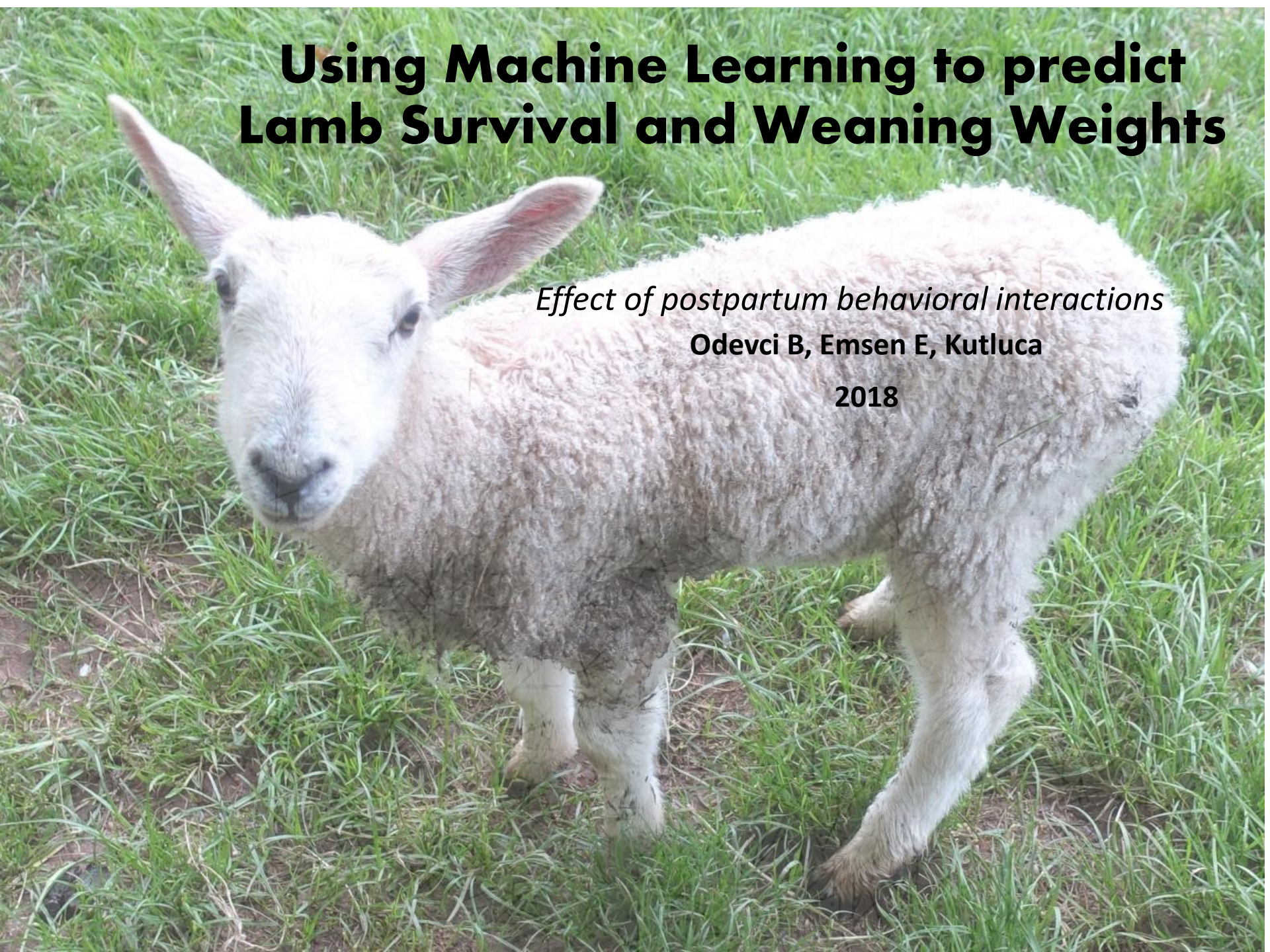
Using Machine Learning to predict Lamb Survival and Weaning Weights



Effect of postpartum behavioral interactions

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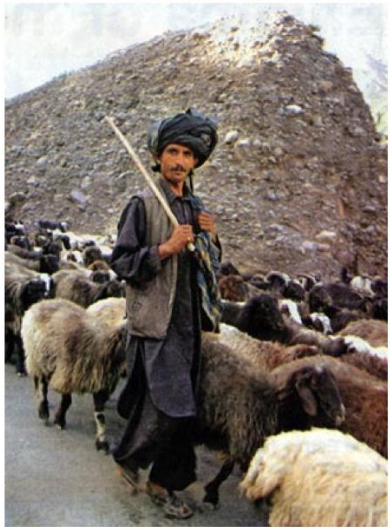
2018

