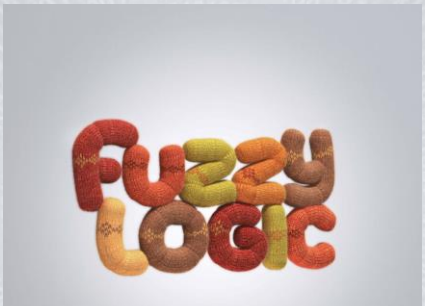
به نام خدا

# کاربرد کامپیوتر در مهندسی پوشاک

مدرس:
دکتر پدرام پیوندی





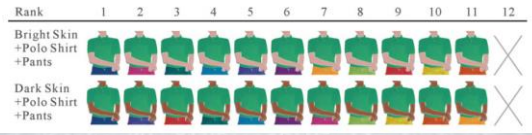



## A Computer-Assisted Colour Selection System Based on Aesthetic Measure for Colour Harmony and Fuzzy Logic Theory

**Shih-Wen Hsiao,* Fu-Yuan Chiu, Hsin-Yi Hsu**

Department of Industrial Design, National Cheng Kung University, Tainan, Taiwan 70101, Republic of China

Received 10 January 2007; revised 20 August 2007; accepted 21 September 2007



**Appearance Measurement System Using Fuzzy Logic**

Haizhuang Kang, Clive Butler, Qingping Yang, Franco Sacerdotti, Fabrizio Benati

Department of Systems Engineering, Brunel University
Uxbridge, Middlesex, UB8 3PH, UK
Tel: +44 1895 274000 Ext. 2954, Fax: +44 1895 812556
Email: empghzk@brunel.ac.uk

Senem Kursun Bahadir[1,2], Fatma Kalaoglu[2], Vladan Koncar[1]

**Analysis of Vibrotactile Perception via e-Textile Structure Using Fuzzy Logic**

[1]Univ. Lille North of France, ENSAIT, GEMTEX
F-59100, Roubaix, France

[2]Istanbul Technical University, Department of Textile Engineering,
Istanbul, 34437, Turkey
E-mail: kursuns@itu.edu.tr

**Abstract**
*The aim of this study is to evaluate vibrotactile perception via an e-textile structure on different parts of the body by different signal types and frequencies. First an e-textile structure was developed by the integration of a vibration motor to knitted fabric using conductive yarns. Then various signal waveforms at different frequencies were applied to diverse parts of the user's body via this novel textile structure. Signals were generated by using a DAQ (Data Acquisition) card. Finally vibrotactile perceptions were evaluated and compared by groups of people using fuzzy linguistic scales. It was found that the signal waveform and frequency had a significant effect on the vibrotactile perception. Furthermore the perception level of vibrotactile stimulation showed differences depending on the part of the human body. This e-textile based vibrotactile information could be highly valuable for applications like directional navigation, where the visual sense is restricted, for driving, for piloting and for medical applications like body relaxation against stress.*

**Key words:** *vibrotactile perception, e-textiles, fuzzy logic, vibration motors, signal waveform, frequency, body parts.*

## Clothing recommendation based on fuzzy mathematics

**Authors:** Lu, Hong[1]; Chen, Yan[2]; Dai, Hong-qin[2]

**Source:** International Journal of Advanced Operations Management, Volume 5, Number 1, January 2013 , pp. 14-30(17)

**Publisher:** Inderscience Publishers

**Abstract:**

In this paper, a clothing recommendation method is developed based on fuzzy mathematics, which is the theoretical foundation of the clothing interactive system. The design elements and sensory knowledge are elicited by using the method of interviewing, laddering and card sorting. The different linguistic variables are represented by triangle fuzzy numbers. Fuzzy total utility value and fuzzy utility similarity are used to show the reflection between the design elements space and sensory image space. The method of analytic hierarchy process (AHP) is applied to quantify the important ratio of nine design element items. On the basis of the fuzzy synthesis evaluation theory, all samples can be sorted into different sets respectively and then the garments in the proper set are recommended to customers according to their single or multiple needs. Although, men's suit is taken as a case study in this paper, the techniques and methods can be extended to other garments.

