PATENTING YOUR COMPUTER MUSIC ALGORITHMS IN THE U.S.¹
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Abstract
Recent trends in the patenting of computer software are discussed with an emphasis on sound generation and sound modification algorithms. The key characteristics that make certain algorithms patentable are reviewed, and how one can recognize whether an algorithm merits patent protection is described. In addition, some of the common "hurdles" patent applicants typically encounter in trying to obtain a patent from the U.S. Patent and Trademark Office are pointed out. The importance of patent protection, as compared to copyright and trade secret protection is also discussed.

INTRODUCTION
Many Companies, Universities, and individuals are applying for patents directed to various software implemented computer music systems and processes. There are, for example, patents directed to sound generation algorithms, sound modification algorithms, music composition software, and musical instrument control systems. In fact, two well known musical sound generation algorithms, the Karplus-Strong plucked string algorithm and Chowning's method of FM sound synthesis, are protected by patents.

In general, computer systems and processes, in both hardware and software implementations, may be protected with copyrights, trade secrets, and patents. However, the apparent preferred forms of protection for "software" implemented inventions have been, in many cases, only copyrights and trade secrets.¹

Although copyrights and trade secrets have been viewed by some as the preferable way to protect computer software, there is an apparent trend toward supplementing that protection, by acquiring patents for software implemented inven-

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¹ Copyrights protect the "expressive" aspects of computer programs, e.g., the choice and order of programming commands. Trade secrets protect any aspects of computer programs which are "hidden," that is, kept "secret." Thus, unless someone "reverse engineers" these hidden aspects, they are protected from unauthorized use.
The Patent and Trademark Office is granting, and courts have upheld, patents directed to such software implemented inventions. Thus, many software developers and researchers are utilizing patents, in addition to copyrights and trade secrets, to protect their works.

This emerging emphasis on patenting software implemented inventions is partly due to the significant benefits patents provide as compared with copyrights and trade secrets. Trade secrets only provide protection for aspects of the invention which are kept secret. Thus, if an invention can be reverse engineered, or if the inventor chooses to share his or her creation by publishing or otherwise publicizing it, any potential protection which may be provided by trade secrets will be drastically curtailed.

With respect to the relative protection provided by copyrights, patents protect the underlying method and/or structure of a program, while copyrights only protect the expressive aspects of a program (see note 1). In addition, an inventor or patent owner may not only preclude "copying" of a program, but may also preclude another from making, using or selling an "independent creation" of the invention; whereas, under the copyright laws, one who can prove that he or she has independently created a program may not be successfully sued.

Given the specific limitations associated with copyright or trade secret protection alone, many developers and researchers rely on both forms of protection to supplement each other. A growing number of developers and researchers are further supplementing the protection provided by copyrights and trade secrets with patents.

THE LIMITS OF SOFTWARE PATENTABILITY

Of course, even with the advantages provided by patent protection, there are limits to patentability which should be taken into consideration before deciding to apply for a patent.

In this regard, some have the impression that computer software programs are not patentable, and thus do not realize that patenting their software implemented inventions is an option. However, there is no law which says that software or computer algorithms, per se, are not patentable, and many software implemented

2 The term "software implemented invention," for purposes of this paper, refers to a computer implemented invention which may be embodied in software form. Many such computer implemented inventions may also be described in terms of hardware circuitry, and thus embodied in hardware form.

3 There is, however, an exception to patentability for "mathematical algorithms," that is, procedures for solving a given mathematical problem. See In re Abell, 684 F.2d 902, 214 U.S.P.Q. 682 (C.C.P.A. 1982); In re Walter, 618 F.2d 758, 205 U.S.P.Q. 397 (C.C.P.A. 1980); and In re Freeman, 474 F.2d 1318, 177 U.S.P.Q. 139 (C.C.P.A. 1973). For example, one may not patent a mathematical equation, such as \( a^2 + b^2 \).
inventions have been determined by the courts to be patentable. Therefore, patenting is often a viable option.

