Exploring Fuzzy Logic To Combine Foot Type and Pointe Shoes

By: Tara Webb

Data Mining Methods

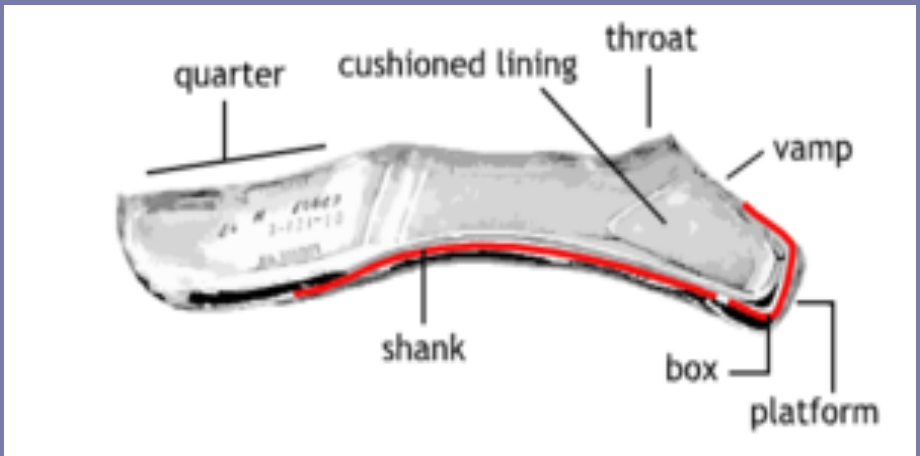
12/12/06

Outline

- What are Pointe Shoes? How is foot type involved in making a decision on which kind to buy?
- Confusion in Finding Appropriate Shoe
- What is Fuzzy Logic?
- How does a fuzzy system work?
- How does it work mathematically?
- Overview

Pointe Shoes

- Special shoe used by female ballet dancers
- Made of canvas, paper, and glue
- Many different brands available
- Two Important Features:
  - The box
  - The shank

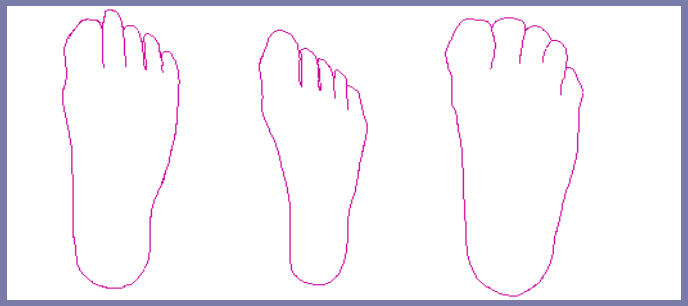


Fitting Pointe Shoes

Flat Feet

Normal Feet

High Arched Feet



Greek/Morton's Foot
This foot type has a second toe that is longer than all the others. The width tends to be narrow to medium.

Egyptian Foot
This foot type has a long first toe and the rest of the toes taper. The width tends to be narrow to medium.