- Lamb survival factors;
  - Management
  - Climate
  - Behavior of the ewe and lamb
  - Other environmental effects
- Motivation;
  - Heritability estimates of lamb survival are low, correlated traits that are more reliable
- Focus in this research;
  - Behaviours from both mother and lamb
  - Behavioural interactions are much more important for prolific sheep with higher litter size

From Shepherd to Machineherd



Variables

- Dam Breed
- Grooming (Duration of licking lamb)
- Dam age
- Dam weight at lambing
- Lamb Genotype (local x Romanov crossbreds)
- Litter size
- Lamb sex
- Birth assistance
- Mothering ability
- Lamb birth weight
- Time to lambs on knee*
- Time to lamb stands*
- Time to first touch to udder*
- Successful suck (sucking for at least 5 seconds)
- Weaning weight

Data Set

Season: Winter
Region: High altitute, cold climate
Sire: 1 Romanov
Dam: 23 Awassi, 37 Morkaraman
Lamb: 69 lambs, Romanov x Awassi, Romanov x Morkaraman

Data Recording

Day 0

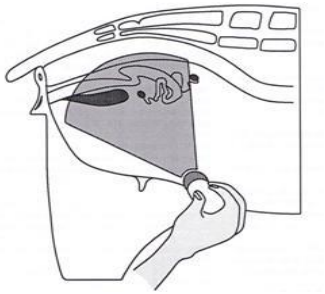
Day 40

Day 144-155

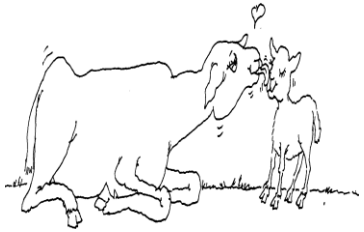
Day 60 after lambing

LAI

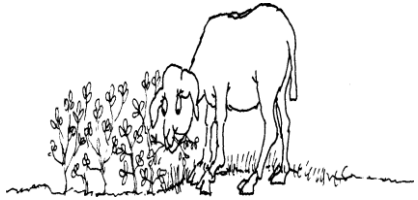
PREGNANCY DIAGNOSIS

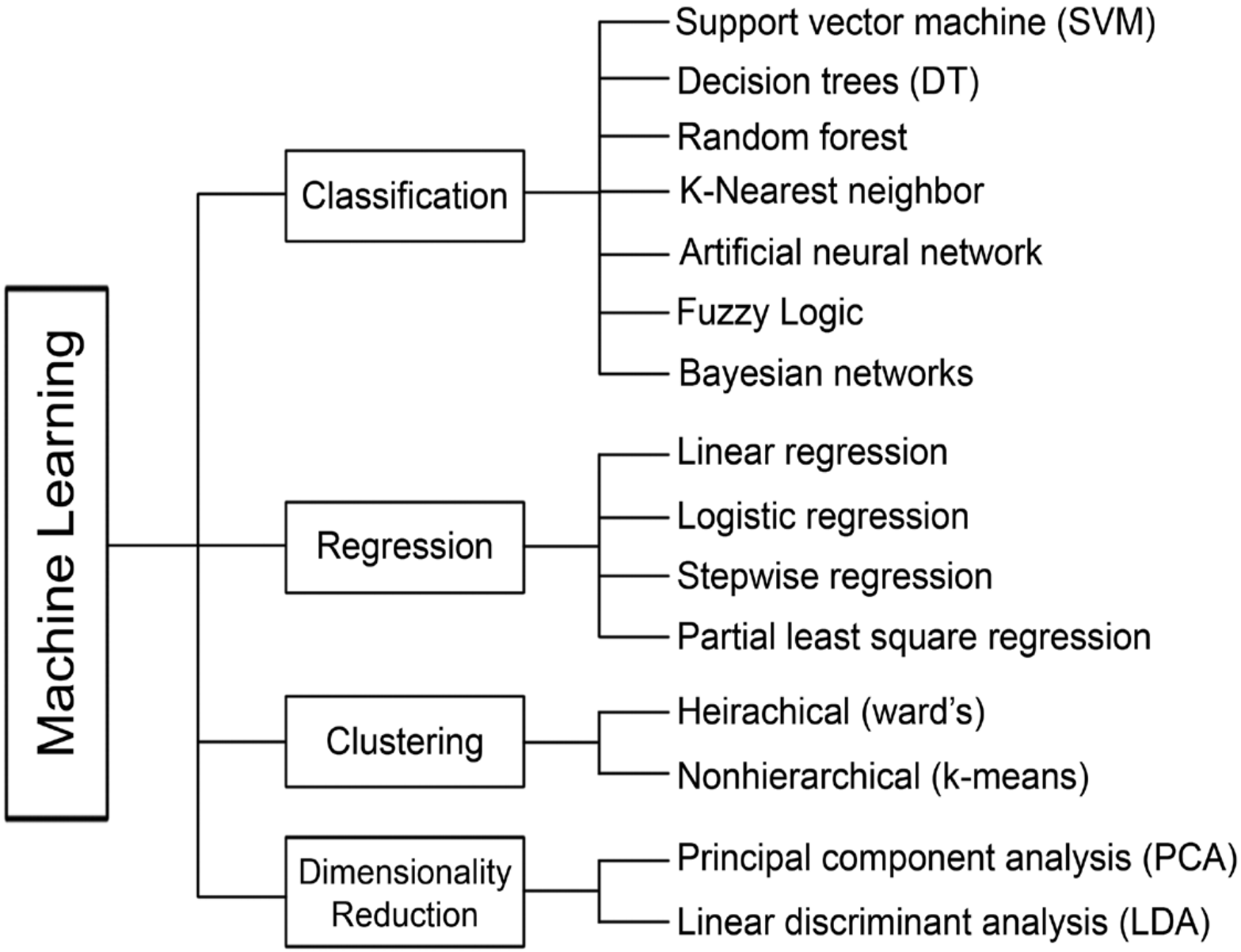


DAM & LAMB BEHAVIOUR AT LAMBING

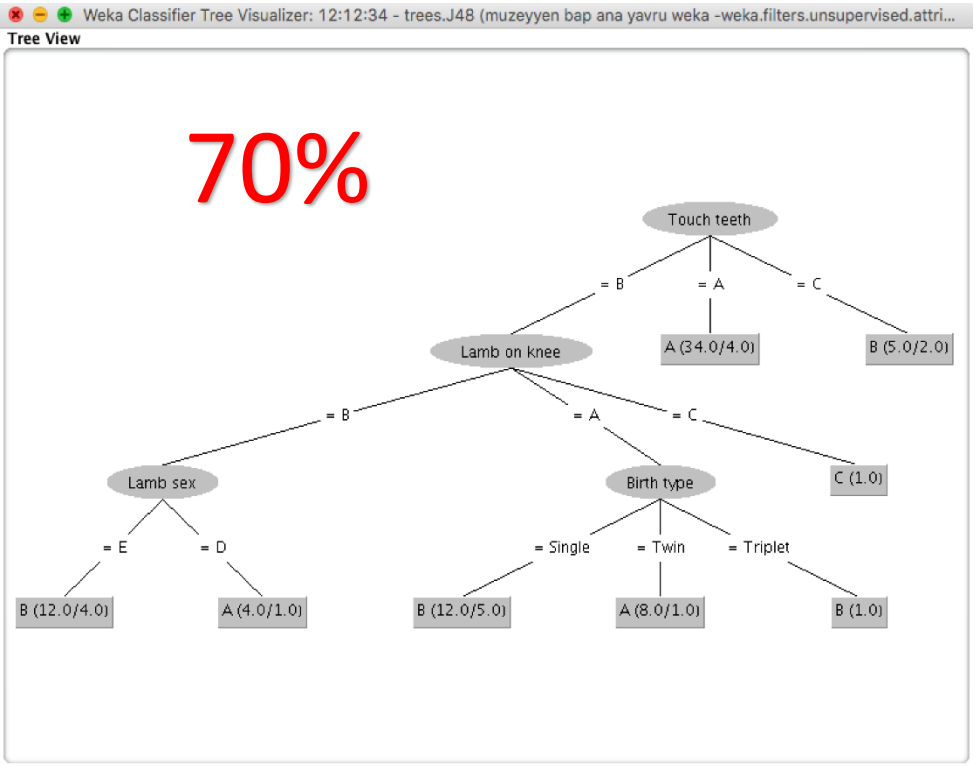


LAMB SURVIVAL AND WEIGHT AT WEANING

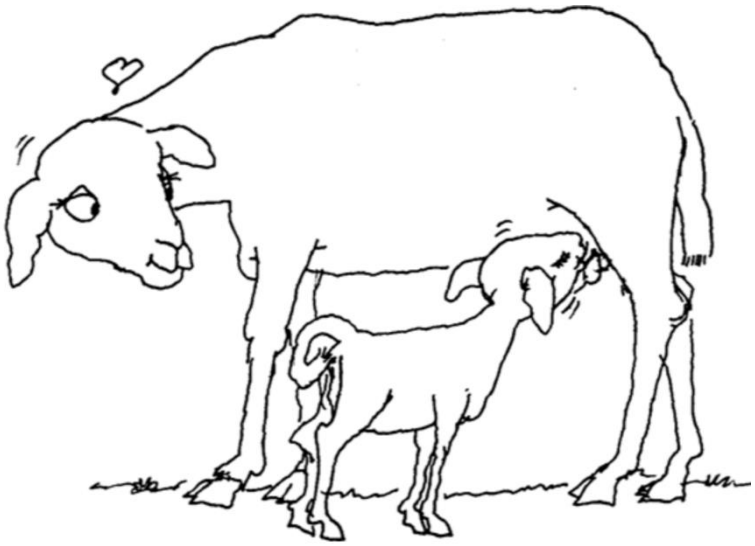



Machine Learning
Classification
Support vector machine (SVM)
Decision trees (DT)
Random forest
K-Nearest neighbor
Artificial neural network
Fuzzy Logic
Bayesian networks
Regression
Linear regression
Logistic regression
Stepwise regression
Partial least square regression
Clustering
Heirachical (ward's)
Nonhierarchical (k-means)
Dimensionality Reduction
Principal component analysis (PCA)
Linear discriminant analysis (LDA)

