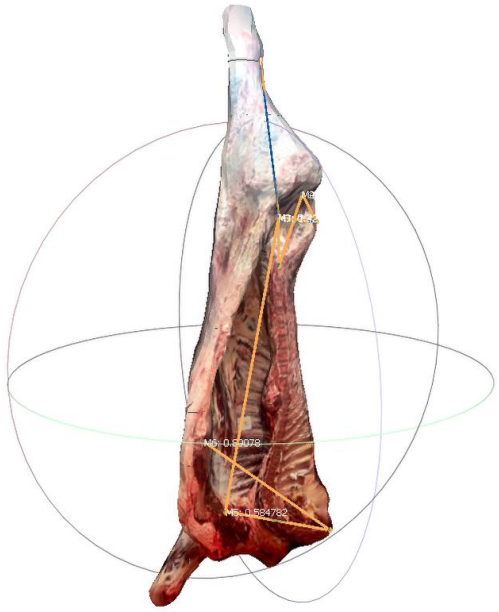

A New Era: Technologies for Beef Yield Grade

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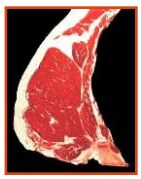
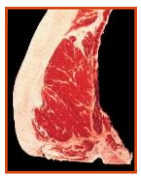
Texas Tech University, Lubbock, TX 79409-2141

AUSTRALIAN WAGYU ASSOCIATION™

YG-1



YG-3



YG-5

USDA Yield Grades

Yield Grades:

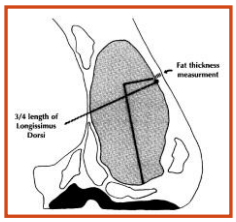
Reflect differences in yield of closely trimmed, boneless retail cuts from the round, loin, rib, and chuck.

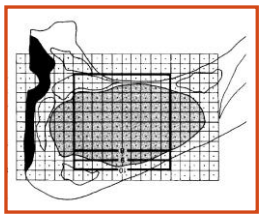
YG-1 more than 52.3%
YG-2 50.1 to 52.3%
YG-3 47.8 to 50.0%
YG-4 45.5 to 47.7%
YG-5 45.4% or less

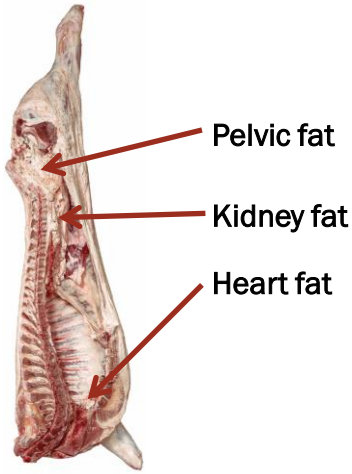
USDA Yield Grade Factors

- Thickness of Fat over the ribeye (adjusted)
- Ribeye area
- Estimated % kidney, pelvic and heart (KPH) fat
- Hot carcass weight

YG = 2.5 +(2.5*FT) – (.32*REA) + (.2*KPH) + (.0038*HCW)



