Measuring and Evaluating Urban Textures Abrasion Amount by Using Fuzzy Logic,Index Overlay, AHP

Dr. Mohammad Ajza Shokouhi
Assistant Professor of Geography and Urban Planning
Ferdowsi University of Mashad, Iran

Parisa Roshani
PhD Student of Geography and Urban Planning
Ferdowsi University of Mashhad, International Branch, Iran

Alireza Hassani
M.A of Urbanism from Science and Industry University
Tehran, Iran

Seyed Ali Hossienpour
PhD Student of Geography and Urban Planning
Ferdowsi University of Mashhad, International Branch, Iran
Binaloud University College of Mashhad

Abstract

Urban textures abrade as a result of natural factors, human and time factor, and time factor potentially revels in other factors (natural and humanistic). Combining these three factors (natural-humanistic- time) in a way that all of them had measured by their especial features is one of the main problems for estimating amount of texture abrasion. The purpose of this paper is estimating amount of urban texture abrasion by using AHP models, fuzzy logic and index overlay by which regions will recognize respectively according to amount of their abrasion, and necessary actions will done according to type of abrasion and their priority. The method which is used in this paper is analytical which is used GIS tool and programming models in order to reach purpose of the paper. By using fuzzy logic, qualitative and quantitative criteria which are affecting on texture abrasion are normalized and ordered in a period from one to zero numerically and continuously and prioritizing of these criteria will be recognized by using analytical model of index overlay. The amount of urban texture abrasion could be reached by combining these criteria and regarding to level of their prioritizing and present strategies and solutions appropriate for each type of abrasion in textures. As the most important and significant features of this method, in comparison with other classic models such as Boolean model (zero and one model), is its flexibility. Analysis and estimation will be more real while increase number of indexes and criteria in this model. Other political and economical considerations have been noticed in this model.

Key Words: Urban Drop, Abraded texture, AHP, Fuzzy Logic, Index Overlay

1-Preface and Subject Design

Change and evolution of a principle is necessary for human life and live and city that it's space and acceleration is different and needs so many factors. City changes can be fast or slow and in both cases such changes will leave effects on time and place and make a deep evolution on urban life and live, also it causes abrasion and erosion and/ or even evolution and recreation in urban activities and spaces (Hanachi,2004).

Abrasion causes disorganization, imbalance and inappropriateness in cities. Urban abrasion leads to many disorders in urban body and activities and as a result it causes to happen some problems such as not suitable access to urban vehicles, services and facilities and urban infrastructures … . Also, issues such as not having social identity, immigration of local people from texture and invasion of low paid people to texture, all are its features (UNCED, 2005).

Inhabitants, people who inhabit in these textures, mostly have low social class and economical level, they can't afford to develop and improve their living place and don't cooperate with urban managers in field of improving, modernization and reconstruction (Robert, 1982).

On one hand, unprogrammed interventions and ignoring priorities of urban abrasion is a barrier for reconstruction of such textures that at least leads to issues such as disorganizations and moving urban growth toward urban suburbs. Therefore, it leads to more costs to build textures with better quality in other urban places.

2- Goal and Work Method

Regarding expressed points, thoughtful notice and precise programming to urban textures is a necessary matter and it is necessary that intervention in textures had done suited with fundamental needs and essential priorities. So, the goal for representing this paper is to estimate amount of urban texture abrasion by using AHP models, fuzzy logic and index overlay, by which the regions will recognize respectively according to amount of abrasion and necessary actions will done.

In this paper at first concepts and basic terms and then models of data combination will study. Finally, the models mentioned above will be used to estimate amount of texture abrasion.

3- Estimate amount of textures abrasion

1-3 Terms and Concepts

Texture: By texture it means combined rangewhich had been shaped during period of city life time within urban space or suburbs in relation andcontinuity with city together withdifferent morphology (Sharan, 2006).

Abrasion: By abrasion it means that inefficiency and reduced usefulness of texture have studied in comparison with average of urban textures in a place. Abrasion of texture or its internal elements have been made due to old age and/or lack of developing program and technical observation on making texture. The result of texture abrasion, that finally caused to destroy its primary value for citizens, has been recognized and understand in different shapes and models such as decrease or lack of biological and security condition, physical, social, economical and facilitative disorder (Shafayee, 1385).

Abraded texture called to a texture of city that itshabitual capabilities was reduced, habitants don't satisfy with living conditions of that special place and don't feel safety and it doesn't fulfill their fundamental needs (Andalib, (A), 2006).