Predicting Lamb behaviour (Successful Suck)

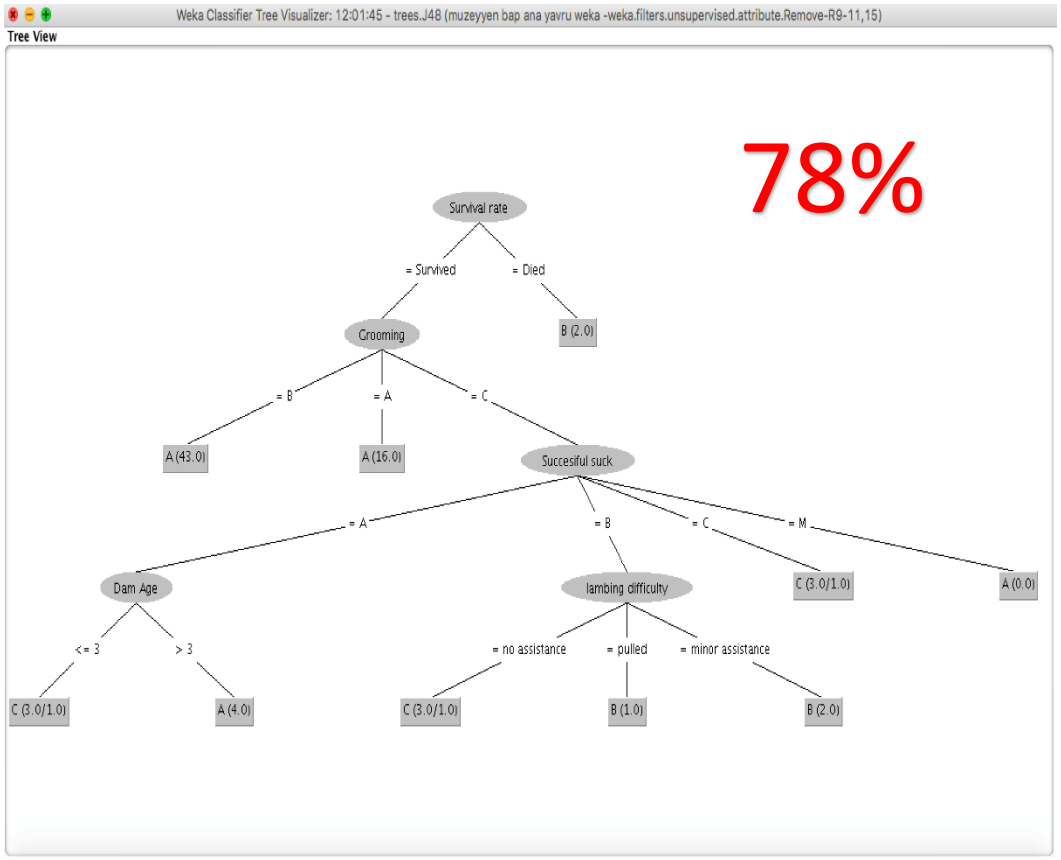


Lamb has teat in its mouth, in correct position, appears to be sucking for at least 5 seconds
A<40 min, B: 40-80 min, C>80 min

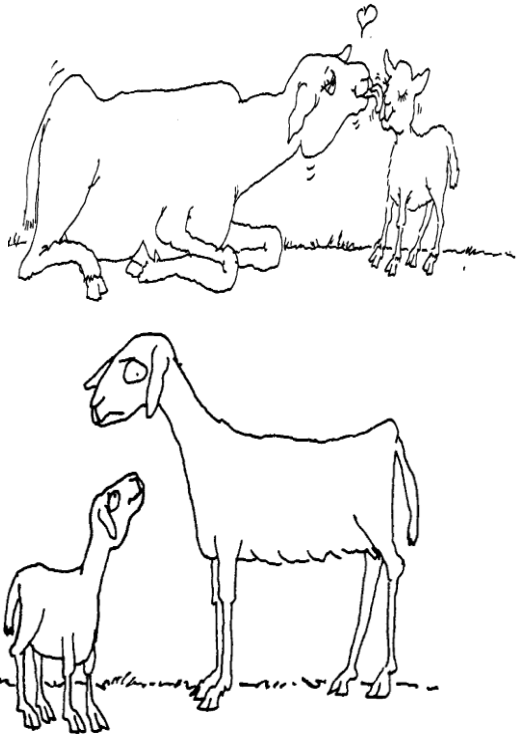


IF lamb touches udder in moderate time
But comes on knee faster and is twin born
THEN
Lamb is a successfull suck

