MODERN PROBLEMS OF RADIO ENGINEERING, TELECOMMUNICATIONS AND COMPUTER SCIENCE

Proceedings of the XII[th] International Conference

TCSET'2014

Dedicated to the 170[th] anniversary
of Lviv Polytechnic National University

February 25 – March 1, 2014
Lviv – Slavske, Ukraine

Ministry of Education and Science of Ukraine
Lviv Polytechnic National University

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SECTION 5
THEORETICAL, SOFTWARE AND ALGORITHMIC ASPECTS OF INFORMATION SYSTEMS AND TECHNOLOGIES DESIGN

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Determination of the Set of Virtual Communities Indicators for Higher Education Institutions (HEI)

Korzh Roman, Peleshchyshyn Andriy, Trach Olha

Abstract - **In this article, the social relevance indicators are defined according to a standard set of socio-demographic characteristics, communication and social indicator of virtual community and importance of group characteristics.**

Keywords - **Higher Education Institutions (HEIs), Virtual community, Social relevance, Communication value, Communication complexity, Thematic relevance.**

I. Introduction

Virtual communities over the Internet are once of the most prospective information environments of the HEIs. However, a significant number of thematically relevant communities for the HEIs originate the problem of selecting the set of those that are much more relevant with provision for the other criteria. Further the concept of a set of virtual community indicator for the higher education institutions (HEIs), namely: the social relevance, the communication value, the communication complexity and the thematic relevance are proposed.

II. Determination of the Social Relevance

Socio-demographic characteristics of virtual communities identify the nature of the audience, which forms the community and, consequently, the proximity of a community task facing higher educational institutions in a process of information activities.

Socio-demographic indicators of virtual communities (VD – groups) are:

- domain (VDRg);
- age (VDAge);
- education (VDSL);
- profession, occupation (VDWD).

The degree of specific community socio-demographic characteristics proximity to the auditorial HEIs for certain thematic group a set of values is an indicator of social relevance and stands for a crucial coefficient to an extent of the virtual communities and generators of information image importance.

Control values are formed by experts on a base of tasks of information activities within a certain community groups.

The list of community groups is formed for the reason of the main HEIs activities with the reference to information activity:

- educational communication;
- business (administrative) communication with students;
- work with matriculants and marketing of educational services;
- scientific communication and marketing of research results;
- administrative activities and staff monitoring;
- economic activity;
- social, cultural and sport activities. [1]

A standard set is formed for each of the specified areas that underlies determining of proximity degree of a particular virtual community to the required, which determines the relevance of the social community. We use this indicator to identify the Euclidean measure of proximity.

Supposing $\overline{VD}^{(P)}$ - standard set of socio - demographic characteristics for the direction of *P*-activity and $Imp\left(VD^{(P)}\right)$ - importance of VD-group characteristics for P-destination, moreover $\sum_{IMPx \in IMP\left(VD^{(P)}\right)} IMPx = 1$ and $0 \le IMPx \le 1$ $\forall IMPx \in IMP\left(VD^{(P)}\right)$.

Then social community relevance in P-direction:

$$Soc\,Rel^{(P)}(VC_i) = 1 - \sqrt{\sum_{VDx \in VD^{(P)}} \frac{\rho^{(SR)}(VDx(VC_i), \overline{VDx})^2}{Diametr^{(SR)}(VDx)^2} Imp(VDx^{(P)})} \quad (1)$$

where: $Diameter(VDx)$ - maximal flow rate difference in attribute values VDx, $Imp\left(VDx^{(P)}\right)$ - scaling factor for the VDx feature in P-direction, $\rho^{(SR)}\left(VDx\left(VC_i\right), \overline{VDx}\right)$ - numerical measure of the difference between the basis for the community and control the distance between them.

The function $\rho^{(SR)}\left(VDx\left(VC_i\right), \overline{VDx}\right)$ is computed according to the formal features of criteria, not directly as an arithmetic difference. Let us consider this question in details.

Each of the criteria are not scalar, but are rather complex objects, which can be described at least as the probability distribution for a given set of values.

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Moreover, for VDRg indication description can bear multi-layered nature.

In this case, "value difference" is thought to be a certain dimension, which reflects the proximity of two objects of the same structure – the standard and the real one. Such value is calculated according to the rules of a particular domain (for example, the calculation of proximity by region must include the geographic coordinates and administrative division). The definition of proximity measures is scientific and applied problem for social and marketing researches and goes beyond the scope of this work. [2]

In case it is mutually and is considered as a platform for information activities for several areas, the largest set of indicators for directions is taken as an indicator of social relevance:

$$\mathrm{SocRel}(\mathrm{VC}_i) = \max_{\{P_i\}} \left(\mathrm{SocRel}^{(P_i)}(\mathrm{VC}_i)\right) \qquad (2)$$

where $\{P_i\}$ - a quantity system of all direction activities.