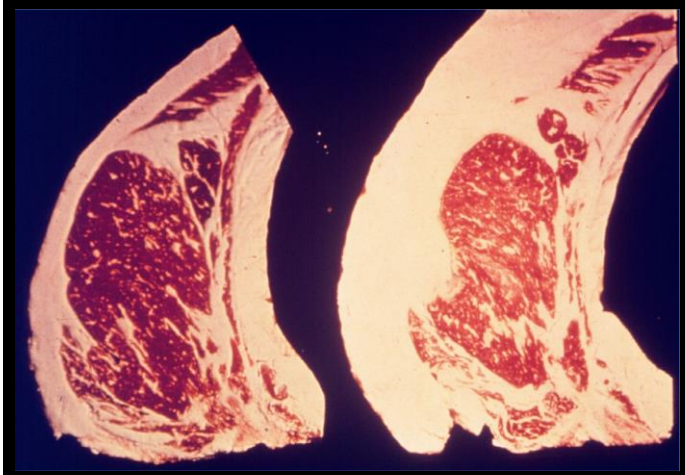


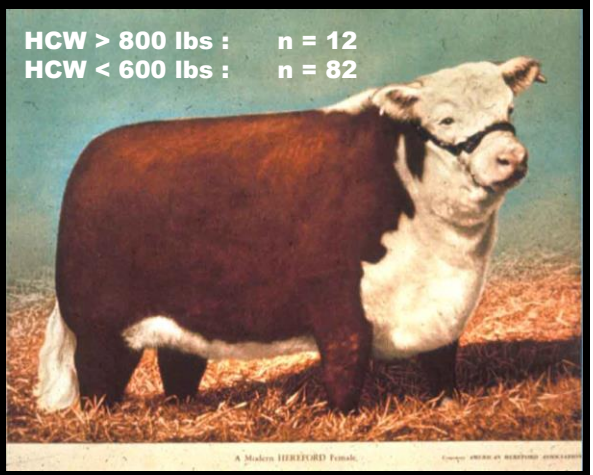


Murphey, 1960 (N = 162)

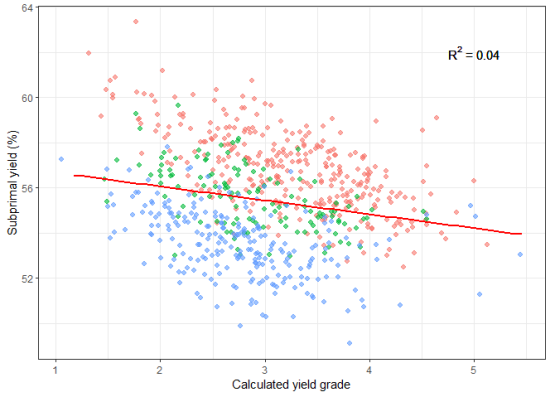
BCTRC (R-L-R-C) = 51.34 – (5.78*FT) – (.462*%KPH) – (.0093*HCW) + (.74*REA)

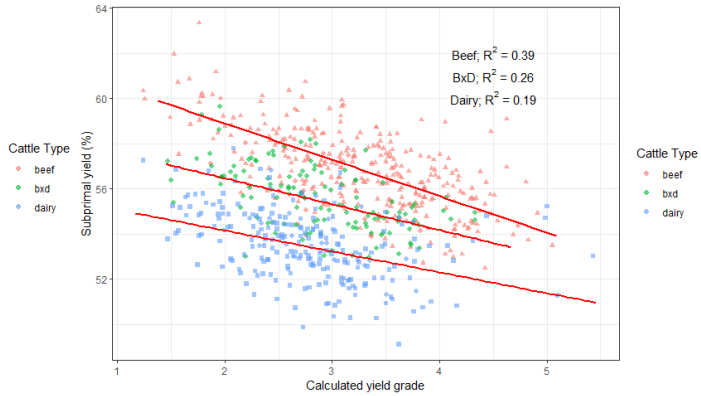
One unit YG (e.g., 2.0 to 3.0) = 2.3% BCTRC



