

Val Tsourikov

Paper: Architecture of Self Learning A.I. Platform for Generative Art



Topic: Architecture

Authors:

Val Tsourikov

Predizo LLC

www.predizo.com

References:

[1]Tsourikov, V.,at al, (2000). "Document semantic analysis with knowledge creativity capability" U.S. Patent number 6,167,370.

[2] Galanter, P. (2012) "Computational Aesthetic Evaluation: Steps Towards Machine Creativity.

www.generativeart.com

Abstract:

The process of creation novelty includes two main phases: generation of many concepts and selection of the concepts that are novel and promising. These two phases are present in any type of creative process: in art, music, mathematics, technical inventions, fashion design.

We propose the architecture of A.I. platform, which can be customized for particular domain. The platform includes following modules: open knowledge base, generator of new structures, semantic distance measurer, trend detector, evaluator of degree of novelty of generated concepts, morphological space builder for promising concepts.

Open knowledge base is semantic by nature and consists of two parts: first part includes basic structures partially filled with content to represent most important existing domain knowledge (relations between colours, geometric figures, images), second part contains structures with high degree of abstraction and limited content. Generator of new concepts includes several algorithms: combinatorial, genetic, analogical reasoning. Novelty evaluator uses semantic distance to decide how novel the new concept is.

The purpose of morphological space builder is to quickly develop new promising concept by building N-dimensional space of many possible modifications of basic concept.

For example, if generator of new structures created semi-transparent white cube with black ball oscillating inside the cube, and experts like it, then shape, colour and oscillating frequency of the ball, as well as shape and colour of the cube will be replaced by many possible options to find the best combinations, i.e. morphological space of the created artefact will be built.

Problem of concepts selection. Evaluation of new concepts generated by A.I. software, is not a trivial task. We suggest to use semantic distance to choose revolutionary concepts and automatic trend analysis for selection of new concepts that may belong to existing or forming trends.

Contact:

valerymt@gmail.com

A.I. platform, semantic distance, trend detector

Architecture of Self Learning A.I. Platform for Generative Art and Films

Dr. Val M. Tsourikov,
Predizo LLC, Minsk, Belarus www.predizo.com
email: valerymt@gmail.com

1. Automatic generation of content as mega-trend

We define mega-trend as phenomenon that has three main features: high and lasting demand determined by fundamental society needs; existence of infrastructure to distribute products or services; technology reached critical point from which it can be used by masses. Let's do quick analysis of automatic content generation.

Content creation is a fundamental feature of human civilization: visual art, books, music, photographs, movies are being created with accelerated rate. Success of social networks as content sharing platforms proves, that content remains in high demand. Easy access to the Internet became a norm, i.e. infrastructure for content distribution exists and is available almost everywhere. A.I. technology for content creation is on the rise (semantic text analysis, natural language processing, voice synthesis, machine learning). Intelligent systems more and more often are used to solve practical problems.

In some areas modern A.I. systems are able to find creative solutions that are better than similar results found by human experts. In 1997 Deep Blue computer defeated G.Kasparov, the most ingenious chess player of all times. Interesting to note, that same year Boston based Invention Machine Corporation launched A.I. software IM-Phenomenon which was able to generate novel solutions of technical problems, in fact acting as an artificial inventor. IM-Phenomenon later was included in more broad software technology now called Goldfire Innovator [1], which is widely used by high-tech companies. Fast progress in generative art and music [2] also supports the idea that society is facing new mega trend – automatic content creation in many different areas.

Because all major components of mega-trend are ready, it's possible to develop A.I. platform for automatic content generation to be used not only by art professionals but also by normal internet users.

2. Main features of A.I. platform for automatic content generation

There are two objectives of the project:

a) to design and implement web-based Artificial Intelligence platform to enable easy access to tools of generative art and movies;

b) to create collaborative environment for people who want to create novel art and movies, that have value for end users and can successfully compete with traditional technologies of creating art and movies.

