An Expert System Prototype: Copyright Law in a Multimedia Environment

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Abstract

Expert systems are software systems that emulate the problem-solving capabilities of human experts. Expert systems, commonly known as knowledge-based systems, are used in both the scientific and business communities.

This paper describes an expert system that encapsulates expert knowledge on copyright laws. Such laws now cover intellectual property in the form of printed materials and electronic data stored on magnetic or laser discs, magnetic tapes, and microfilm. Information on copyright laws and the protection of intellectual properties in various formats are essential as we begin to incorporate multimedia technology into our classrooms and offices.

Introduction

Our goals in developing this expert system prototype on copyright law were two-fold. Firstly, we wanted to create an electronic version of the information contained in the Winthrop University Policy on Copyrighted Material, so that we could make it easily accessible to the entire university community over the university computer network. Secondly, we wanted to create a system that would be useful as an instructional resource for teaching topics related to either copyright law or expert systems technology.

Expert systems technology is a successful area of study within the discipline of Artificial Intelligence (AI). Expert systems emulate the problem-solving capabilities of human experts. They are beneficial in that they make expert information available even when human experts cannot be present. Also, they can incorporate the knowledge of several experts into a single system and can usually explain the reasoning used in generating their conclusions. It is this property of expert systems that lends itself to our prototype project of explaining copyright law in a multimedia environment.

The area of multimedia involves many types of copyrighted works, the legal implications of which are overwhelming. Most information technology (IT) users have neither the knowledge of or expertise in copyright law to insure that they do not infringe

on an author's property rights. This paper discusses copyright law, as it applies to the field of multimedia technology, and the development of an expert system that makes this expertise available "on-line".

Expert Systems

Expert systems (ES) are software systems designed to solve problems that are usually solved by human experts. Expert systems depend on a large body of stored knowledge, called a knowledge base, and a mechanism for reasoning with that knowledge, called the inference engine. Because of their dependence on large quantities of stored knowledge and knowledge processing techniques, expert systems are often referred to as knowledge-based systems. The knowledge base, the inference engine, and the user interface constitute a complete expert system.

Expert systems are usually limited to a narrow domain of expertise. Typically, they can respond to queries in the problem domain, provide explanations for answers generated, and sometimes offer alternative solutions to problems. Also, they are usually able to deal with probabilistic or fuzzy knowledge, by incorporating factors of uncertainty.

One of the best known expert systems, and one that is mentioned in virtually all AI and ES textbooks, is MYCIN. MYCIN encapsulates domain knowledge related to infectious blood diseases. Given the results of a patient's lab tests, MYCIN can diagnose and prescribe treatment and, when requested, it can explain its reasoning in English. MYCIN's success is comparable to that of human experts in the field of infectious blood diseases and was shown to outperform both medical students and general practitioners. Despite its remarkable success, MYCIN has never been put into practical use. Questions concerning the legal and ethical responsibilities for diagnoses and treatments precluded its practical use.

Since the emergence of MYCIN in the 1970's, many expert systems have been developed and used successfully in domains that are not "life critical" in nature. Some of the many fields in which knowledge-based systems technology has been applied are finance, manufacturing, airline scheduling, management, military science, geology, and software engineering. Knowledge-based systems have provided a variety of benefits including increased quality and speed in the performance of complex tasks, reductions in errors and costs, decreases in personnel, improvements in customer service, ability to combine knowledge from several experts, and the freeing of experts from making repetitive decisions. Expert systems technology is appealing because expertise is scarce and expensive. Additionally, as salaries for experts continue to rise, the cost/benefit ratio of developing expert systems continues to improve.

A person who develops an expert system is called a knowledge engineer. The first task of the knowledge engineer is to determine if the problem domain is suitable for the application of expert system technology. Expert systems will succeed in many, but not all, problem domains. Human judgements/conclusions are rarely based on knowledge alone, but also involve reasoning. Experts use intuition, insight, instinct, or

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A person who develops an expert system is called a knowledge engineer. The first task of the knowledge engineer is to determine if the problem domain is suitable for the application of expert system technology. Expert systems will succeed in many, but not all, problem domains. Human judgements/conclusions are rarely based on knowledge alone, but also involve reasoning. Experts use intuition, insight, instinct, or

rules of thumb that are not easily describable. ESs have not been successful in areas such as stock market forecasting, criminal investigations, and sports predictions. ES applications that are usually successful are those that are limited in scope and have domains that can be described in a straightforward manner.