**Keywords:** MANAGEMENT AND BUSINESS; Operational Management and Marketing

**Document Type:** Research Article

**DOI:** http://dx.doi.org/10.1504/IJAOM.2013.051323



## Fuzzy Logic of Matching Sense on Fashion Image

Fashion products contain lots of sensory information, such as style, color, matching of clothing and accessories, etc. Sensory Engineering is applied as an approach for garment industry to improve service of CRM (customer resource management), to provide personalized design frame work, to establish fashion E-retail and decision support system. It can be used for quality inspection, product design and marketing of fashion products. Although accounts of researches have acquired quite achievement on mathematical formalization of sensory data, the models for of clothing and accessories are still not established. In this research, several methods were designed to establish the models for matching sensory of fashion image data based on fuzzy logic theory. The sensory data used in this research were collected according to consumer preferences and the fuzzy logical rules were generated from expert knowledge.

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**Date of Conference:** 18-20 Oct. 2008

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Jinan

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10.1109/ICNC.2008.908

**INSPEC Accession Number:**
10393170

Indian Journal of Fibre & Textile Research
Vol. 34, September 2009, pp. 258-266

# An intelligent system for supporting design of fashion oriented personalized fabric products

Gaurav Agarwal, Ludovic Koehl & Xianyi Zeng
Ecole Nationale Superieure des Arts et Industries Textiles, 9 rue de l'Ermitage, 59070, Roubaix, France
and
V K Kothari[a]
Department of Textile Technology, Indian Institute of Technology, Hauz Khas, New Delhi 110 016, India

*Received 1 September 2008; revised received and accepted 21 November 2008*

An intelligent system for supporting the design of fashion oriented personalized fabric samples has been proposed. Based on fuzzy logic and semantic network, it permits to model the relationship between fabric parameters and fashion design elements via fashion images. This system can effectively help textile producers and designers to determine parameters of new fabrics to be produced according to fashion requirements of garments and predict garment fashion styles for given fabrics. A sensory evaluation on fabric hand has been used to determine fabric parameters of a collection of samples. Principal component analysis has been used to reduce the complexity of the model. A set of fashion images has been selected in order to extract abstract fashion design elements and identify relationship between fabric samples and fashion design elements. This system is helpful for textile companies to realize mass customization, i.e. design and production of personalized products with very low costs.

**Keywords:** Fabric parameters, Fashion design elements, Fashion images, Fuzzy logic, Mass customization



Indian Journal of Fibre & Textile Research
Vol. 36, March 2011, pp. 74-80

# Estimation of fabric color by camera based neuro- fuzzy technique

A Shams-Nateri [a]
Textile Engineering Department, University of Guilan, Rasht, Iran

*Received 3 January 2010; revised received and accepted 9 June 2010*

A new method for measuring the textile fabric color by digital camera has been developed in order to establish a relationship between the digital camera RGB response and the device-independent CIE color space by using neuro-fuzzy technique. The results show that the performance of digital camera based neuro-fuzzy technique depends on the number and type of membership function. The best prediction is obtained in CIELAB color space by using two Gaussian combination membership functions with 2.75 $\Delta E^*ab$.

**Keywords:** Digital camera, Fabric, Membership function, Neuro-fuzzy technique



NC STATE UNIVERSITY
College of Textiles NC STATE UNIVERSITY
JTATM Journal of Textile and Apparel, Technology and Management
*Volume 6, Issue 3, Spring2010*

# Scheduling Optimization in a Cloth Manufacturing Factory Using Genetic Algorithm with Fuzzy Logic for Multi-Objective Decision

Bessem Kordoghli,[1,3] Seifeddine Saadallah,[3] Mohamed Jmali[1,2] and Noureddine Liouene[2]

[1]Textile Research Unit (URT) of ISET Kasr Hellel
B.P 68 Ksar Hellal 5070, TUNISIA, Tel. (+216) 73 475 900, Fax (+216) 73 475 163
bessem.kordoghli@ismmm.rnu.tn

[2]National Enginnering School of Monastir (ENIM)
Av. Ibn EL Jazzar, 5019 Monastir Tunisia, Tel (+216) 73 500 511, Fax (+216) 73 500 514

[3]High Institute of Fashion of Monastir (IS3M)
Av. De GOLF, 5019, Stah Jabeur, Monastir Tunisia, Tel (+216) 73 461 423, Fax (+216) 73 464 212

