1. In order to estimate the extent to which online articles belong in the fuzzy set “Fake News”, the following could be measured:
   1. Number of references to indefinite authorities, eg. “According to our *political analysts* [*scientists, experts*]”
   2. Number of references to legally or professionally accountable sources, eg. “According to data published by the *Department of the Treasury*” and not “According to an article by [*another journalist*]”
   3. Number of occurrences of the word *Trump*
   4. Number of weasel words, eg. {*May, could, often, probably*}

Five rules which could be used to compute the estimation are:

1. IF Number of weasel words is LOW AND Number of references to accountable sources is HIGH THEN Fake News is LOW.
2. IF Number of references to indefinite authorities is LOW AND Number of references to accountable sources is LOW THEN Fake News is MEDIUM.
3. If Number of references to accountable sources is MEDIUM and Number of weasel words is MEDIUM THEN Fake News is MEDIUM.
4. IF Number of references to indefinite authorities is HIGH AND Number of references to accountable sources is LOW THEN Fake News is HIGH.
5. IF Number of weasel words is HIGH AND Number of occurrences of the word *Trump* is HIGH THEN Fake News is HIGH.

I recognize that training or validating such a system would be difficult because of the sparsity of ground-truth data.

1. Batyrshin and Kaynak [1] proposed a variety of general parametric t-norms, such as:

where p is the parameter. Eskil *et al.* [2] used such parametric t-norm forms to tune fuzzy control systems with genetic algorithms. Their system was a robotic manipulator. They used this parametric optimization because such robotic systems are have complex dynamical behaviors; forces, velocities, torques and angular positions are all inter-related. The optimization process allowed their fuzzy control system to learn the nature of these dynamics, saving the need for manual parameter or rule set tuning.

1. The action of driving a car on a highway may be described as a fuzzy rule-based system. Measurables might include:
   1. Amount of traffic: {LOW, MEDIUM, HIGH}
   2. Road conditions: {FLAWLESS, WORN, DAMAGED}
   3. Visibility: {FAR, MEDIUM, NEAR}

Driving speed (normalized for speed limit or traffic speed) might be the output determined by these measureables and the following rules:

1. IF Traffic is LOW AND Conditions are FLAWLESS AND Visibility is FAR THEN Speed is HIGH.
2. IF Conditions are DAMAGED OR Visibility is NEAR THEN Speed is LOW.
3. IF Traffic is MEDIUM and Conditions are WORN THEN Speed is MEDIUM
4. IF Traffic is MEDIUM and Visibility is MEIDUM THEN Speed is MEDIUM

These rules and measurables might be useful for a self-driving car. When I am driving, I believe I apply other fuzzy rules, resulting in other fuzzy quantities such as “Safety”. The safer I perceive a road to be, the more likely I am to drive quickly on it. Other relevant fuzzy factors, arising from other measurables, might include “Lateness”. If I have no schedule, there is no reason to drive quickly. If I might miss a flight, then I will drive more quickly.

1. To determine the membership of a closed curve in the fuzzy Circle set, one could measure the variance of the radius of curvature along the curve. This has a closed form when the functional form of the curve is known. If the form of the curve is not known in advance, small arcs of known length and variable curvature could be fit to corresponding lengths of the curve, minimizing the sum-squared-error between the small arc and curve segment, for each such segment. The variance of the set of the error minimizing arcs’ curvatures is then computed in its normal discrete statistical sense.

Since this variance can take on any positive real value, it would need to be mapped over the range [0, 1] using a sigmoidal function such as the hyperbolic tangent function, or the error function. The complement of this would be used, since larger variances in curvature should result in less membership in the fuzzy Circle set. Coefficients of the sigmoidal functions affect how forgiving our system is in what is considered a circle. Larger positive slopes of the sigmoid function mean larger variances are more quickly mapped to values closer to one, and since the complement is used, the less like a circle the curve is considered.

**References**

[1] – I. Batyrshin, and O. Kaynak, “Parametric Classes of Generalized Conjunction and Disjunction Operations for Fuzzy Modelling”, IEEE Transactions on Fuzzy Systems, vol. 7(5), pp. 586-596, 1999.

[2] – M.T. Eskil, M.O. Efe, and O. Kaynak, “T-Norm Adaptation in Fuzzy Logic Systems Using Genetic Algorithms”, Proceeding of the IEEE International Symposium on Industrial Electronics, 1999.