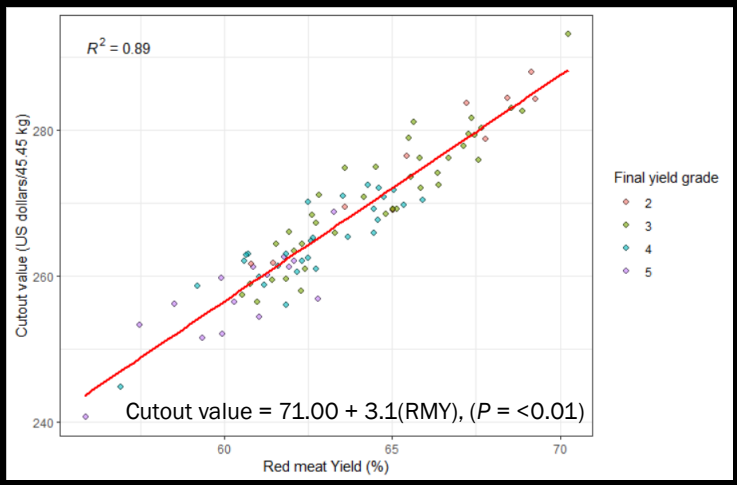


Accuracy current USDA beef yield equation





Red Meat Yield = Cutout Value



UPDATING THE YIELD GRADE EQUATION

Updating Coefficients (Traditional Statistics)

Limited to linear relationships

Current Predictors
(HCW, REA, PYG)
Accuracy = 17%

$$\text{Yield Grade} = X_1 + (X_2 \times \text{HCW}) + (X_3 \times \text{PYG}) + (X_4 \times \text{KPH\%}) - (X_5 \times \text{REA})$$

Current Predictors
+ Cattle Type
Accuracy = 61%

$$\text{Yield Grade} = X_1 + (X_2 \times \text{HCW}) + (X_3 \times \text{PYG}) + (X_4 \times \text{KPH\%}) - (X_5 \times \text{REA}) + (X_6 \times \text{Cattle Type})$$

Artificial Intelligence

Current Predictors
(HCW, REA, PYG)
Accuracy = 19%

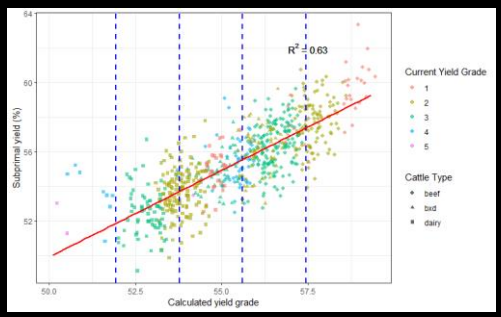
61% improvement
***Temporary solution**

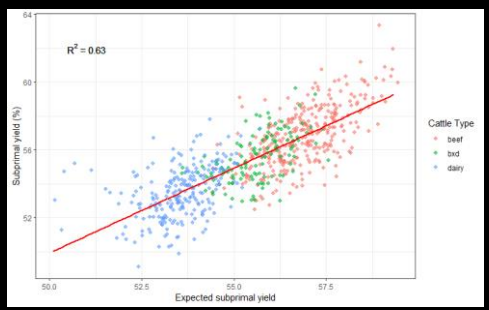
Current Predictors
+ Cattle Type
Accuracy = 66%