Key concepts of the platform:

- automation of all three main phases of creative process (novel idea generation, evaluation of new ideas, learning of new things, including trends detection in user preferences);
- adaptive nature of the platform, determined by machine learning and predictive analytics algorithms;
- pragmatic output of the platform – generated art and movies will be distributed to end users as products, which have aesthetic value.

Conceptually, the platform is similar to A.I. systems for creativity automation, developed earlier in space research, technical innovations [3] and financial engineering [4].

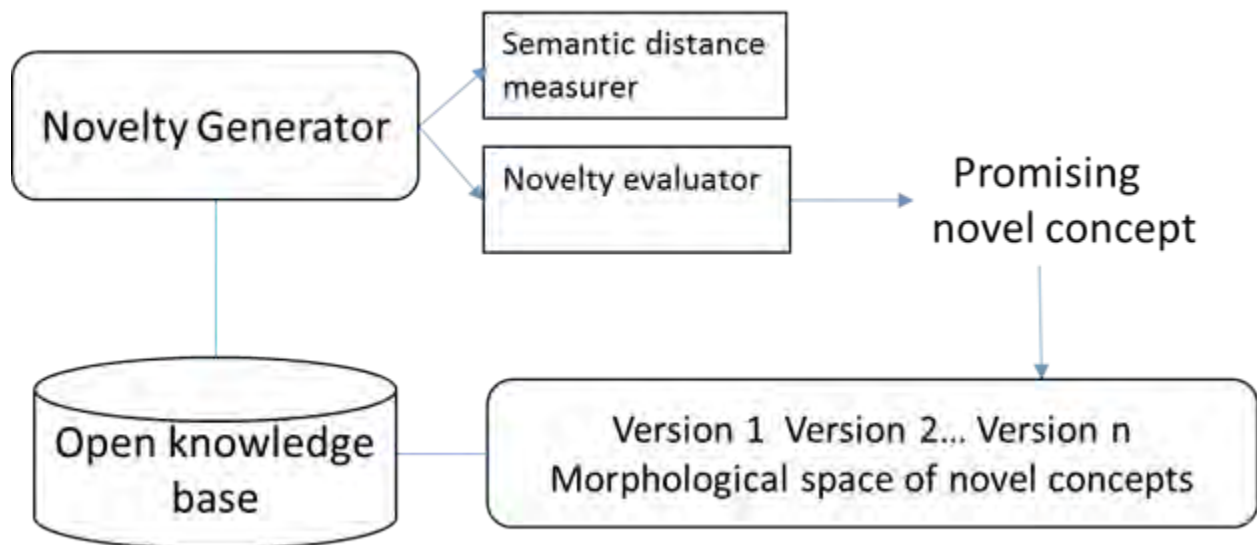


Figure 1 – Architecture of A.I. platform

The architecture of A.I. platform can be customized for particular domain. The platform includes following modules, as shown in Figure 1 :

- open knowledge base of abstract structures and shells,
- novelty generator of new structures and concepts,
- semantic distance measurer,
- trend detector of user preferences,
- evaluator of degree of novelty of generated concepts,
- morphological space builder for promising concepts.

Open knowledge base contains basic graphical structures, shells, music themes and abstract movie scripts. The knowledge base can be updated by platform developers or by end users.

Generator of new visual structures, texts, scenes and scripts acts as a composer of novelty. It constantly creates novel artefacts by using built-in knowledge bases, new trends discovered on the internet, and inputs from platform users. There are several algorithms involved in generation of novelty in this important module. Machine learning, trend analysis, inputs from users and predictive analytics help find promising directions in search for novelty and increase probability of creation valuable results.

Semantic distance measurer calculates semantic distance of newly generated structure or text and sends results to evaluator of novelty of generated concepts to determine formal coefficient, which shows how far new structure is from known concepts.

