Procedia Computer Science

Volume 88, 2016, Pages 359–364

7th Annual International Conference on Biologically Inspired Cognitive Architectures, BICA 2016

Migration of the Individuals

Viacheslav E. Wolfengagen[1], Larisa Yu. Ismailova[1], Sergey V. Kosikov[2], Irina A. Parfenova[2], Mikhail Yu. Ermak[2], Vasiliy D. Petrov[2], Ilya A. Nikulin[2], and Victor A. Kholodov[2]

[1] National Research Nuclear University "MEPhI" (Moscow Engineering Physics Institute), Moscow, 115409 RF, {jir.vew@gmail.com; lyu.ismailova@gmail.com}

[2] Institute for Contemporary Education "JurInfoR-MGU", Moscow, 119435 RF, kosikov.s.v@gmail.com

Abstract

The individuals are modeled by the elements of variable domains. The primitive frame to detect the individual migration from domain to domain is proposed. The supporting computational model is based on a separation of individuals into actual, possible and virtual ones. As was shown, this leads to an adoption of the stage-by-stage cognition model with a pair of evolvents to capture dynamics of the domains – the 2-dimensions model. The first evolvent reflects the generation of the individuals in a domain, the beginning of and canceling out their existence in a domain. The second evolvent reflects the shifts in properties of the individuals. As awaited this unified data model will have the applications to a wide range of models in computer science and Information Technologies.

Keywords: data model, computational model, conceptual modeling, stage-by-stage cognition model, variable domains, Big Data, Thick Data

1 Introduction

The migration problem in a modern world is put on the superior positions giving rise to various analytical studies [12]. The dynamics of migration processes generates a manyfold of tasks including economical, social [1] and a lot of computational ones. This problem has especially many faces in computer science and Information Technologies, for instance, migration of data, software, pages in nets, Web-sites etc. The growing amount of research papers emphasizes the importance of a commonly adopted supporting computing model but a divers of particular results is yet far from a suitable solution.

Selection and peer-review under responsibility of the Scientific Programme Committee of BICA 2016

doi:10.1016/j.procs.2016.07.449

Smart drill-downs [7] lead to new kinds of exploration operators, but are not of computational generality for data dynamics. The dynamic of data in [8] is in association with Web-technologies and contributes in and brings in more dynamics in data modeling.

The flexible and dynamical data models are important for Data Science [4], data provenance [2], conceptual modeling, based on granularity [3]. These research results give a fat land for advancing the dynamic data models with the elements of evolutionary cognition representation.

A preliminary study of possible media of interaction and dynamics study was in [10] for semantic nets and in [9], [11] for applicative models in case of interaction of objects with environment. The vision of information processes with a high degree of dynamics from a point of view of computational thinking was studied in [5], [6].

In the current paper the further advance is proposed using as a central point the behavior of the individual in a domain. The assumptions are of rather general using: the notion of a variable domain; stage-by-stage cognition model with explicit evolvent; representable functor category to capture the dynamics both of the individuals and domains. Here is attempt to put up a unified approach to conceptual modeling. Migration of the individuals – regardless they are human beings, data, programs or information processes, – is considered in conjunction with the commutative diagrams in Section 2. Section 3 reflects the migration computational framework for individuals. Section 4 contains the brief study and a computational model to capture the migration directions of the individuals. Very short indication of suitability the method and computational model to Bid Data analysis is given in Section 5 covering the general commutative diagram for migration map.

2 Migration maps and commutative diagrams

Here is a discussion of a conceptual stand for objects in their dynamics.

2.1 Individuals: old-timers, migrants and clones

Individuals are those that are determined by the individualizing functions. In practice instead of term ‘individual’ there is a term ‘object’.

2.1.1 Generic and derived objects.

Most of the features that determine the objects can be duplicated, creating the *derived objects*, or *clones*. Usually this is a shared term to describe the copies, instances or references. Some features of objects can be copied, and the source object and a *copy* are independent. Using defining characteristics of the objects in multiple locations leads to the emergence of *instances*. Behavior of the instances depends on a strategy of the impact on the defining characteristics. *Links* borrow a certain amount of characteristics of the source, or *generic* objects, generating the pairs of objects, each of which includes its own set of unique characteristics. They take an intermediate position between copies and instances. The instance can be converted to an independent copy when it becomes the owner of the unique characteristics. The links lead to the emergence of a family of similar objects that share the same core set of baseline characteristics, but also have their own unique characteristics. The places of ‘living’ of the objects and their species are *domains*, and their behavior is determined by the strategies and ways of ‘settling’ the domains.

2.1.2 Inhabitance.

The individuals are gathered into the domains where they *inhabit*, but it is important to note that, at least, hypothetically they can be gathered into a single domain D. Assume that D is a domain of *possible* individuals, where 'possible' means 'possible relative a theory', which is set in advance. It is important, that possible individuals are *relative*, that opens a perspective of their resettlement on subdomains. The *virtual* individuals are idealized objects, which are introduced to increase a regularity. The *possible worlds* are known as different collections of individuals endowed with the structure or without it.