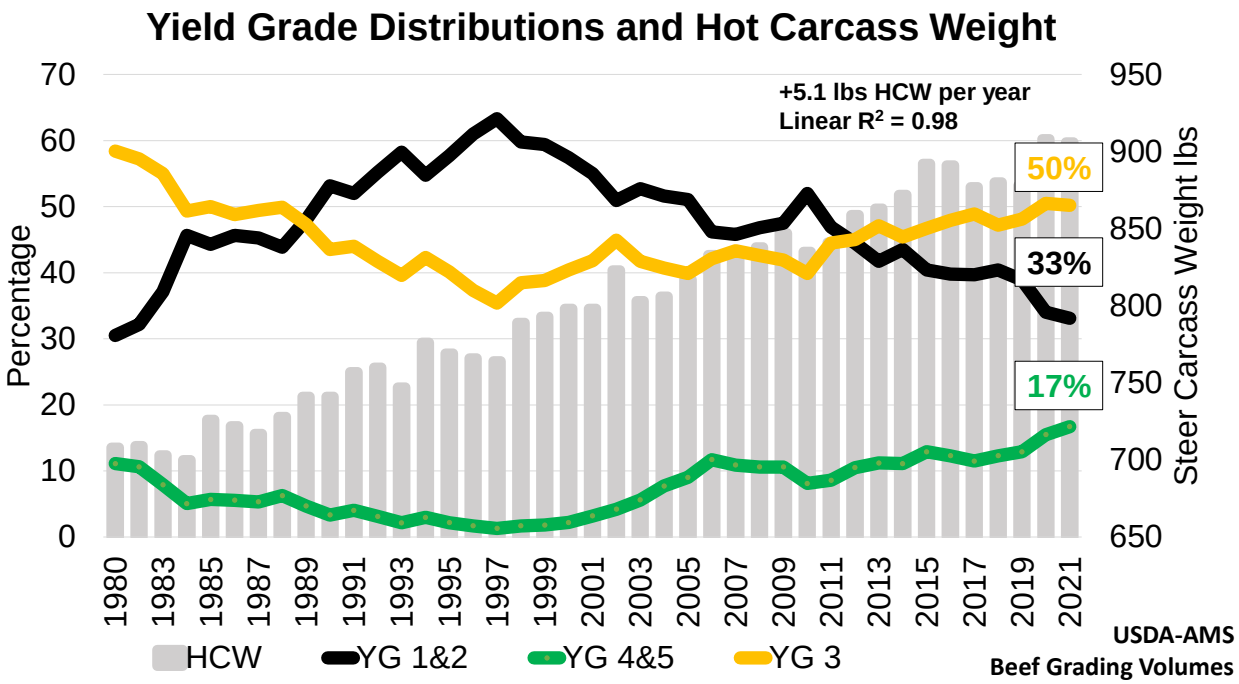
Accuracy modified subprimal yield equation ~ Adjusted for cattle type

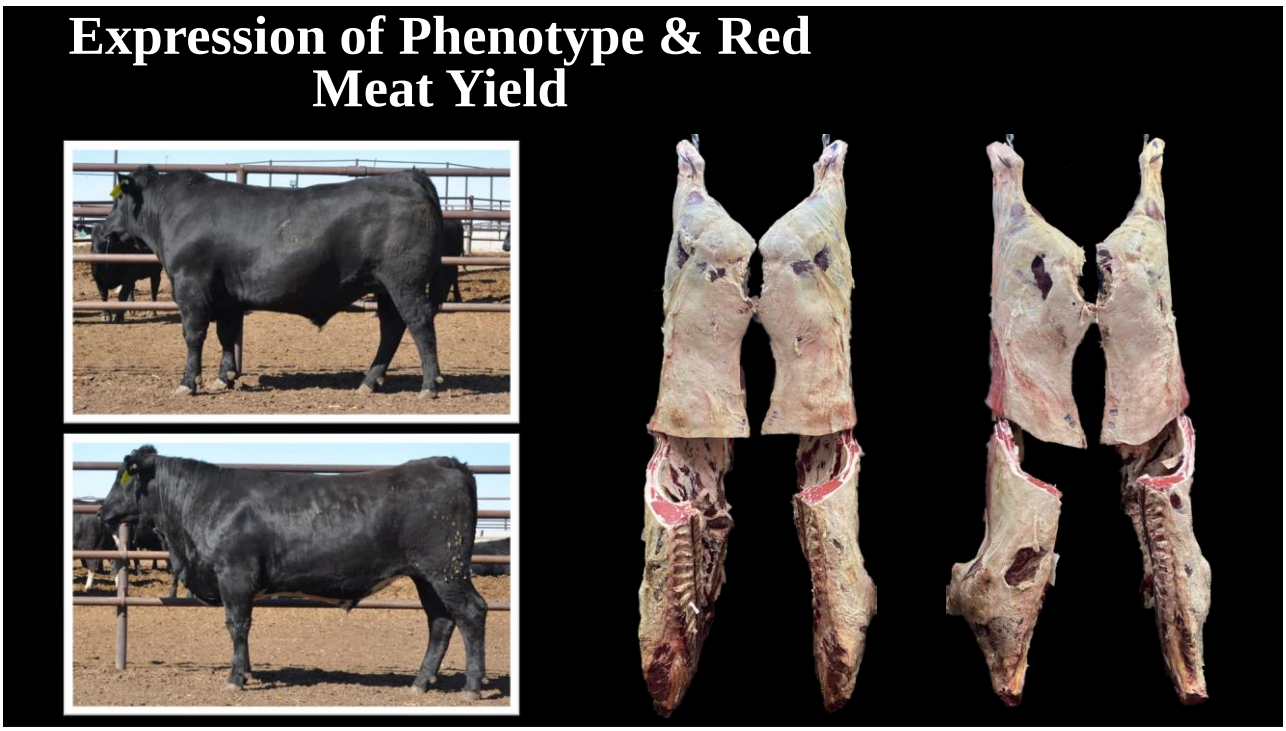
Subprimal yield = 56.94+(0.40*REA)–(0.0042*HCW)-(3.57*FT)