AUTEX 2009 World Textile Conference 26-28 May, 2009 Izmir, Turkey

# EVALUATION OF APPAREL PLANTS ACCORDING TO ERGONOMIC CONTIDIONS USING FUZZY LOGIC

**A. Ash İlleez[1], Can Ünal[1], Mücella Güner[2]**
[1] *Ege University, Emel Aksu Vocational High School, Bornova, Izmir, Turkey*
[1] *Ege University, Faculty of Engineering, Department of Textile Engineering, Bornova, Izmir, Turkey*
can.unal@ege.edu.tr

**ABSTRACT**

In this study, physical conditions of eight different apparel mills such as temperature, humidity, illumination and noise were evaluated. In order to evaluate these aforementioned conditions, measurements were taken in 4 different seasons in all departments of the apparel mills. A hundred units scale was prepared for the evaluation based on the determined limit values for the apparel industry. These limit values were determined as a result of the literature search related with the performed measurements. This prepared scale was used for the evaluation of 4 different physical factors for the departments according to the fuzzy logic method. The values obtained for each apparel mill via using fuzzy logic method were re-evaluated considering the employee capacity. Thus, comparison of 8 different apparel mills was done based on the final result.
**Keywords:** Physical working conditions, ergonomics, fuzzy logic, apparel industry.



*Proceedings of the 10th Asian Textile Conference -ATC-10 – September 7-9, 2009 Ueda, Japan*

# Knowledge-based Interactive Design for Men's Suit

**Hong Lu, Yan Chen*, Hongqin Dai**

*Department of Clothing Design and Engineering,*
*College of Textile and Clothing Engineering, Soochow University,*
*Suzhou, Jiangsu, 215021, China*
*Phone: +86-512-67158048, Fax: +86-512-67246786, E-mail: yanchen@suda.edu.cn*

**Abstract:** The design elements of Men's suit are discussed and analysed in this paper. The design elements of men's suit are divided into nine parts: silhouette, style line of collar, fall, break point, rever position, facing corner, bust pocket, waist pocket and decoration. These elements have direct influences on the sensory evaluation results. A knowledge-based interactive design system for men's suit is advanced on the basis of these researches. The knowledge in this model includes the explicit and implicit parts respectively. The explicit part is related to men's suit itself, which is acquired from designers by laddering, and interviewing methods etc. The implicit part is related to the sensory created from the men's suit, which is obtained by means of card sorting and investigation to designers, customers and some other professional persons. According to the different sensory demands of consumer, some appropriate suits are recommended for choice. The recommend procedure is accomplished by using fuzzy synthesis evaluation.

**Key words:** knowledge acquisition, knowledge based, design, fuzzy systems





# Learning-based fuzzy colour prediction system for more effective apparel design

Chi-Leung Hui, Tak-Wah Lau and Sau-Fun Ng
*Institute of Textiles and Clothing, The Hong Kong Polytechnic University, HungHom, Hong Kong, People's Republic of China, and*
Chun-Chung Chan
*Department of Computing, The Hong Kong Polytechnic University, HungHom, Hong Kong, People's Republic of China*

The current issue and full text archive of this journal is available at
www.emeraldinsight.com/0955-6222.htm

# A new method of ease allowance generation for personalization of garment design



Yu Chen, Xianyi Zeng, Michel Happiette and Pascal Bruniaux
*Ecole Nationale Supérieure des Arts & Industries Textiles, Roubaix, France, and*
Royer Ng and Winnie Yu
*Institute of Textiles and Clothing, The Hong Kong Polytechnic University, Koeloon, Hong Kong, People' Republic of China*

**Abstract**

**Purpose** – The purpose of this paper is to present recent work for optimizing the estimation of ease allowance of a garment using fuzzy logic and sensory evaluation.



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## A Fuzzy Algorithm for understanding the customer's desire. An application designed for textile industry.