Assuming *migration* of individuals by domains, we conclude that individuals may emerge in the domain starting their existence, inhabiting the domain for any period, and then leave it, canceling out to exist.

Given the characteristics of the individuals inhabiting the domains, they can be represented by the *old-timers*, *migrants* and *clones*. The latter kind of individuals is treated collectively, but actually requires isolation and analysis of cases.

2.1.3 Migration.

The relocation of individuals from domain to domain requires the introduction of a system to regard of their migration. To express the migration will require some system of *indexing*. As known, any system of structures can be indexed by the elements of a suitable set, and in different ways. For a fixed set I, we obtain a system of *actual* individuals A_i for $i \in I$:

$$\underset{i\in I}{A_i} \subseteq D \subseteq V,$$

where V is a domain of the virtual objects, D is a domain of the possible objects, and A is a domain of the actual objects.

2.1.4 Concepts.

Mention the *concepts* in the sense of R. Carnap as constructions whose value depends on the indices, or *assignments* belonging to I, and forming a series of values, i.e. the *function*. Choosing 0 to indicate a lie, and 1 to indicate a truth, the elements of 2^I, where $2 = \{0, 1\}$, are considered as the *propositional*, and the elements of V^I as *individual* concepts. We can write:

$$\underset{i\in I}{A_i{}^I} \subseteq D^I \subseteq V^I,$$

resulting in a classification of concepts, which is parallel to the classification of individuals.

3 A migration map of the individual

The following layout can be referred as a *migration map* of the individual. The diagram in Figure 1 for the individual h, which is an *old-timer* in the old world A, reflects the map of his transformations.

3.1 A recognition of the migrant.

If the A-inhabitant h'' of a new domain can be decomposed as

$$h'' = g \circ h,$$

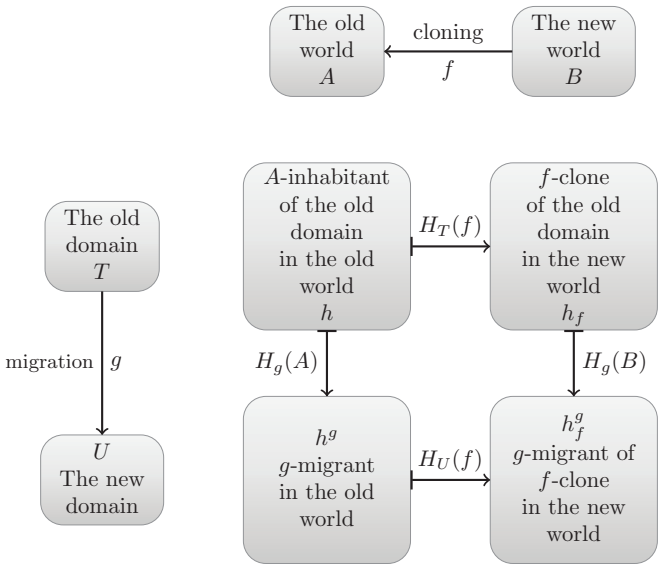

Figure 1: The map of individual transformations.

where h is the A-inhabitant of an old domain, then it is the *g-migrant* h^g:

$$h'' = g \circ h \equiv h^g.$$

Otherwise, it is an "atomic" A-inhabitant of the new domain, i.e. it is *A-generated* in the new domain U and its *old-timer*. Abbreviating, we say: *A-old-timer* of U.

3.2 A recognition of the clone.

In case the B-inhabitant h' of an old domain can be decomposed as

$$h' = h \circ f,$$

where h is the A-inhabitant of the same, i.e. of the old domain, then it is the *f-clone* h_f:

$$h' = h \circ f \equiv h_f.$$

Otherwise, it is an "atomic" B-inhabitant of the old domain, i.e. it is *B-generated* in the old domain T and its *old-timer*. Abbreviating, we say: *B-old-timer* of T.

3.3 Computational model.

Similar patterns in the form of a computational model can be expressed by the commutative diagram in Figure 2.

Note that events evolve along the evolvent $f : B \to A$ in the direction *from A to B* (pay attention to reversed order!).

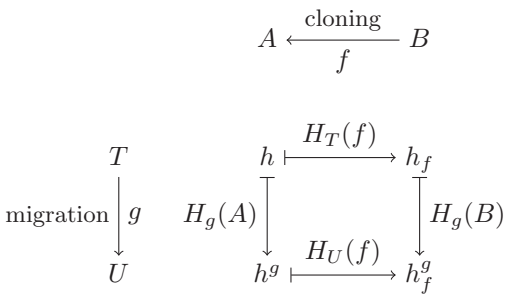

Figure 2: Computational model of the individual migration

4 A map of migration directions

The migration of individuals on the domains is relative, depending on the worlds. In order to become an inhabitant of that or another domain, the individual has the following possibilities: to be generated in this domain; to be f-cloned in the same domain; to g-migrate, generally speaking, of any other domain; finally, in general case, to be (f, g)-transformed. It remains now to understand with what kind of individual will we deal in this domain.