- Beef Adjustment = 0 (baseline)
- BeefxDairy Adjustment = -1.76
- Dairy Adjustment = -4.02






Yield Grade Distributions and Hot Carcass Weight
+5.1 lbs HCW per year
Linear R² = 0.98
50%
33%
17%
Percentage
Steer Carcass Weight lbs
70
60
50
40
30
20
10
0
950
900
850
800
750
700
650
1980
1983
1985
1987
1989
1991
1993
1995
1997
1999
2001
2003
2005
2007
2009
2011
2013
2015
2017
2019
2021
HCW
YG 1&2
YG 4&5
YG 3
USDA-AMS
Beef Grading Volumes

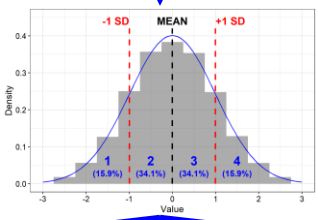

Expression of Phenotype & Red Meat Yield

Phenotype's Relationship to Red Meat Yield

6 pens of steers
3 pens of heifers

Sire: Angus or SimAngus
Dam: Holstein

Processing Time	Days on Feed	BW, lbs
Arrival	0	777
Re-Implant	104	1,234
Harvest	180	1,417

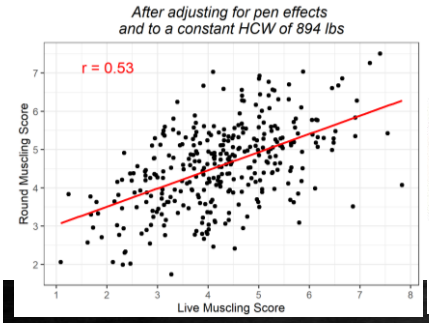


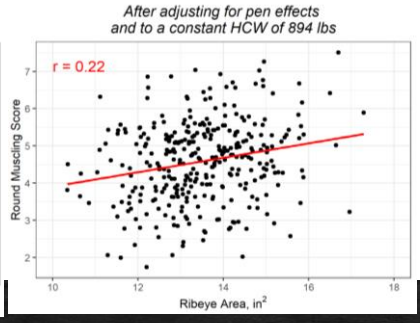
Muscling: 1 (dairy) to 9 (beef)
Frame size: 1 (dairy) to 9 (beef)
Phenotype score = muscling + frame size



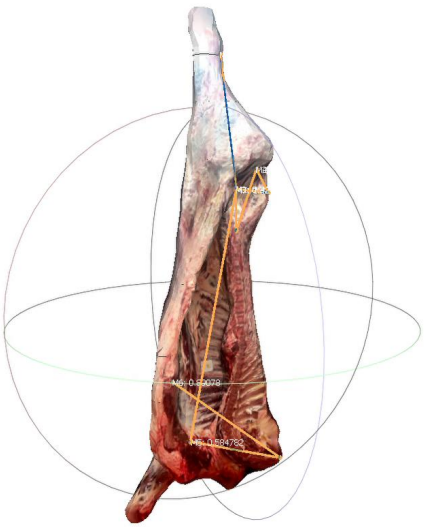

Muscling Considerations

Trait	Fully Dairy-type	Partially Dairy-type	Partially Beef-type	Fully Beef-type	*P*-value
Live muscling score	2.8^{d}	4.0^{c}	4.5^{b}	5.6^{a}	<0.01
Ribeye area, in^2	13.2	13.5	13.6	13.5	0.30
Round muscling score	3.8^{c}	4.5^{bc}	4.8^{ab}	5.3^{a}	<0.01