Trend detector uses semantic analysis and statistical machine learning algorithms to find evidence of trends being formed in sentiment, tastes in art, music and preferences in films. Data from this module is used to control computational process in generator of novelty module. Trend detector processes databases of social networks, online communities, clubs and other places where general users and domain experts express their opinions on art, movies and music.

Morphological space builder for promising concepts takes most innovative and practically feasible concept and generates all possible permutations of the concept, thus creating many versions of original idea. Main objective of this phase is to let end users to observe the entire universe of possible versions of novel concept at once and chose the most interesting candidates for further development.

The A.I. platform includes several universal modules, which can be used in all areas – from generative music to movies. For example, combinatorial intelligence, genetic algorithms, semantic processors [5], Bayesian networks, ant colony optimization and fuzzy logic can be applied to any domain.

Customizable modules have knowledge bases created by domain experts and later by platform users. Knowledge base for generative art will have different structure vs. knowledge base for generative films.

3. Methods of Novelty Generation

There will be two types of novelty generation approaches: analogy-based methods to generate art, music and movies that remain within boundaries of existing paradigms; and revolutionary methods which may help create new style in art or movies.

Direct analogy. This simple but practically very useful method uses replacement of objects or operations in entire system (graphical image, movie scenario) without changing the basic structure of initial system. For example, in movie script direct analogy means that conflict between two adult characters may be used to describe similar conflict between two teenagers, or slightly modified conflict between adults. Structure of the conflict remains the same, but it is moved to different time, culture, place or social group. Direct analogy algorithms sits on the top of all major abstract structures of visual scenes, scripts, dialogues.

Automatic creation of movie script from novel, short story, discussions on message boards, social network activity. Modern semantic processors are able to create meaningful summaries of texts, which will be used to generate movie scripts.

Interactive novelty generation. To make sure that novel ideas created on the platform have pragmatic value, human users will be involved as active participants in generative process. Computer creates novel idea, users approve or reject it; depending on user votes, the algorithm will take different path in search for novelty.

Pattern and scene recognition. Users load photographs, drawings, videos to the platform; pattern and scene recognition software finds most promising patterns or scenes and starts generative art or film algorithms to create novel content.

Introduction of new technology that will enable generation of novelty. For example, BCI (brain computer interface) may help create new forms of art, like direct emotional contact between artist and the audience. Combination of A.I., nanotechnology and synthetic life may lead to creation of self-controlled art-objects, which are alive and intelligent.

3d printing is rapidly changing the way art is created. The role of A.I. platform in this

case is to bring together new disruptive technologies, generative algorithms and users to quickly realize potential of BCI, synthetic life and similar revolutionary breakthroughs in science and technology [6].

The platform users will have an opportunity to apply many other methods of novelty creation, which have being developed in generative art, music and films.

If users see value in novel idea, concept or script generated by the platform, they will have an opportunity to refine original result by using special module of amplifiers of positive effects of new idea.

4. Collaboration

The platform will have feature rich environment for creative collaboration between artists, actors, script writers, musicians and managers. The concept of online film production network is not new, several of them exist today. What is new - and this is really critical difference – the layer of Artificial Intelligence between human users of the platform (Fig. 2).

A.I. tools make production of content (art, music, movies) much faster, cheaper and with higher probability of success (determined by predictive analytics and trend analysis). Intelligent generative technologies do not have internal cultural constraints, hence they may find unusual combinations of building blocks that human creators tend to miss.