*Fabio Krykhtine*
*Federal University of Rio de Janeiro – PEP/COPPE/UFRJ – Brazil*
*E-mail: fabiokrykhtine@yahoo.com*

*Carlos Alberto Nunes Cosenza*
*Federal University of Rio de Janeiro – PEP/COPPE/UFRJ – Brazil*
*E-mail: cosenza@pep.ufrj.br*

*Francisco Antônio Dória*
*Federal University of Rio de Janeiro – PEP/COPPE/UFRJ - Brazil*
*E-mail: fadoria63@gmail.com*

*Submission: 23/04/2013*
*Accept: 05/05/2013*



## Characterization of Fashion Themes Using Fuzzy Techniques for Designing New Human Centered Products

**Y. Zhi[1, 2, 3,*], D. Ruan[4, #], X. Zeng[1, 2], L. Koehl[1, 2], C. Chaignean[5]**

*[1]Univ Lille Nord de France, F-59000 Lille, France*
*[2] Laboratoire Génie et Matériaux Textile (GEMTEX)*
*Ecole Nationale Supérieure des Arts et Industries Textiles (ENSAIT), F-59100 Roubaix, France*
*[3]Damart Serviposte,F-59100 Roubaix, France*
*[4]Belgian Nuclear Research Centre (SCK•CEN), Boeretang 200, 2400 Mol, Belgium*
*[5]Department of Applied Mathematics and Computer Science Ghent University, 9000 Gent, Belgium*

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## منطق فازی

مزایای عمده استفاده از سیستم های فازی

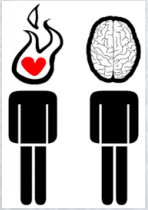
۱- بیان و توصیف عدم قطعیت

۲- ابزاری جدیدی برای حل مشکلاتی که تئوری احتمالات راهی برای آن ها ندارد

۳- استفاده از دانش انسانی

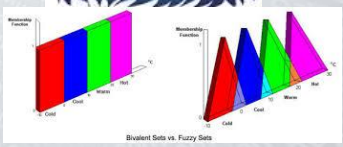


## منطق چیست؟



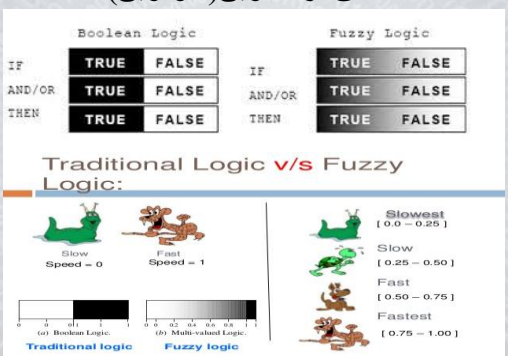
## فازی چیست

واژه «فازي» در فرهنگ لغت آکسفورد، به معناي «مبهم، گنگ، نادقيق، گيج، مغشوش، درهم و نامشخص» آمده است. معاني ديگري مثل کرکي، درهم و برهم، پرزدار، تيره و نامعلوم نيز از جمله معاني ديگر واژه فازي است.





## منطق ارسطویی( دودویی)




- منطق ارسطو، اساس ریاضیات کلاسیک را تشکیل می‌دهد. براساس اصول و مبانی این منطق، همه چیز تنها مشمول یک قاعده ثابت می‌شود که براساس آن، هر چیز یا درست است یا نادرست. منطق ارسطویی دقت را فدای سهولت می‌کند. نتایج منطق ارسطویی، «دوارزشی» و «درست یا نادرست»، «سیاه یا سفید» و «صفر یا یک» می‌تواند مطالب ریاضی و پردازش رایانه‌ای را ساده کند .
-

منطق فازی، جهان‌بینی جدیدی است که به رغم ریشه داشتن در فرهنگ مشرق زمین، با نیازهای دنیای پیچیده کنونی بسیار سازگارتر از منطق ارسطویی است. منطق فازی، جهان را آن‌طور که هست به تصویر می‌کشد. دنیایی که ما در آن زندگی می‌کنیم، دنیای مبهمات و عدم قطعیت است. مغز انسان عادت کرده است که در چنین محیطی فکر کند و تصمیم بگیرد و این قابلیت مغز که می‌تواند با استفاده از داده‌های ناصحیح و کیفی به یادگیری و نتیجه‌گیری بپردازد، در مقابل منطق ارسطویی که لازمه آن داده‌های دقیق و کمی است، قابل تامل است.