Weight:	1480 lbs	1510 lbs
12th Rib Fat:	0.68 in	0.64 in
Ribeye Area:	18.2 sq in	18.7 sq in
Yield Grade:	2.4	2.2
Quality Grade:	Low Choice	Low Choice

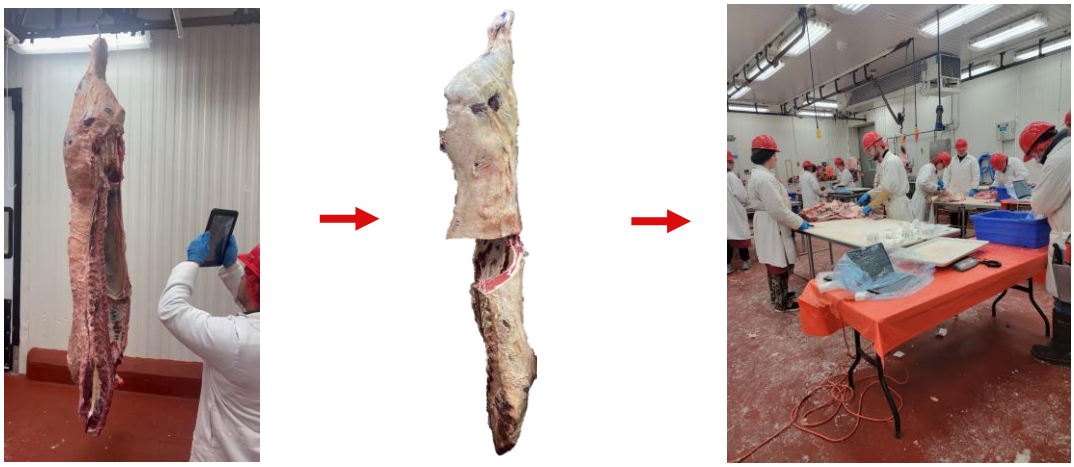


3-DIMENSIONAL IMAGES TO PREDICT RED MEAT YIELD

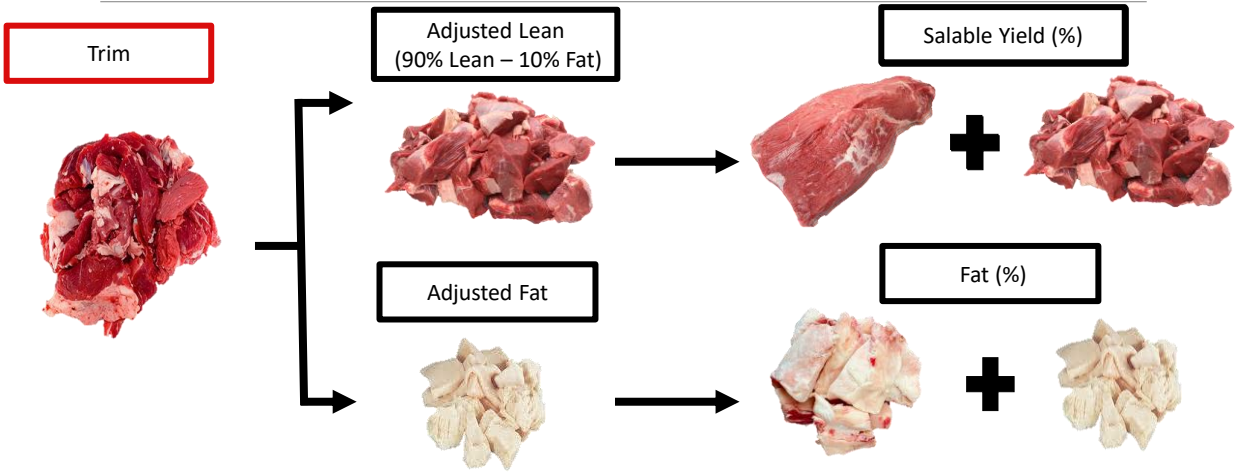
Predictors

- Volume
- Linear Measurements
- Cross Sections
- Shape Indicators
- Surface Area
- X, Y, Z Coordinates

