Fuzzy Wakeup System

# Introduction

As a part of the course Fuzzy Logic & Control Systems we have created a control system that uses fuzzy logic. This control system is based upon the notion of an alarm but has also been thought about to be extended to a fully featured “wakeup system”. The difference is that the wakeup system helps you all the way until you’re fully awake. This could include things as the amount of coffee you get, the length of the shower and so on.

We did it because the idea was interesting enough and something where we thought we could incorporate what we had learned.

The Fuzzy system we created outputs favourable results that we think gives us a certain degree of confidence that it was worth using fuzzy logic. It was definitely worth using fuzzy logic because of the learning process, and the fuzzy nature of sleep and the human day and night cycle.

# Background

## Sleep

Sleep is something we all do, we all need to do it, but we really don’t know why we do it. A perfect subject for a fuzzy system ☺

Our sleep is affected by numerous of things. Most of these are highly individual, such as how much we need to sleep or how much movement every day is normal. While some are a little bit more universal, this could be that we should eat at least three hours before bedtime.

Sleep is however an area which needs more research, so we’re basically working by what seems to be working for people. Like, we’ve all felt that if you move a lot during a day you’ll fall asleep faster.

## Usage of fuzzy logic

This problem is a good match for a fuzzy system because of the fuzzy nature of the problem (as described in previous chapter). There are no crisp values that can be used on such a personal system.

TSK vs. Mamdani

Why fuzzy logic is a good choice.

# Simulation / Model

## Inputs (DESCRIBE THEM)

### Last meal or drink

### Slept day before

### Exercise before sleep

### First meeting

### Time went to bed

### Current sleep cycle

### Amount of REM sleep

### Brightness

### Noise

These basic inputs is used in our categories and used as modifiers later on.

## Rules

## Defuzzification methods

## Outputs

The outputs are from the categories

* Easiness of falling asleep
* Time to sleep
* Quality
* Time of alarm
* Easiness of waking up

# Results & Analysis

## Results

### Screenshots

### Example runs (tables + sentences)

## Evaluation

How are the results?

Justify our choices.

# Conclusions

Was a fuzzy solution justifiable?

# Rules

The rules are categorized based upon output

* Time to sleep is calculated based upon these inputs:
  + First meeting
  + Last meal or drink
  + Went to sleep
  + Slept day before
  + Current sleep cycle
* Here are some rules I came up with
  + IF First meeting IS VERY EARLY AND Went to sleep IS VERY LATE Time to sleep IS VERY LITTLE
  + IF First meeting IS VERY EARLY AND Went to sleep IS LATE Time to sleep IS VERY LITTLE
  + IF First meeting IS EARLY AND Went to sleep IS VERY LATE Time to sleep IS VERY LITTLE
  + IF First meeting IS EARLY AND Went to sleep IS LATE Time to sleep IS LITTLE
  + IF First meeting IS NORMAL AND Went to sleep IS LATE Time to sleep IS LITTLE
  + IF First meeting IS NORMAL AND Went to sleep IS NORMAL Time to sleep IS ENOUGH
  + IF First meeting IS NORMAL AND Went to sleep IS EARLY Time to sleep IS ENOUGH
  + IF Went to sleep IS EARLY AND Current sleep cycle IS DEEPLY ASLEEP Time to sleep IS LONGER THAN USUAL
  + IF Slept day before IS VERY LITTLE AND First meeting IS VERY LATE Time to sleep is LONGER THAN USUAL
  + IF Slept day before IS LITTLE AND First meeting IS LATE Time to sleep is LONGER THAN USUAL

# References

<http://sleepfoundation.org/how-sleep-works/how-much-sleep-do-we-really-need/>

<http://www.joybauer.com/insomnia/how-food-affects-sleep.aspx> - Summary: eat at least three hours before bedtime. Eating just before might keep you awake

<http://www.webmd.com/sleep-disorders/features/cant-sleep-adjust-the-temperature> - Summary: You should have the room a little bit colder when you sleep. But at a comfortable level ☺

<http://www.thedietchannel.com/AskTheExpert/dieting-weightloss-obesity/Calories-Whats-an-ideal-daily-intake.htm> - Summary: We should eat 3 meals and 2-3 snacks per day. 400-600 calories per meal for men, 300-500 for woman and 100-200 calories per snack. This makes the “normal” span between 1100 to 2400

## Expectations

* Proper English (Grammar, punctiotion, full sentences)
* Reasonable amount of references, 3 to 5 preferred.
  + Both fuzzy logic and domain specific references.
  + Peer-reviewed (i.e. avoid wikipedia / anonymous webpages)
* Don't plagiarize
* Results, screenshots, rules, etc… will be the same for everyone in a group.
* The simulation submission is to verify you did what you're reporting to have done.
* The best and worst group may be investigated.
* The coursework is marked individually, but good group-work helps.
* Avoid over-complication the problem: Fuzzy logic is deployed to simplify solutions, not the other way around.