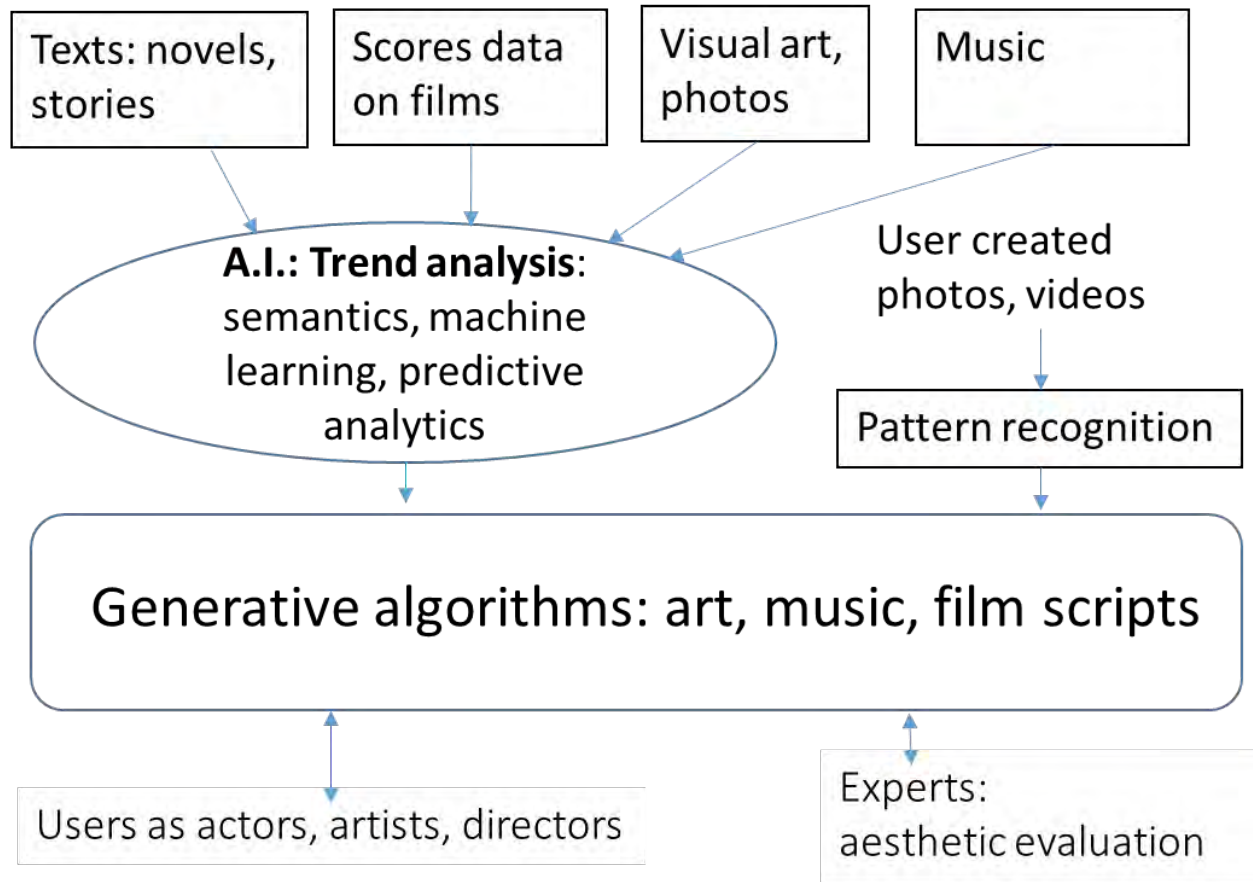


Figure 2 – Collaboration between users, experts and generative system

References

1. Tsourikov, V. Inventive Machine: second generation. *AI and Society*, 1993, 7(1): p. 62-77.
2. McCormack, J., d'Inverno, M. (editors). *Computers and Creativity*. 2012, Springer, 430 p.
3. Tsourikov, V. Invention Machine Project. *Journal of TRIZ (in Russian)*, 1991, 2(1), p.17-34.
4. Tsourikov, V., et al., A.I. system for automatic synthesis of trading technologies and portfolios for investment funds. In *International Conference on Artificial Intelligence*. 2008, p. 275-279. Las Vegas.
5. Tsourikov, V., et al, Document semantic analysis with knowledge creativity capability, 2000. U.S. Patent number 6,167,370.
6. Galanter, P. Generative art after computers. In *International Conference on Generative Art*. 2012. Milan, Italy: Generative Design Lab, Milan Polytechnic.