Materials and Methods
Yield Data Collection

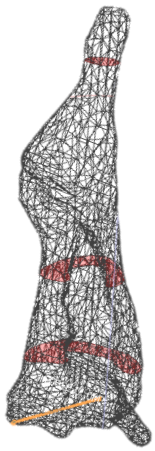


Materials and Methods
Data Management



3D-IMAGING

ARTIFICIAL INTELLIGENCE

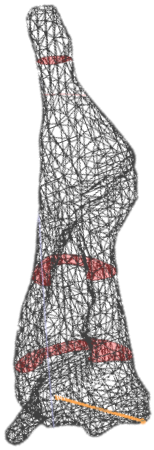


60%

Accuracy

40

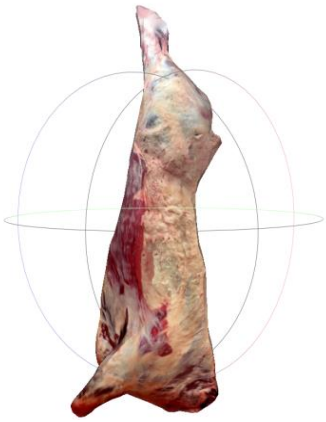
Sample size



Artificial intelligence is essential to unlock the full potential

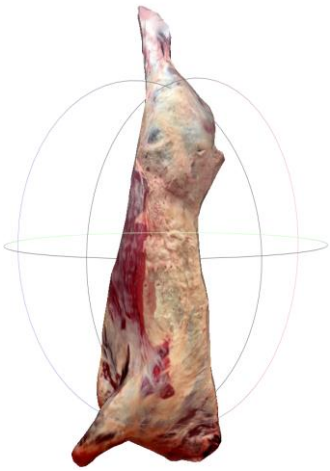
DATA AUGMENTATION

RMY = 60.32%

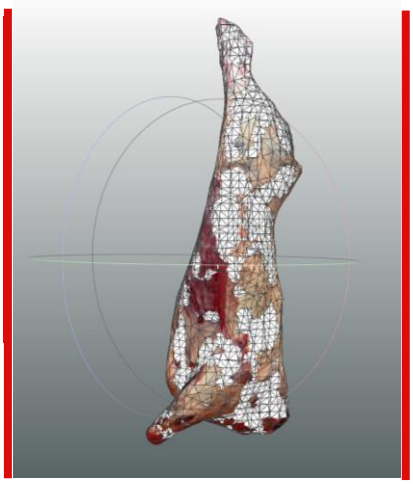


RMY = 64.99%

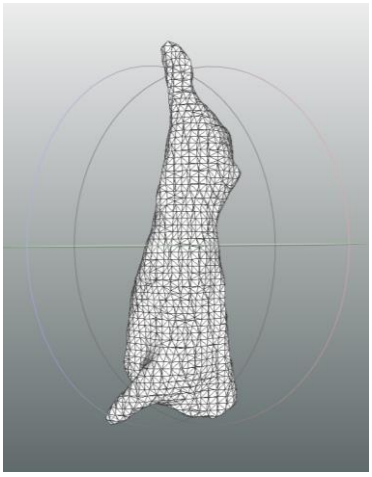
RMY = 71.46 %



Real Carcass



Data Augmentation



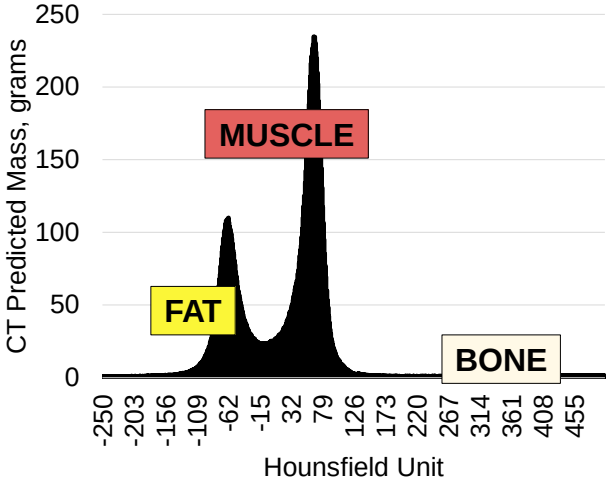
Virtual Carcass

Conclusion

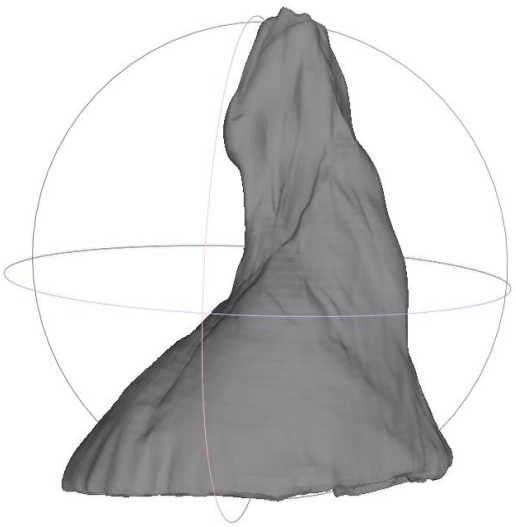
1. 3D imaging combined with deep learning outperforms current USDA Yield Grade predictors.
2. Future research should focus on increasing sample sizes and exploring alternative modeling techniques.

Using CT to Determine Composition