## منطق فازی

$A = \{1,2,3,4,5\}$

$(1 \in A) \equiv True$ $\quad (2 \notin A) \equiv False$

$(6 \in A) \equiv False$

$$I_A(x) = \begin{cases} 1 & x \in A \\ 0 & x \notin A \end{cases}$$



## منطق فازی

روزهای زوج = { شنبه ، دوشنبه ، چهارشنبه }

روزهای فرد = { یک شنبه ، سه شنبه ، پنج شنبه }

جمعه



## منطق فازی

روزهای زوج = $\left\{ \frac{\text{شنبه}}{1} , \frac{\text{دوشنبه}}{1} , \frac{\text{چهارشنبه}}{1} , \frac{\text{جمعه}}{0.5} \right\}$

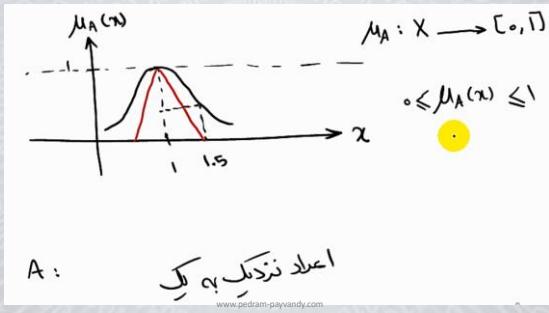
اعداد طبیعی نزدیک به ① = $\left\{ \frac{1}{1} , \frac{2}{0.5} , \frac{3}{0.25} , \frac{4}{0.1} \right\}$

## دانش انسانی چیست





## منطق فازی





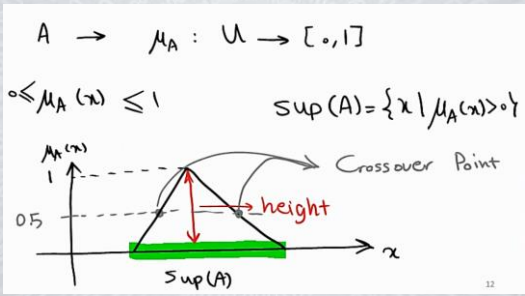

## منطق فازی

$A \longrightarrow \mu_A(.)$ $\qquad \mu_A : U \longrightarrow [0,1]$

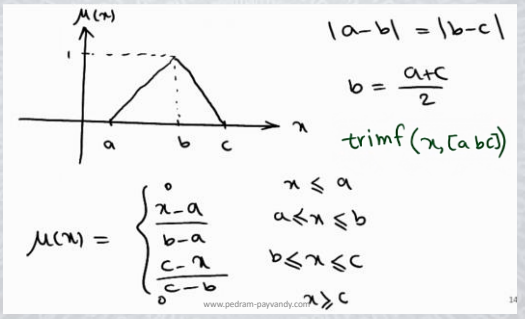
مجموعه $\qquad$ تابع عضویت

$(x \in A) \equiv \mu_A(x)$

## منطق فازی




## منطق فازی




## trimf

Triangular-shaped membership function

**Syntax**

```
y = trimf(x,params)
y = trimf(x,[a b c])
```

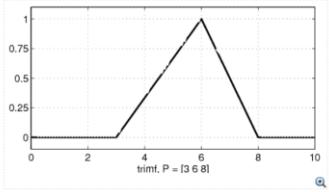
$$f(x;a,b,c) = \begin{cases} 0, & x \le a \\ \frac{x-a}{b-a}, & a \le x \le b \\ \frac{c-x}{c-b}, & b \le x \le c \\ 0, & c \le x \end{cases}$$

or, more compactly, by

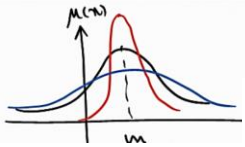
$$f(x;a,b,c) = \max\left(\min\left(\frac{x-a}{b-a}, \frac{c-x}{c-b}\right), 0\right)$$