Predicting Mothering ability

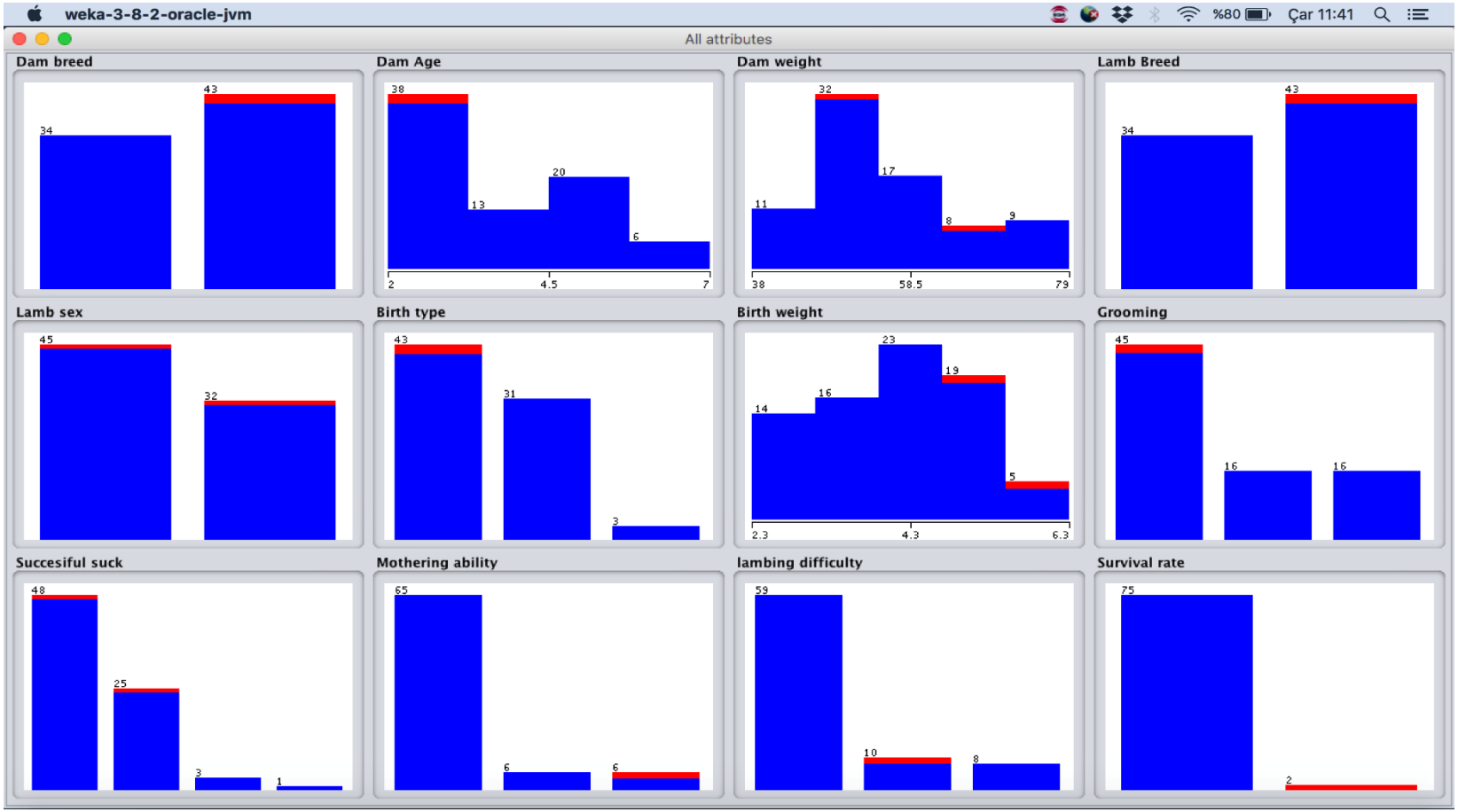


78%

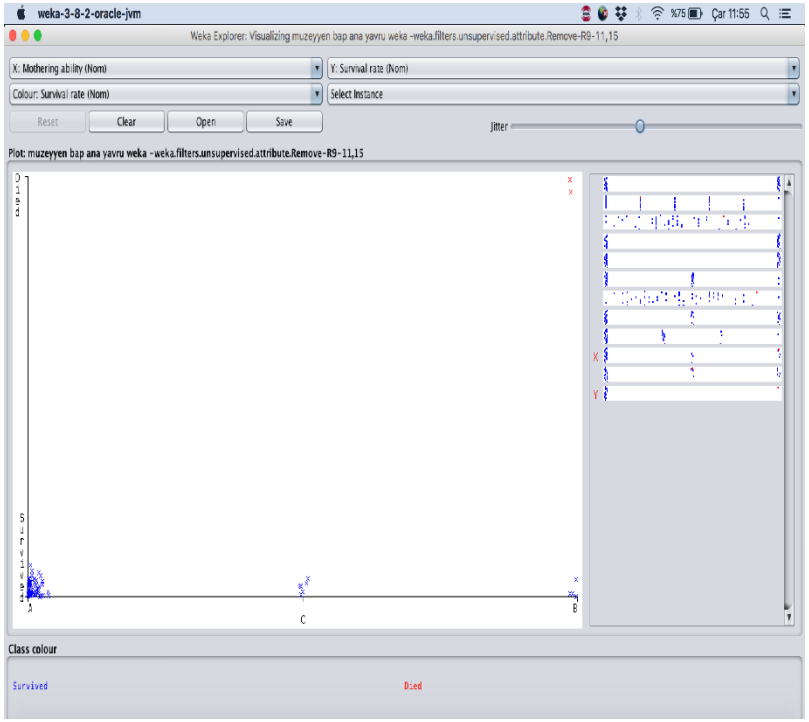


Even if mother grooms short time,
IF lamb sucks quickly and mother is older than 3 years
She is a good mother