Total abrasion: total abrasion which have been permeatedboth in its body and activities and leads to its total abrasion (Habibi and Maghsoodi, 2002).

Relative abrasion: relative abrasion happens in body or activities and caused to relative abrasion in urban spaces (Habibi and Maghsodi, 2002).

Abraded textures strain because of different reasons, so they have been seen with different aspects of various shapes. Disorders in following cases are the most comprehensive aspects for determining and defining identity and recognizing texture area:

1)Physical shape 2)texture solidarity and stability and building materials of internal parts of texture 3) structure and infrastructure 4) performance of network system 5) functional dimensions 6) environment situation 7) social dimensions 8) economical dimensions 9) operation of urban management 10) kind of ownership (Tisdell, 1996).
Urban drop has represented due to increasing unemployment, changes in population (exit of immigrants, workplaces and activities from internal parts ofcities), In fact, urban drop isspatial concentration of environmental, physical, economical and social problems (Cowan, 2005).

Urban drop has different dimensions. If at first steps of noticing to urban drop, physical drop is received more attention, then after that social drop, means occurrence of types of social disorders and economical drop in meaning of reduceemployment opportunities alsomentioned, recognized and analyzed better (Roberts, 2000:63-64).

Fuzzy logic: fuzzy logic or undetermined and obscure logic take mathematical classification so many concepts and variables and systems which are vague and inaccurate and provide fields for reasoning, control and making decisions under uncertain condition (Farhoodi, 2005).

Hierarchical analysis: (AHP) process of hierarchical analysis is an strong and concentrate method which is used under condition that different decision making criteria makes it difficult to make decisions between options (Atthirawong, 2001).

3-2 Models of layers synthesis

Boolean logic or Zero and One logic

Boolean logic had taken from the name of mathematician named JeorgeBooli, in this logic weighting of units in each layer of information is done according to zero and one score (Malczewski, 2006).

In this model, one entrance map has been created for each factor. One score represents appropriateness and zero score shows inappropriateness of spatial location of that pixel. Then entrance maps synthesis with each other by using Boolean And or Or operator and create a Bionary exit map. If maps combined by AND operator, then pixels which containing value 1 in exit map show places that provide all factors related to considered use. And if entrance maps have been combine by OR operator, so pixels that containing value 1 in exit map, show places that one or more factors are correct in them (PirMoradi, 2005).

Index Logic (weighting to criteria)

In this model, different weights had gave to different classes and various complications which are available and flexible combinations thathave been obtained from maps, support domain of numbers.

In this model, location finder criteria order according to their level of importance that have been obtained, criteria and sub criteriahad been weighted. The important point which should be mention in this model is the fact that order of importance has changed based onkind of project and economical, social, cultural andbody condition which is ruled on project (Bonham, 1994).

This model used to put suggested options in order based on considered criteria and accordingly the option which is in the highest level have the most suitable case for intervention. The following table simply represents sample of weighting criteria.

Table 1: Sample of criterion weighting

Row	Criterion	Obtained Score	Number of Subcriterions	Score between Sub Criterions	Obtained Score of Sub Criterions	
1	A	3	5	(3/5)	(1)	3
					…	…
					(5)	4 (3/5) -5
2	B	2	4	(2/4)	(1)	2
					…	…
					(4)	-3 (2/4) 2
3	C	1	8	(1/8)	(1)	1
					…	…
					(8)	-7 (1/8) 1

Source: Writers, 2012

Fuzzy Logic or Undetermined Logic

This hypothesis has been represented for the first time by Iranian scientist professorAskarLotfiZadeh who is teaching in Berkley University USA, in order to act under condition of uncertainty.

This hypothesis is able to grant mathematical order to many inaccurate and vague concepts and variables and systems and provide fields for reasoning, control and making decisions under condition of uncertainty. Level of membership disclosure, gathering and sharing, complementarity, multiplication, sum, … are main abilities of this synthesis model. Mathematic functions such as linear threshold,Hyperolic and … in order to make layers and fuzzy sets(Sui, 1994). For example if several variables such as nearing to network roads and or fault have been studied for location finding of urban facilities, determining level of membership is as following (LotfiZadeh, 1978) :

$$F_{(x)} = \begin{cases} if x < 1000\, meters \rightarrow \\ if\ 4000 < x < 1000\, meters \rightarrow \dfrac{X_{max} - X}{\Delta X} = score \\ if x < 4000 \rightarrow (0) score \end{cases}$$

It means that fuzzy amount of 1000 meters locationfrom connection road equals to (1), fuzzy amount of 4000 meters location from road equals to (0) and fuzzy amount of 1600 meters location by using linear threshold function equals with 0/46.