**Examples**

```
x=0:0.1:10;
y=trimf(x,[3 6 8]);
plot(x,y)
xlabel('trimf, P=[3 6 8]')
```



## منطق فازی



$$\mu(x) = \exp\left(-\frac{1}{2\sigma^2}(x-m)^2\right)$$

**gaussmf**

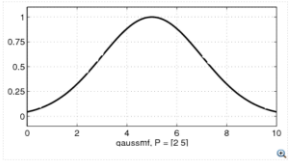
Gaussian curve membership function

**Syntax**

```
y = gaussmf(x,[sig c])
```

**Examples**

```
x=0:0.1:10;
y=gaussmf(x,[2 5]);
plot(x,y)
xlabel('gaussmf, P=[2 5]')
```




## منطق فازی

**trapmf**

Trapezoidal-shaped built-in membership function

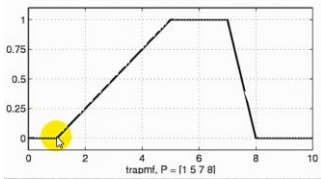
**Syntax**

```
y = trapmf(x,[a b c d])
```

$$f(x;a,b,c,d) = \begin{cases} 0, & x \le a \\ \frac{x-a}{b-a}, & a \le x \le b \\ 1, & b \le x \le c \\ \frac{d-x}{d-c}, & c \le x \le d \\ 0, & d \le x \end{cases}$$

or, more compactly, by

$$f(x;a,b,c,d) = \max\left(\min\left(\frac{x-a}{b-a}, 1, \frac{d-x}{d-c}\right), 0\right)$$

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**zmf**

Z-shaped membership function

**Syntax**

```
y = zmf(x,[a b])
```

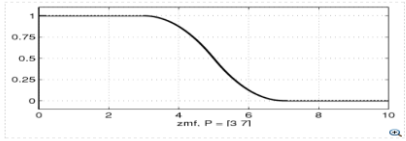
**Description**

This spline-based function of x is so named because of its Z-shape. The parameters *a* and *b* loca

$$f(x;a,b) = \begin{cases} 1, & x \le a \\ 1-2\left(\frac{x-a}{b-a}\right)^2, & a \le x \le \frac{a+b}{2} \\ 2\left(\frac{x-b}{b-a}\right)^2, & \frac{a+b}{2} \le x \le b \\ 0, & x \ge b \end{cases}$$

**Examples**

```
x=0:0.1:10;
y=zmf(x,[3 7]);
plot(x,y)
xlabel('zmf, P=[3 7]')
```



**smf**
S-shaped membership function

**Syntax**

```
y = smf(x,[a b])
```

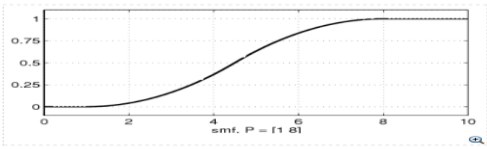
**Description**

This spline-based curve is a mapping on the vector x, and is named because of its S-shap

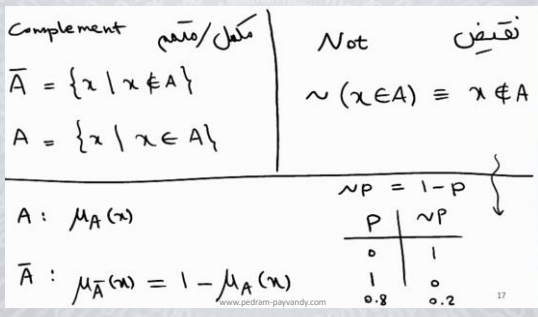
$$f(x;a,b) = \begin{cases} 0, & x \le a \\ 2\left(\frac{x-a}{b-a}\right)^2, & a \le x \le \frac{a+b}{2} \\ 1-2\left(\frac{x-b}{b-a}\right)^2, & \frac{a+b}{2} \le x \le b \\ 1, & x \ge b \end{cases}$$

**Examples**

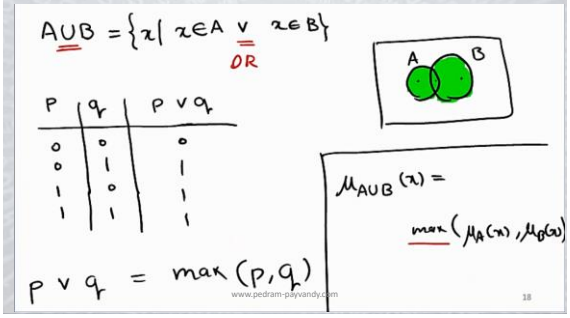
```
x=0:0.1:10;
y=smf(x,[1 8]);
plot(x,y)
xlabel('smf, P=[1 8]')
```