Importantly, the change of enumeration of Higher Education Institutions(HEIs) direction activities and socio-demographic characteristics does not lead to the change in the method of calculating the social virtual community relevance.

III. Determination of the Communication Value and Communication Complexity

Communication specifications describe rules and style of communication in virtual communities and, therefore, serve as the basis of the applied techniques of effective communication in communities of various kinds. These characteristics are divided into the following groups:

- terms of Registration and Identification (a need to provide personal information (VGPD), possibility of presenting professional data (VGWD), usage of single social networking profile (VGSN));
- advertising and marketing information (allowed advertising (VGAd), allowed information about the organization and announcements (VGN), allowed a link to their own information resources (VGSR));
- language characteristics and the nature of rhetoric (procedural language community (VGHL), the general level of aggressiveness (VGAG), the presence of deliberate trolling (VGTR), moderation stiffness (VGMR), usage of profanity (VGPC)).

In practice, the formalization of communication value is an important feature of intellectualization software and algorithmic means of information activities. This applies to:

- facilitation of registration of membership in the community;
- intellectual posts verification for compliance with the rules of the community;
- constructing algorithms for finding optimal performers for each community separately.

Some indicators (VCMR, VCPC etc.) should be used to formalize communication procedures in hostile environments (for instance, appealing community moderator in accordance with opponent's abuse). [3]

In addition, two synthetic indicators are based on the characteristics of this group: the value of communication and communicative difficulties, which should be used in determining the overall importance of community.

Indicator of communicative value states in which way the community rules are beneficial to the *Higher Education Institutes(HEI)* in terms of active informational activity, that is, as far as possible to benefit in terms of improving the information image of the HEI. For example, a community where posting links to their own resources is prohibited, are less valuable than similar communities, where it is allowed. Given a list of basic characteristics define this indicator as a following:

$$\begin{aligned} ComUf(VC_i) &= SocRel(VC_i)(VGPD(VC_i)* \\ &*VCU^{(VGPD)} + VGSN(VC_i)VCU^{(VGSN)} + \\ &+VGAd(VC_i)VCU^{(VGAd)} + VGN(VC_i)* \\ &*VCU^{(VCN)} + VGSR(VC_i)VCU^{(VGSR)}) \end{aligned} \qquad (3)$$

where: $VCU^{(VCPD)}, VCU^{(VCSN)}, VCU^{(VCAd)}, VCU^{(VCN)}, VCU^{(VCSR)}$ - appropriate weighting coefficients for performance.

Indicators of social relevance factor $\mathrm{SocRel}(\mathrm{VC}_i)$ stands for the multiplier for weighted sum of features.

Communication complexity factor indicates how time consuming and difficult is the basic of communicative activities in the community (without substantive aspect), that is, how difficult is the communication on universal level. High level factor indicates a potential threat to the image of the device by the concept of evaluating by society a person whom he or she communicates with. As a result, participation of representatives of higher education institutions in such communities should be limited to circle of people who have special psychological and rhetorical training. Accounting such representatives is useful feature is the integrated computer and information management system.

Considering a given list of basic characteristics let us define the communication complexity indicator as a following:

$$\begin{aligned} ComCost(VC_i) &= VGHL(VC_i)VCU^{(VGHL)} + \\ &+VGAG(VC_i)VCU^{(VGAG)} + VGTR(VC_i)* \\ &*VCU^{(VGTR)} + VGMR(VC_i)VCU^{(VGMR)} \end{aligned} \qquad (4)$$

where: $VCU^{(VGHL)}, VCU^{(VGAG)}, VCU^{(VGTR)}, VCU^{(VGMR)}$ - appropriate weighting coefficients for the

performance, $VGHL(VC_i)$ - numerical function that reflects the usage of one or another language. Inverse dependence of moderation is typical for the indicator $VGMR(VC_i)$. This is due to the fact that, contrary to common opinion, mostly strongly moderated communities are easier for communicative environment in terms of users with a high level of culture and education (to which respectively refer representatives of the university, academic staff and administration).

Communication complexity factor is one of the components of the overall indicators of using community. [4]

IV. DETERMINATION OF THE THEMATIC RELEVANCE

A set of indicators that further characterize virtual communities in comparison to traditional websites has been considered above. The formalization of these characteristics is the basis of a unified information and mathematical models of universal folder of web communities.

However, for some problematic areas more additional characteristics that reflect their specificity should be devoted to the web-community .

Recording and analysis of community educational profile is important for the university, regardless of whether the community is targeted to higher education. For certain tasks facing universities (such as career guidance) require information activities in these communities.

In this way, the basic characteristics of virtual community in educational field VC_i is described by a tuple:

$$VCS\_Ch(VC_i) = (VT(VC_i), VA(VC_i), VI(VC_i), VD(VC_i), VC(VC_i), VS(VC_i)) \quad (5)$$

where: $VS(VC_i)$ - group of special characteristics for community in educational field.