For all other layers the same action is used and worth of region space is calculated. Maybe the biggest weakness of this model can be called as not standard weighting based on differentideas and opinions (Gerla, 2001).

Probability Logic

In this logic, different data layers are combined with each other by using models of match coefficient, Capa index, Entropy, Moran index, Kramer and …. . And they have been analyzed in two by two or several layers (Dubois, 2001).

Coefficient of Correlation

It has been recognized based on analysis of two layers of variables correlation value such as disease distribution and population density, acceleration and accidents, height and temperature and … and weighting to layers will be based on highest coefficient of correlation.(Azar, 2006)

Artificial Neural Network

It is kind of modeling according to human's brain which has been stimulated by using mathematical models. Use of this model in layers and variables modulation is still at the beginning of the road (Kasabov, 1998).

3-3 Using AFI model in estimating texture abrasion amount

This model itself is a modulation of three models and scientific logic that effective factors in weighting textures abrasion could have been estimated and analyzed based on this model. Abrasion which is defined based on mentioned definitions is resulted from humanistic, time and geographical factors that these factors have been appeared in appearance of building.

Generally, factors affected in physical abrasion can be classified in following cases:

Age of building: This factor resulted from time condition as older age of the building will be increase probability of abrasion.

Kind of materials: In classification of Statistics Center, building materials can be divided into durable, Semi durable, Weak, and …. .

Floors: Most of abraded buildings have one or at least two or more floors that this factor itself returns back to kind of materials used in building.

Situation of accessing to passerby: Blocks which don't access to transportation network, can't use urban services appropriately and less people tend to live there and these blocks be inhabitant longer (Habibi, 2006).

Access to infrastructure services: Tendency to live in buildings which have lower infrastructures than minimum level is less than other places and such buildings being empty for longer time period.
Neighborhood, Consistency, Inconsistency and …

Over than mentioned physical factors, social, economical and environmental factors play an important role in urban drop and abrasion. As social factors can mention to level of illiterate and education, race groups and population density and … .

Economical factors have been studied in field of level of income, employment situation and unemployment, price and land worth and building and … (Kalantari, 2005). Environmental pollutions (noise, sound, air and …), being near or far from faults and flood ways and …. are environmental factors (Seven Cities, 2005).

Measuring level of importance for abrasion factors

Hierarchical analysis process (AHP) is used for measuring this amount. In order to determine coefficient (importance), criteria have been compared two by two and analyzing matrix has been made and then consistency coefficient had measured (Zebardast, 2002). For ease of obtaining to the result, Expert Choice software can be used for measuring amount and level of importance for factors. After doing this step, factors which are effective in abrasion have been ordered according to level of importance.