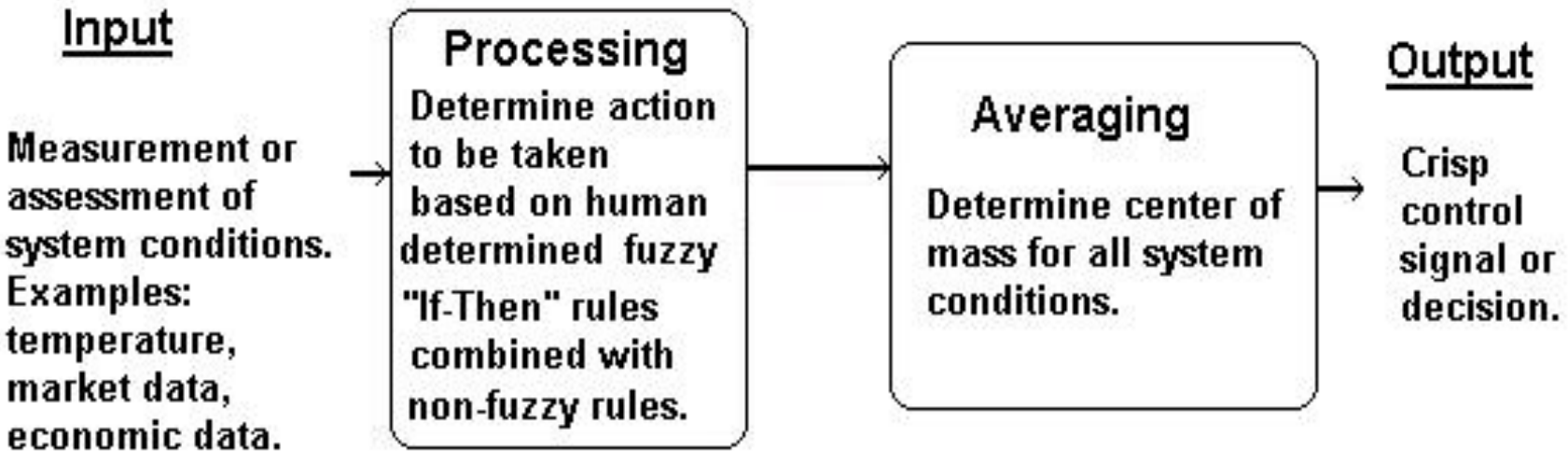
Giselle/Peasant Foot
This foot type has at least three toes the same length (sometimes more) and the toes tend to be short. It tends to be well-suited for pointework. The width tends to be medium to wide.

Fuzzy Logic: Human Vs. Computer Thinking

- Humans use fuzzy logic in their everyday lives!

- Humans evaluate in a fuzzy manner.
- Computers evaluate in precise values.

Fuzzy Logic System



The Fuzzy Logic Control-Analysis Method

Mathematically Speaking:

- Foundations of Fuzzy Logic can be thought of as an extension of set theory
- A set can be described as a membership function, $m_A(x)$, defined over some "Universe of Discourse."
- $m_A(x) = 1$ when x is an element of the set
- $m_A(x) = 0$ when x is not an element

Mathematically Speaking Cont'd:

- In a fuzzy set, $m_A(x)$ could be values other than 0 or 1.
- This is a way of describing a percentage of how much the element belongs to the set.
- This leads to the if-then statement:
  - IF A THEN B

Mathematically Speaking Cont'd:

- The fuzzy sets of A and B are combined by using the Cartesian Product, R = A X B
- This R takes on a membership equal to the min $\{m_A(a), m_B(b)\}$ for each (a,b) pair
- The results are then aggregated by taking the maximum membership for each state in the "then" part across all the results of each rule.
- The last step is to "defuzzify" the aggregated set to get a crisp output value.

Overview

- Fuzzy logic is based on the way humans evaluate.
- It gives percentages of belonging which lead to a precise action.
- This percentage of belonging directly relates to the problem of matching foot types to pointe shoes.
- It is my recommendation that this would be an optimal way to solve this problem.

References:

- Feet and Foot Types. Retrieved October 8, 2006, from www.dancer.com/**foot**type
- Fuzzy Logic. Retrieved October 8, 2006 from http://en.wikipedia.org/wiki/Fuzzy_logic
- Kaehler, Steven D. (n.d.). Fuzzy Logic Tutorial. Retrieved November 18, 2006, from
- http://www.seattlerobotics.org/encoder/mar98/fuz/flindex.html
- Micalewicz, Z. & Fogel, D. (2002). *How to Solve It: Modern Heuristics*. New York: Springer.
- Pointe Shoes. Retrieved October 8, 2006, from http://en.wikipedia.org/wiki/Pointe_shoes
- Sowell, Thomas. (n.d.). Fuzzy Logic Tutorial. Retrieved October 8, 2006, from http://www.fuzzy-logic.com
- What is My Foot Type?. Retrieved October 8, 2006, from
- www.northlan.gov.uk/leisure+and+tourism/sports+activities/running/what+is+my+**foot**+type