Thus, the old-timers, migrants and clones live different lives, and this difference can be expressed by a commutative diagram above. The community of B-inhabitants of the old domain consists of its B-old-timers and of the f-clones of A-inhabitants. The community of B-inhabitants of the new domain consists of its B-old-timers and of g-migrants of B-migrants of the old domain. To an observer, inside the domains, they are indistinguishable, and their recognition is possible, while being at the meta level.

5 Big Data and a migration map

Consider the effect giving a representation of the *dynamics* of a problem domain, and of rather general form. More specifically, we discuss the possible ways to change some domains, the counterpart elements of which are the individuals. In particular, we can discuss their "resettlement", "cloning" "copying", etc. Meaningful interpretation of g-migrants of f-cloned individuals needs a special diagram which is a consequence of the diagrams above.

This diagram is based on several assumptions dealing with the individual behavior. Suppose that the data can be distributed by the domains and worlds. How can be seen this assumption is not too restrictive. Cloned individuals "live" of the same life. The objects and corresponding explanatory systems can be represented in the form of *conceptual frame*.

Conclusions

In the current paper the further advance is proposed using as a central point the behavior of the individual in a domain. The assumptions are of rather general using: – the notion of a variable domain; – stage-by-stage cognition model with explicit evolvent; – representable functor category to capture the dynamics both of the individuals and domains.

[1.] An attempt to put up a unified approach to conceptual modeling has been done.

Migration of the individuals – regardless they are human beings, data, programs or information processes, – is considered in conjunction with the commutative diagrams.

[2.] The migration computational framework for individuals is reflected.

[3.] A brief study and a computational model to capture the migration directions of the individuals in the domains has been done. Computational model is based on the variable domains.

[4.] A very short indication of suitability the method and computational model to Bid Data analysis and Thick Data extraction is given covering the general commutative diagram for migration map.

Acknowledgements

This research is supported in part by the RFBR grants 16-07-00914, 16-07-00892, 16-07-00912, 16-07-00909; 15-07-06933, 15-07-06898; 14-07-00119; 14-07-00087, 14-07-00107, 14-07-00072, 14-07-00054.

References

[1] Ruben Andersson. Europe's failed fight against irregular migration: ethnographic notes on a counterproductive industry. *Journal of Ethnic and Migration Studies*, 42(7):1055–1075, 2016.

[2] Gabriella Castro Barbosa Costa. Using data provenance to improve software process enactment, monitoring and analysis. In *Proceedings of the 38th International Conference on Software Engineering Companion*, ICSE '16, pages 875–878, New York, NY, USA, 2016. ACM.

[3] Sonia Berman and Thembinkosi Daniel Semwayo. A conceptual modeling methodology based on niches and granularity. In *Proceedings of the 26th International Conference on Conceptual Modeling*, ER'07, pages 338–358, Berlin, Heidelberg, 2007. Springer-Verlag.

[4] Drew Conway. Data science through the lens of social science. In *Proceedings of the 20th ACM SIGKDD International Conference on Knowledge Discovery and Data Mining*, KDD '14, pages 1520–1520, New York, NY, USA, 2014. ACM.

[5] Larisa Ismailova. Applicative computations and applicative computational technologies. *Life Science Journal*, 11(11):177–181, November 2014.

[6] Larisa Ismailova. Criteria for computational thinking in information and computational technologies. *Life Science Journal*, 11(9s):415–420, November 2014.

[7] Manas Joglekar, Hector Garcia-Molina, and Aditya Parameswaran. Smart drill-down: A new data exploration operator. *Proc. VLDB Endow.*, 8(12):1928–1931, August 2015.

[8] Vasilis Verroios, Panagiotis Papadimitriou, Ramesh Johari, and Hector Garcia-Molina. Client clustering for hiring modeling in work marketplaces. In *Proceedings of the 21th ACM SIGKDD International Conference on Knowledge Discovery and Data Mining*, KDD '15, pages 2187–2196, New York, NY, USA, 2015. ACM.

[9] V. E. Wolfengagen. *Applicative computing. Its quarks, atoms and molecules.* Moscow: "Center JurInfoR", 2010.

[10] Viacheslav Wolfengagen. Semantic modeling: Computational models of the concepts. In *Proceedings of the 2010 International Conference on Computational Intelligence and Security*, CIS '10, pages 42–46, Washington, DC, USA, 2010. IEEE Computer Society.

[11] Viacheslav Wolfengagen. Computational ivariants in applicative model of object interaction. *Life Science Journal*, 11(9s):453–457, November 2014.

[12] Population Modeling Working Group. Population modeling by examples (wip). In *Proceedings of the Symposium on Modeling and Simulation in Medicine*, MSM '15, pages 61–66, San Diego, CA, USA, 2015. Society for Computer Simulation International.