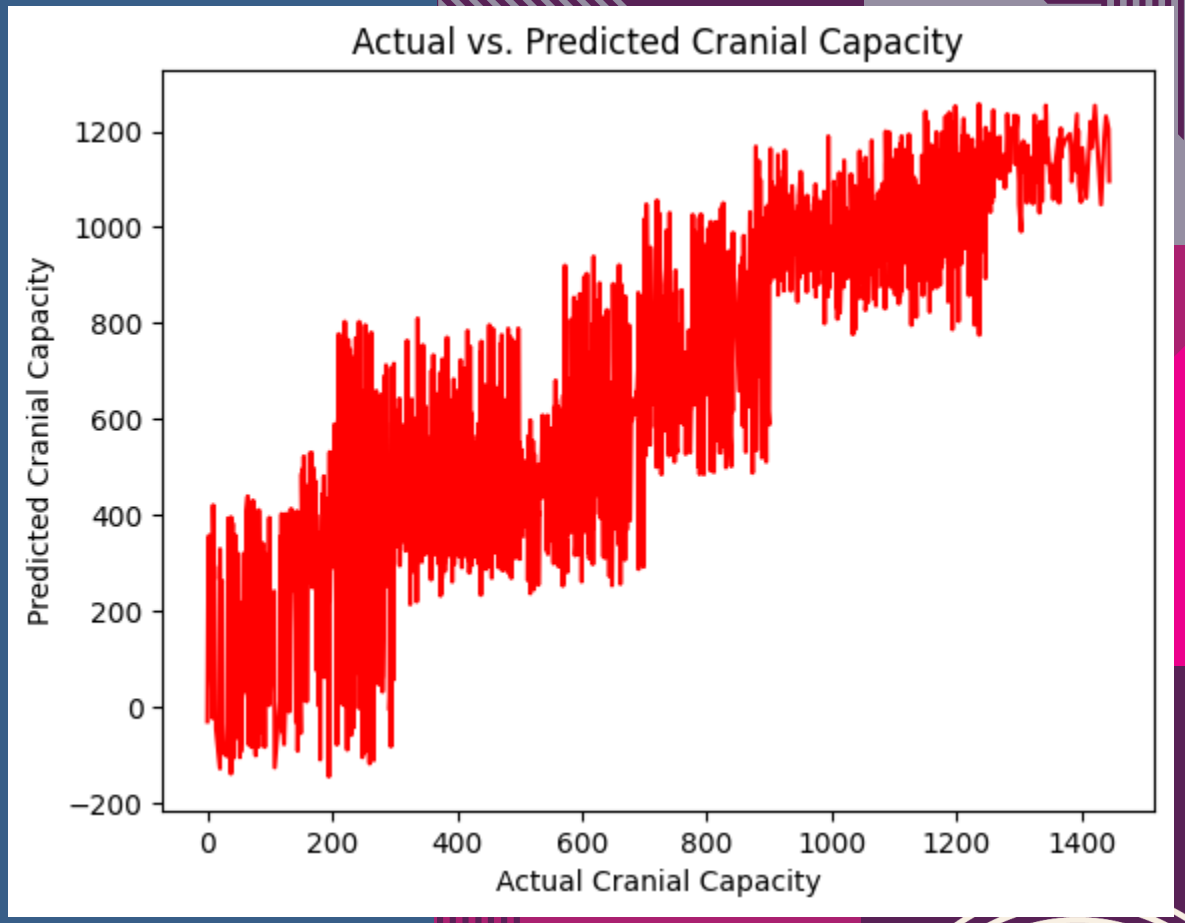
Medi-Karriere

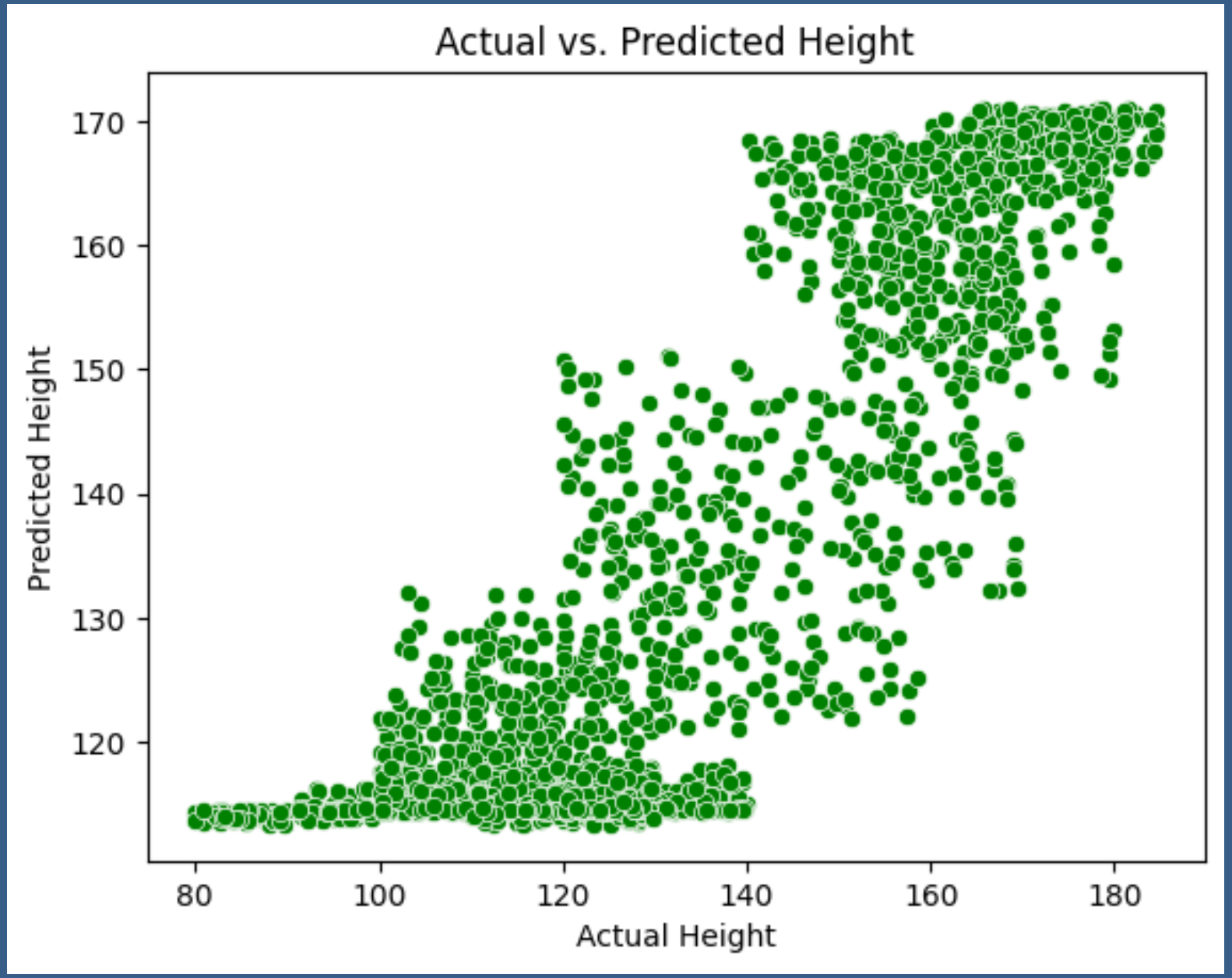
FORAMEN MAGNUM






Actual vs. Predicted Cranial Capacity
Predicted Cranial Capacity
Actual Cranial Capacity
1200
1000
800
600
400
200
0
−200
0
200
400
600
800
1000
1200
1400


Actual vs. Predicted Cranial Capacity
Predicted Cranial Capacity
Actual Cranial Capacity
1200
1000
800
600
400
200
0
−200
0
200
400
600
800
1000
1200
1400


Actual vs. Predicted Height
Predicted Height
170
160
150
140
130
120
80
100
120
140
160
180
Actual Height

FINAL TIPS & TAKEAWAYS

It has been shown the interrelating factors such as technological development, anatomy and dental structure.

As the time passes, the bipedality situation was structured and the cranial capacity grew parallel according to that. The relationships between teeth structure and jaw shape and facial skull structures are correlated.

THANK YOU

Atakan Erdogan