## منطق فازی




## منطق فازی



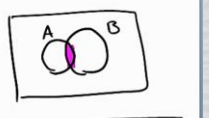
## منطق فازی

$A \cap B = \{x \mid x \in A \wedge x \in B\}$

AND

| P | q | $P \wedge q$ |
|---|---|---|
| 0 | 0 | 0 |
| 0 | 1 | 0 |
| 1 | 0 | 0 |
| 1 | 1 | 1 |

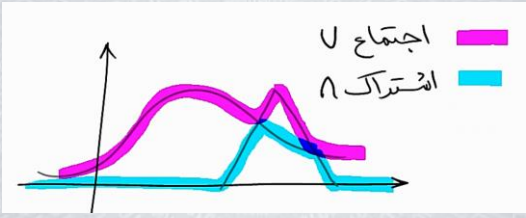
$P \wedge q = \min(P, q)$




$\mu_{A \cap B}(x) = \min(\mu_A(x), \mu_B(x))$




## منطق فازی






## منطق فازی

جبری

$t(a,b) = ab$

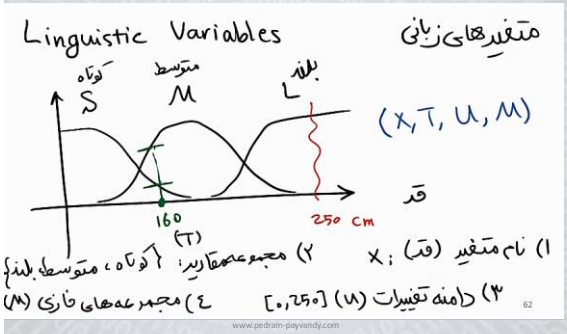
$s(a,b) = a+b-ab$

$t(a,b) = 1 - s(1-a, 1-b)$

$= 1 - [(1-a) + (1-b) - (1-a)(1-b)]$

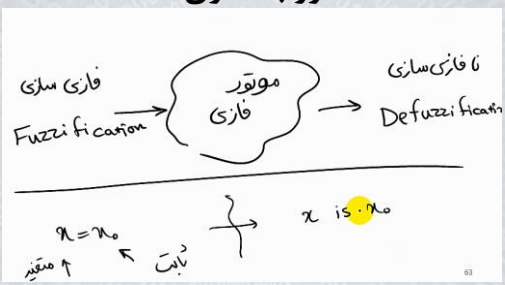
$= ab$

## روابط فازی






## روابط فازی






## روابط فازی

$x$ is $A$ $\equiv \mu_A(x)$

$x$ is not $A$ $\equiv c[\mu_A(x)]$

$1 - \mu_A(x)$

## روابط فازی

$x$ is $A$ and/or $y$ is $B$

$\mu_A(x)$ $\mu_B(y)$

and: t-norm — or: s-norm

$\min / \max \left(\mu_A(x), \mu_B(y)\right)$

$\mu_A(x) \cdot \mu_B(y)$ $\quad \mu_A(x) + \mu_B(y) - \mu_A(x)\mu_B(y)$





## روابط فازی

Rule : قاعده

If <گزاره> Then <گزاره>

گزاره متغیر P — گزاره گلی q

$p \rightarrow q$



## روابط فازی

If $\langle FP_1 \rangle$ Then $\langle FP_2 \rangle$

If $x$ is $A$ and $y$ is $B$ Then $z$ is $C$

$p = \mu_A(x) \cdot \mu_B(y)$ $\quad q = \mu_C(z)$

## روابط فازی

Mamdani Implication

$\mu_{QMM}(p,q) = \min(p,q)$

$\mu_{QMP}(p,q) = pq$

$\mu_{QZ} \leq \mu_{QD} \leq \mu_{QL}$

$QZ \subseteq QD \subseteq QL$

$QMP \subseteq QMM \subseteq QG$

$QG \subseteq QL$



## روابط فازی

IF $\langle FP_1^{\text{کم}} \rangle$ THEN $\langle FP_2^{\text{زیاد}} \rangle$ Rule (R)