Taking as a subject problematic area in education field we distinguish the following additional characteristics for subgroups communities:

- educational profile;
- community issues;
- tone of the community;
- association with the institution.

Special performance of virtual community in educational field (group VS) of listed above groups:

- Association with the institution (maintenance (VSTS), influence on policy moderation (VSMP), traffic exchange from the official site (VSTE), availability of information obligations regarding community support (VSIS), usage of a single account (VSCA)).
- The educational profile and community issues (educational level (VSSL), community subject (VSTh), the main problems, which are discussed (VSP), the main task of participants (VSMA), the main motivation of the owners (VSMM)).
- The tone of the community (attitude to education in general (VSLR), attitudes towards educational institution (VSUR), the presence of negatively motivated participants (VSAM)).

The above characteristics bear socio-communicative, humanitarian nature, but their incorporation into formal models and architecture of information management activities system allow the university to expand the possibilities for optimizing staffing process and quality control assignments. Individual characteristics (use of profanity, tone) can be set according .to applied linguistics analysis of texts, including algorithmic means of lexicographical and sentiment analysis.

Given values are used to modify the parameters of the communicative value (see (3), (4)) and communication complexity based on the features of virtual communities and the educational direction of their subjects and to determine the relevance of content meaningful community areas of the university. [5]

Supposing $\overline{VST}^{(T)}$ - standart set of characteristics and problems of the community profile for the direction of P and $Imp(VST^{(T)})$ - importance of the attributes of the **VST** group for thematic areas **T**, while $\sum_{IMPx \in IMP(VST^{(Th)})} IMPx = 1$ and $0 \le IMPx \le 1$ $\forall\, IMPx \in IMP\,(VST^{(Th)})$.

Then the community thematic relevance in the subject T:

$$Th\,Rel^{(Th)}(VC_i) = VSA(VC_i) * * \left(1 - \sqrt{\sum_{VDx \in VD^{(Th)}} \frac{\rho^{(TR)}(VSTx(VC_i), \overline{VSTx})^2}{Diametr^{(TR)}(VSTx)^2}} * * \sqrt{\mathrm{Im}\, p(VSTx^{(Th)})}\right) \quad (6)$$

where: $Diameter^{(TR)}(VSTx)$ - maximum flow rate difference in attribute values $\rho(VSTx(VC_i), \overline{VSTx})$ - numerical measure of the difference between the criterion for the community and control, the distance between them VSTx , $Imp(VSTx)$ - scale factor for the criteria $VSTx$ ((coefficient is not determined for each subject separately Th, considering the large number of possible subjects for the HEI)) $VSA(VC_i)$ - association coefficient of the university community.

$$VSA(VC_i) = VSMP(VC_i) VSTE(VC_i) VSIS(VC_i) VSCA(VC_i) \quad (7)$$

The function $\rho^{(TR)}(VSTx(VC_i), \overline{VSTx})$ is defined as the formal distance between the semantic concepts or subjects. To determine this distance it is advisable to use the theory of graphs (route length between the nodes of

the semantic network), semantic analysis (proximity concepts) and fuzzy logic (linguistic variables).

Obviously, for the Higher Education Institutes (HEI) there are a number of thematic areas that form appropriate set $\{Th_i\}$, which describes the whole complex of subjects that are relevant information of the university activities. When the greatest of criteria by categories is taken as a content relevance indicator.

$$ThRel(VC_i) = \max_{\{Th_i\}}(ThRel^{(Th)}(VC_i)). \quad (8)$$

Subject relevance is specifying coefficient to determine communicative value. Thus, community communication value can be substantially reduced if contextual relevance is low. Thus the rate of communicative value of educational communities $ComUfE(VC_i)$ is obtained by incorporation of content relevancy community:

$$ComUfE(VC_i) = ComUf(VC_i)ThRel(VC_i). \quad (9)$$

Communicative complexity factor of the educational community is formed by correcting the total communication complexity factor (4) considering features of the educational community.

$$ComCost(VC_i) = VSL(VC_i)(VGHL(VC_i)* *VCU^{(VGHL)} + VGAG(VC_i)VCU^{(VGAG)} + +VGTR(VC_i)VCU^{(VGTR)} + VGMR(VC_i)* *VCU^{(VGMR)}) \quad (10)$$

where: $VSL(VC_i)$ - indicator of community loyalty:

$$VSL(VC_i) = VSLR(VC_i)VSUR(VC_i)VSAM(VC_i) \quad (11)$$

Communicative complexity factor of the educational community is one of the components of the overall criterion for using community to carry out information activities in the Higher Education Institutes (HEI) [6].

V. Conclusion

Mentioned above set of indicators is oriented on communication tasks, though their incorporation into formal models and the ATM Architecture & Information Management activities allow the HEIs to expand the possibilities for optimizing staffing process and quality control assignments. Some criteria can be identified by using computer-linguistic analysis of texts, in particular algorithm means of lexicographical analysis.

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