There are, however, many hurdles one must overcome before one may obtain a strong, enforceable patent. Patent applicants encounter some such "hurdles" in the form of requirements regarding the content of the claims which define the invention. The Patent and Trademark Office examines the claims to determine, among other things, whether each of the claims meets the requirements of Novelty, Nonobviousness, and Statutory Subject Matter. If a claim fails to meet one of these requirements, the Patent and Trademark Office will not grant patent protection for the invention defined by that claim.

THE NOVELTY REQUIREMENT

As a general rule, the Novelty requirement for patentability will be met if the invention is "new" as defined in the patent laws. The invention is not new, and thus fails the Novelty requirement, if every aspect of the invention recited in the claim is present in a single "prior art" reference; that is, if every aspect is (1) disclosed by another in a prior document or (2) was on sale, in public use, or published by anyone (including the inventor) more than one year prior to filing of the application with the U.S. Patent and Trademark Office.

THE NONOBVIOUSNESS REQUIREMENT

In order to meet the Nonobviousness requirement, the invention must comprise a significant "advance" over what has been done before in the pertinent technological area. The "advance" must be significant enough so that it would not have been obvious to one of ordinary skill in the pertinent art, at the time the invention was made, to invent the same thing.

=c^2. Since many computer programs may use mathematical algorithms to achieve their desired objectives, some have wrongly interpreted the "mathematical algorithms" exception to extend to all computer programs. This is not true. Diamond v. Diehr, 450 U.S. 175, 191 S.Ct. 1048 (1981); In re Pardo, 684 F.2d 612 (C.C.P.A. 1982); Paine, Webber, Jackson & Curtis, Inc. v. Merrill Lynch, Pierce, Fenner & Smith, Inc., 564 F.Supp. 1358, 218 U.S.P.Q. 212 (D.Del. 1983).

4 Patents typically contain many claims, each describing unique features of the invention and defining the scope of protection of the patent in varying degrees. The number of different claims that can be drafted to cover an invention from different aspects and perspectives is limited only by the ingenuity and creativity of the claim drafter.

5 For example, suppose someone invented a new car which is "new" because it has a special gas saving carburetor. However, there exists a patent, issued a few years ago, which discloses that same special gas saving carburetor; only it is not
THE STATUTORY SUBJECT MATTER REQUIREMENT
The claims may be denied patent status if they recite subject matter which has been excluded from the patent law or statute, that is, which is not "statutory." One example of such subject matter, which is not statutory, is the "mathematical algorithm" (see note 3). If a claim recites a mathematical algorithm, it will be excluded from patent protection, if it is not applied, in a significant way, to physical elements.

Many computer programs do not comprise "mathematical algorithms," and are not excluded from patent protection even though they may not be claimed in terms of physical elements. Some examples of such "non-mathematical" algorithms are: (1) Process for converting source program into object program; (2) Process for translating a source natural language, such as Russian, to a target natural language, such as English; and (3) Method of reassigning priorities within a computer.

CONCLUSION
Any one of the above-noted "hurdles" or patentability requirements may be difficult to overcome. Therefore, before applying for a patent, a researcher or developer should precisely define the invention to be protected, and determine whether this defined invention meets each of the requirements for patentability. If the invention appears to meet the requirements of Novelty, Nonobviousness, and Statutory Subject Matter, then it may merit patent protection. At this point, the researcher or developer, should consult with a Patent Attorney, or Registered Patent Agent, to jointly determine the best approach to use in obtaining a strong, enforceable patent.

Patents are being recognized more and more as a valid means of protection for computer algorithms, regardless of whether they are implemented by means of hardware or software. Thus, since a patentee may exclude others from making, using, or selling a patent invention, Universities, individuals, and companies are recognizing the importance of patents, and are patenting their software implemented inventions. As a result and in view of the emerging trend toward patenting software implemented inventions, developers and researchers should not only be aware of the patent laws from the perspective of applying for patent protection of their inventions, but should also take precautions to insure against infringing existing valid patents.

installed in a car. The patent only mentions that the carburetor could be used with internal combustion engines. The Patent and Trademark Office would probably not grant a patent to the new car, even though it is new, since it would have been "obvious," in view of the patent's disclosure, to put the carburetor into a car (which has an internal combustion engine).