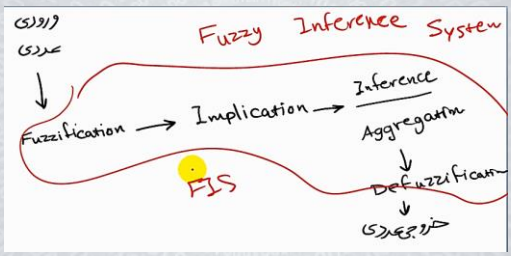
$p = \mu_{FP_1}(x)$ $\quad q_h = \mu_{FP_2}(y)$

$\mu_{RZ}(x,y) = \max\{\min\{\mu_{FP_1}(x), \mu_{FP_2}(y)\}, 1-\mu_{FP_1}(x)\}$

$\mu_{RMP}(x,y) = \mu_{FP_1}(x)\,\mu_{FP_2}(y)$



## روابط فازی



## روابط فازی

Fuzzy Inference System

Rule (i) :

IF $\langle FP_{1i} \rangle$ THEN $\langle FP_{2i} \rangle$

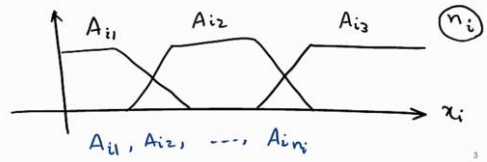
Rule Base



## روابط فازی

Input :

$x_1, x_2, \ldots, x_i, \ldots, x_N$

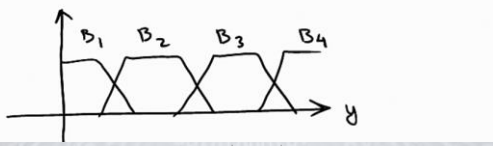





## روابط فازی

Output:

$y \rightarrow B_1, B_2, \ldots, B_{ny}$ ($ny$)



## روابط فازی

Rule (k) :

IF ($x_1$ is $A_{1l_1}$ and $x_2$ is $A_{2l_2}$ and ... — and $x_N$ is $A_{Nl_N}$) مقدم

THEN ($y$ is $B_{ly}$) تالی

مجموعه فازی

$\mu_{B_{ly}}(y)$





## روابط فازی

Rule (k):

IF $FP_{1k}$ Then ($y$ is $B_{ly}$) $\mu_{B_{ly}}(y)$

$$\alpha_k = \min\{\mu_{A_{1l_1}}(x_1), \dots, \mu_{A_{Nl_N}}(x_N)\}$$

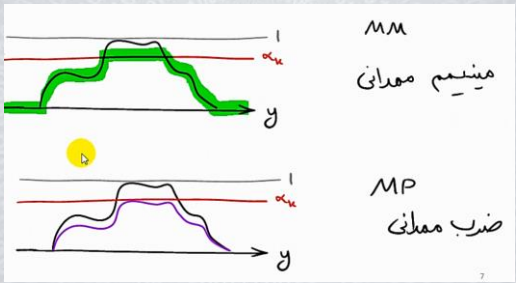
یا

$$\alpha_k = \mu_{A_{1l_1}}(x_1) \times \dots \times \mu_{A_{Nl_N}}(x_N)$$





## روابط فازی




MM

مینیمم ممدانی

MP

ضرب ممدانی

## روابط فازی

$\alpha_k$ $\mu_{B_{ly}}(y)$

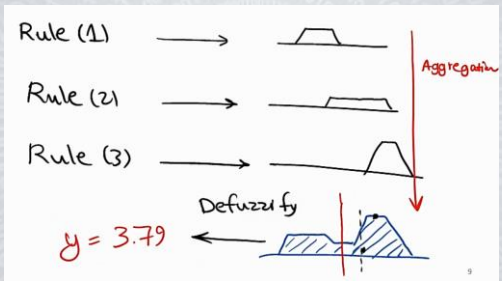
MM: $\min(\alpha_k, \mu_{B_{ly}}(y))$

MP: $\alpha_k \mu_{B_{ly}}(y)$

هردو توابع تعلق هستند



## روابط فازی






## روابط فازی