(Composed) Attributes used to predict survival of lambs

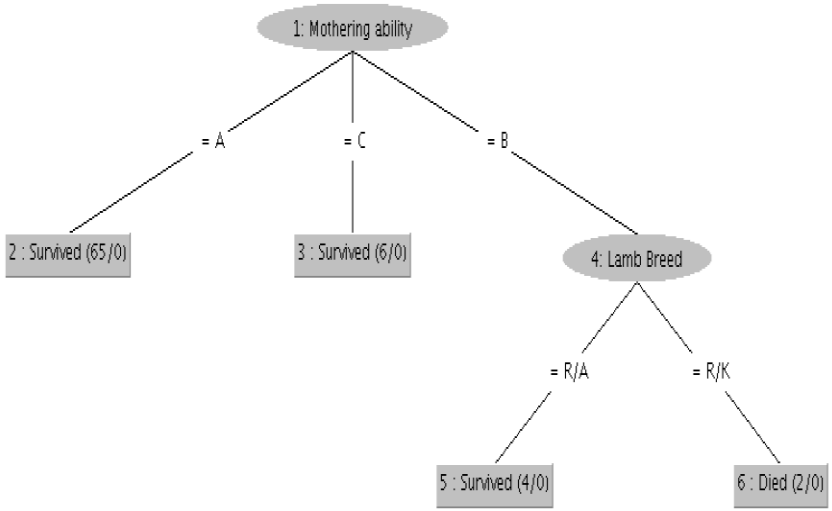


Predicting Lamb Survival Rate



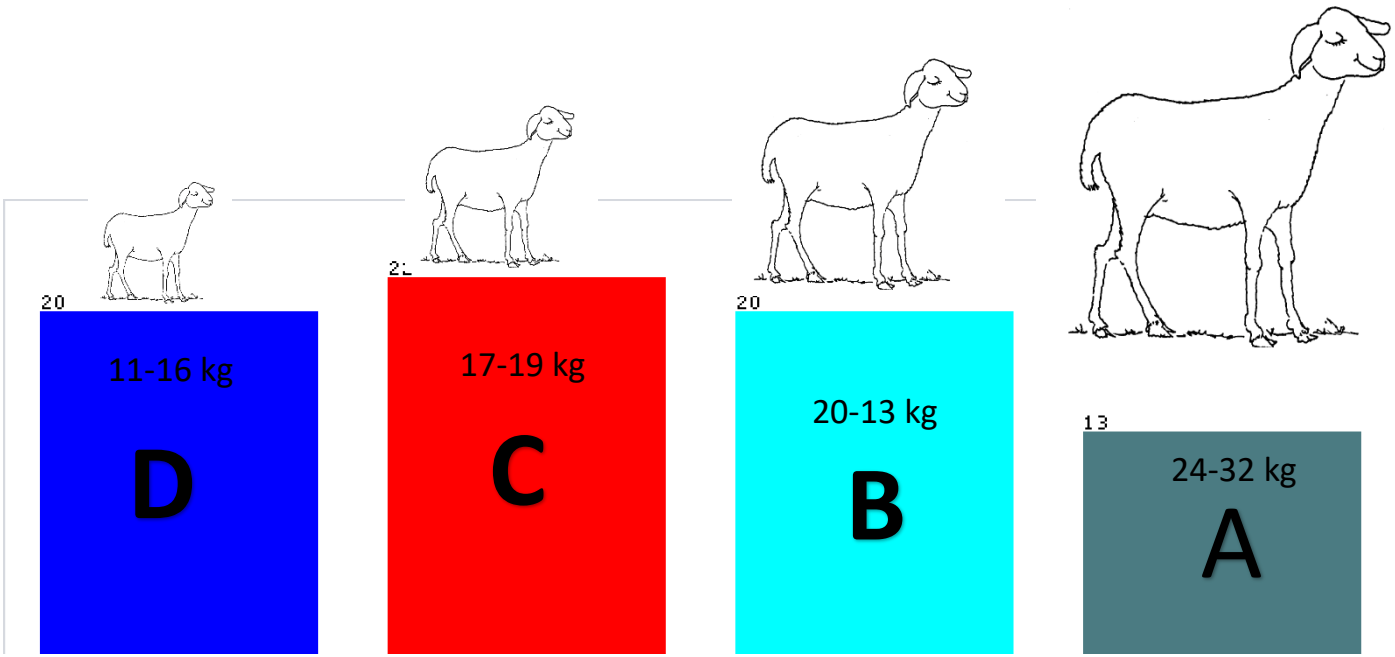
