Intrusion Detection with Genetic Algorithms and Fuzzy Logic

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The big picture

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KDD99

- Generated by simulating a military network environment in 1999.
- Has long been a standard data set for intrusion detection.
- Data in the set is classified as normal or attack activity.

- KDD99 uses 41 features.
  - *Features* are properties of a *record*, (either an attack or normal activity), that are used to describe the activity.

Some features of KDD99

1. duration: length of the normal or attack activity in seconds.
2. src_bytes: number of bytes sent from source to destination.
3. num_failed_logins: number of failed login attempts.
4. root_shell: returns 1 if root shell is obtained, else returns 0.
5. num_access_files: number of operations on access control files.
6. srv_count: number of connections to the same service as the current connection in the past two seconds.
7. serror_rate: percentage of connections that have “SYN" errors.
8. same_srv_rate: percentage of connections to the same service.

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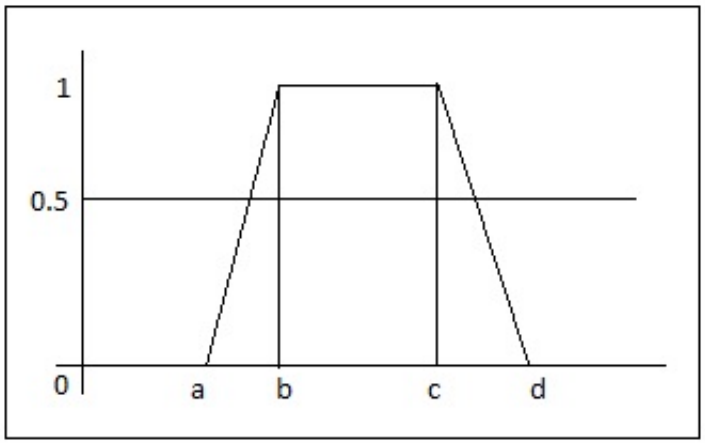
Measuring the probability of a record being an attack

- Trapezoidal shape



- The parameters are the values of a feature.

- Fuzzy algorithm

if data value is between *b* and *c* **then**
  prob = 1.0
else if data value is between *a* and *b* **then**
  prob = $(\text{data} - a)/(b - a)$
else if data value is between *c* and *d* **then**
  prob = $(d - \text{data})/(d - c)$
else
  prob = 0.0
end if

Encoding of features and rules

- The four parameters are encoded into blocks.
- Each block is a feature with values between 0.0 and 7.0.

010	011	100	101
a=2	b=3	c=4	d=5

- A rule has 12 blocks of features, at the end is the type of attack.

010	011	100	101	.....	010	011	101	111	DoS
a=2	b=3	c=4	d=5	.....	a=2	b=3	c=5	d=7	
		Block 1				Block 12			Type

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Conclusions

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Thanks!

Thank you for your time and attention!

Questions?

References