What is the <u>gold standard</u> for "true yield" measurement?



Dr. Blake Foraker - Blake.Foraker@ttu.edu



CT data for 3D rendering

Texas Tech and Australian Wagyu Collaboration

Objective I: Development of a Conformation-Based Carcass Scoring System

Objective II: Establishing Relationship Between Ribeye Image Data and Carcass Conformation

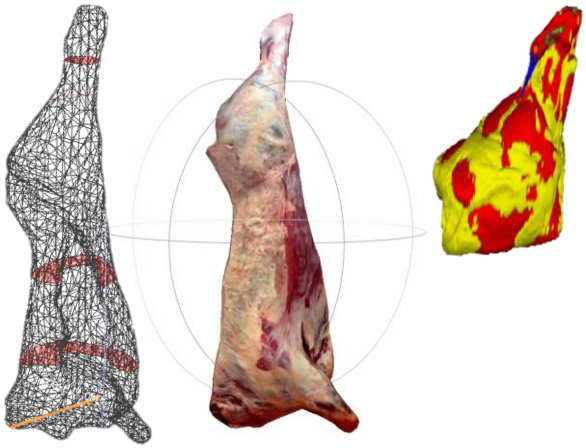
Objective III: Utilizing Advanced 3-Dimensional imaging Technologies for Predicting Red Meat Yield

Your Role…

We are currently looking for **purebred and crossbred Wagyu carcasses in Texas** to support a research project using **3-dimensional imaging technologies**.

If you have carcasses available or expect to in the near future, we would be grateful for the opportunity to connect.

Please contact:
Dr. Dale Woerner — (970) 980-4386 ; dale.woerner@ttu.edu
Cooper Carter — (806) 471-1493 ; coopcart@ttu.edu



Thank You!

Questions ?

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