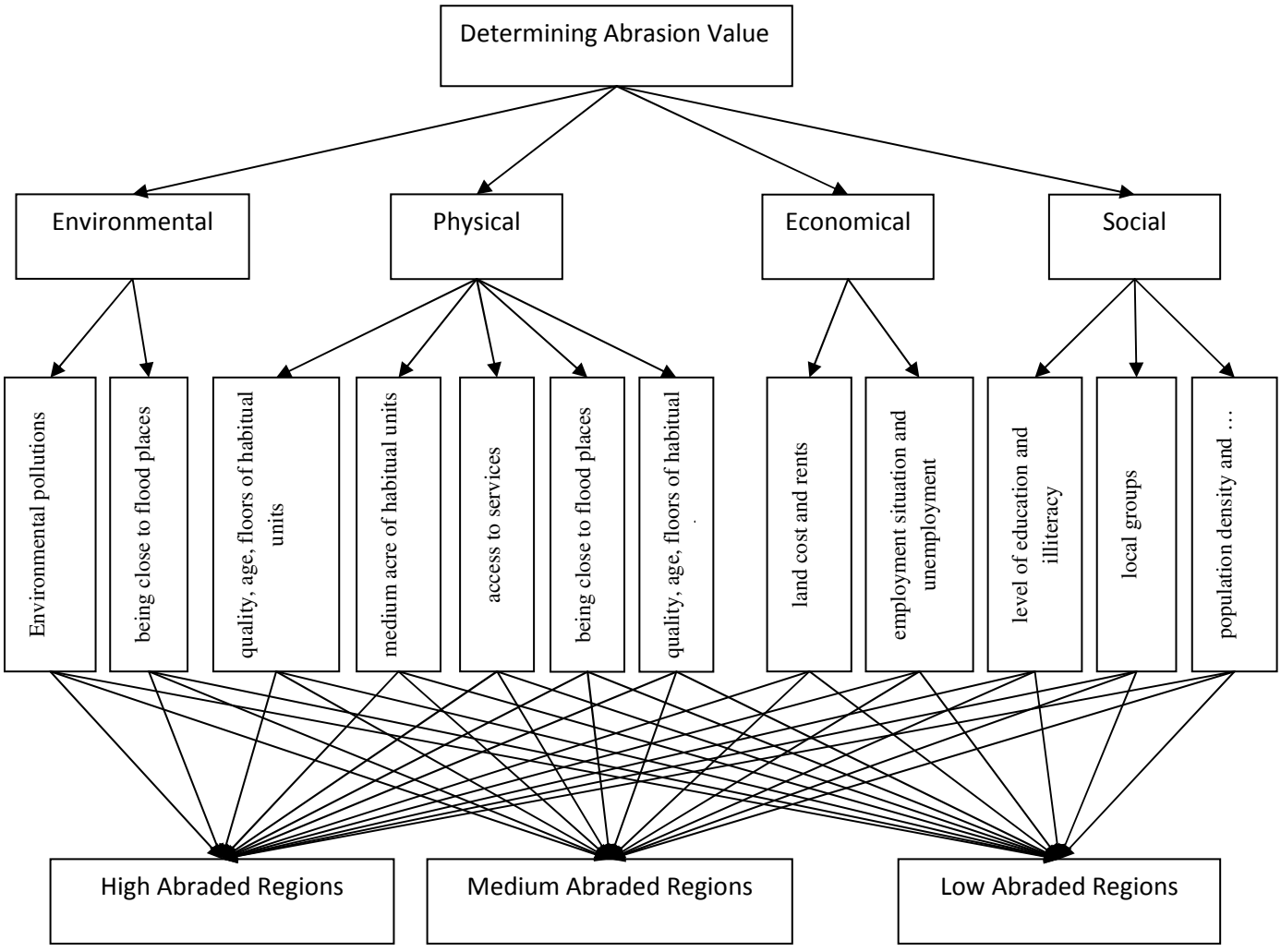

Figure 1: Making hierarchy of criterions and goals for determining regions which are faced with urban drop

Weighting to abrasion sub criteria

One of the limitations in this step is differentiation of measuring amount of factors which are effective in abrasion that this limitation can be increased by using Fuzzy Logic, as all sub criteria have changed to mathematical quantity and in closed period of zero to one by using this method and or on the other word different criteria have been normalized and numerical by using Fuzzy Logic.(

Measuring Abrasion Amount

In order to measure abrasion amount after analyzing options, in comparison with each other and also normalizing them, Index Overlay method is used.(Mc Donell,1995) Abrasion factors have been ordered based on hierarchical analysis and their score will be calculated in reverse of their amount. As if factors 18 are effective in physical abrasion, the factor which is in level 1 has been obtained score 18and the factor that is placed in level 18 has been obtained score 1. Then, these scores have been multiplied in scores of sub scores (that obtained in Fuzzy Logic).

For example, if a criterion gains score 15 and its sub criterion gains score 0.87 in fuzzy logic then the score of that part in that criterion is equals with 13.05.

Then other scores is calculating for abrasion factors and these scores is summed together in each part and the abrasion value of that part has been estimated. For example, if a region is gained score 8.14 for building quality factor and score 12.14 for floor factor and … therefore the abrasion value of that region is equals with:

8.14+12.14+ …

So, scores have been classified in GIS environment for all parts respectively according to their level of priority (Campbell, 1995). The regions which gained the highest scores are more abraded, therefore several operational solutions will be suggested to improve abrasions according to abrasion value.

4- Conclusion

In this paper, AHP, Fuzzy Logic and Index Overlay synthesis model had been used in order to estimate abrasion value of parts in urban textures.By using this model, intervention in textures become efficient and targeted. Urban managers and other authorities, who can intervene in texture, can become aware of relative value of textures abrasion and according to recognized priorities intervene in textures. Such interventions, which are based on aware decisions that are completely match with abrasion value of urban texture, may lead to savings in time and costs and also improve quality of decision making and policy making levels in range of urban management. Use of this model improve realism for offer intervention suggestions about urban abrasion textures and make it closer to operational steps.

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