Random Tree

96%

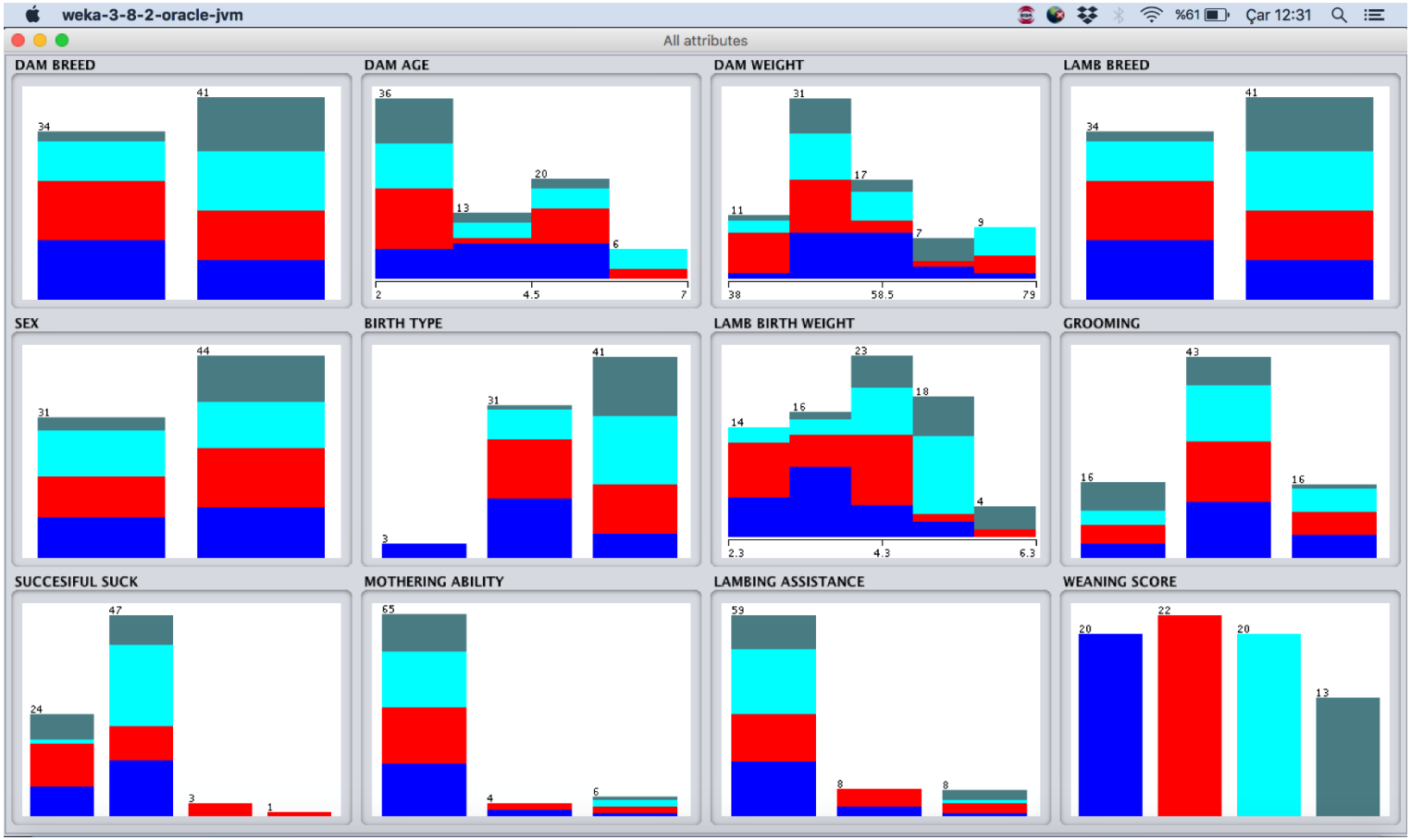


Most important factor for Lamb Survival is <u>mothering ability</u>
Second critical factor is Lamb Breed

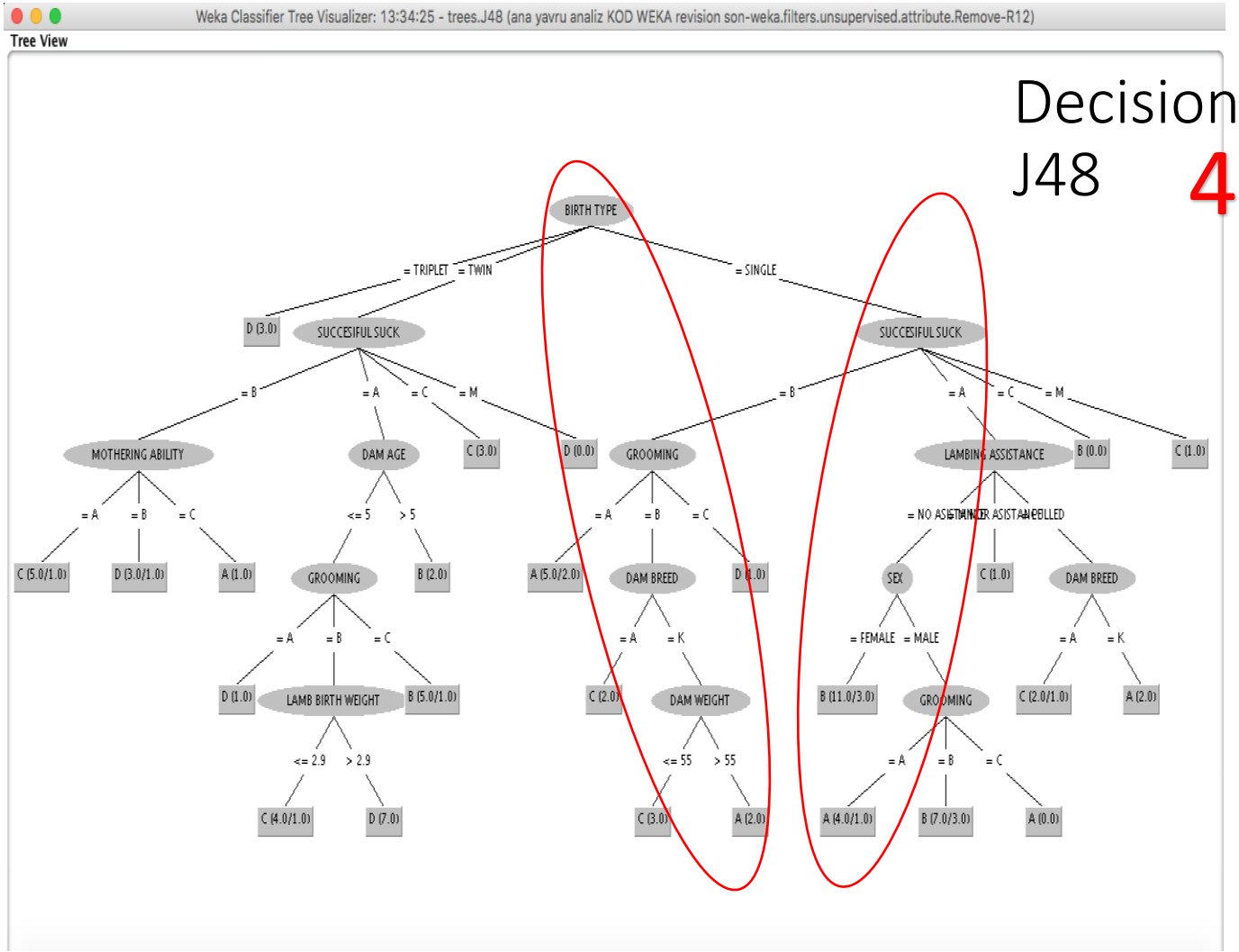
Predicting Weaning Weight of Lambs



Attributes used to predict weaning weight of lambs



Weaning Weight



Decision Tree
J48 **41%**

Single born with no assistance, male lambs, licked longer time by mother, weans best

No stable results for twin lambs

Results

- Machine learning algorithms have better predictive power in classifying lamb survival than weaning weights
- The most successful classification algorithms applied for lamb survival and weaning weights was MultilayerPerceptron with 100% and 41% accuracy rates, respectively.
- Ramdomtree (96%) for lambs survival and J48 (41%) for weaning weights of lambs clearly outperformed all other methods.

Thanks for listening