Knowledge engineering is an iterative process that includes knowledge acquisition, system development, and system validation. Knowledge acquisition is the task of capturing domain-specific knowledge from an expert or group of experts. The task is difficult since experts are often unaware of all of the factors that they use when making expert judgements. Additionally, different experts may use different approaches to solving the same problem. The knowledge engineer must generate appropriate questions in order to elicit the information needed.

Before an expert system can be developed, the knowledge engineer must decide how the information will be represented and which programming language or system to use for the implementation. Most expert systems are developed using languages that can be described as rule-based. A knowledge base consists of facts in the domain and rules that specify how the facts may be used. Early expert systems were developed from scratch, many in LISP. Now, however, many expert systems are developed using software tools called expert system shells. An expert system shell provides the control mechanism for an expert system, i.e., the inference engine. The inference engine provides the "intelligence" of the system in that it determines how the facts and rules of the knowledge base will be used to draw conclusions or make decisions. The job of the knowledge engineer then becomes one of providing the domain specific knowledge. Use of these types of tools leads to quicker system development. Since such shells typically use a high-level, English-like language for rule construction, knowledge engineers need not be experienced computer language programmers. Additionally, expert system shells typically provide mechanisms for explanation, knowledge acquisition, and interaction with other programming environments.

The application described in this paper was developed using an expert system shell called VP-EXPERT. This package provides the inference engine, an editor to be used to enter the knowledge, and an English-like rule-based language to capture the knowledge. Additionally, this tool is able to give explanations for the conclusions it draws, incorporate uncertainty in terms of factors of confidence, interact with database files created by a variety database management systems, and interact with worksheet files created by a variety of spreadsheet programs.

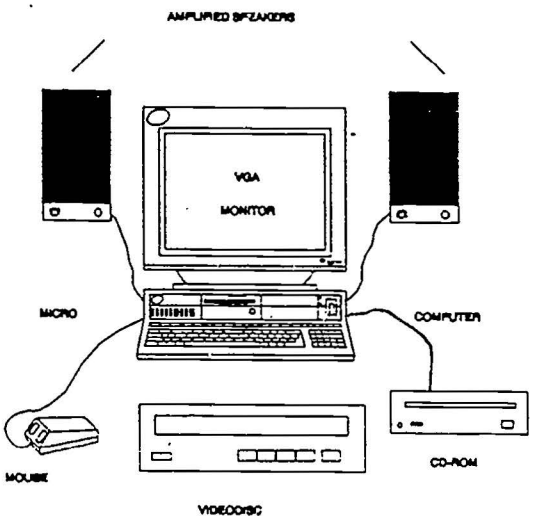
Multimedia

At present, there are as many definitions of a multimedia system as there are vendors selling them. Multimedia systems exist on multiple platforms. Essentially, a multimedia system allows one to communicate media (still, motion, audio, graphic and text images) in a computer based environment. Our concern in this paper is the media itself and the related copyright laws affecting it.

A typical multimedia system is represented in the following figure. How the elements of a multimedia system are packaged is determined by the specific end-user application. The elements must be configured in "technical harmony" so they work synergistically for the desired effect.

A basic system consists of a PC with CD ROM, an audio card and stereo speakers. This system is used mainly on an individual basis, by faculty or students who wish to incorporate graphics from the CD-ROM into their text files for handouts, reports, and other documents. It also suffices for small classroom presentations using an LCD viewer.

MULTIMEDIA SYSTEM



A mid-range system is comparable to many of the multimedia systems currently in place. In addition to the basic unit, it has a more powerful cpu, more hard disk space, higher quality sound card and speakers and may also come equipped with a videodisc player. It is most appropriate for use of interactive (canned) demonstrations and can be used to create and display animations. This setup is optimal for help centers and media centers.

A high-end system has an even more powerful cpu and increased storage capabilities. It has a digital audio card and a full-motion video card allowing for data capture and compression. This system allows one to combine video stills, full-motion video, audio, text, graphics, and animation into an interactive presentation. Opportunities abound for the use of these segments. They can be formulated into self-study programs, incorporated into tutorials, or set up for elaborate lecture presentations.

The more extensive and complex the media, the more complicated becomes the legal interpretation of copyright infringement. With the use of multimedia the potential for copyright violation is much greater. Many cases must be resolved in court. The following section on copyright law provides some insight into the law.

Copyright Law

© Copyright is a form of protection the law provides to the authors of "original works of authorship" for their intellectual works , both published and unpublished. The constitutional provision respecting copyright states "The Congress shall have power . . . To promote the Progress of Science and useful Arts, by securing for limited Times to Authors and Inventors the Exclusive Right to their respective Writings and Discoveries" (United States Constitution, Article I, Section 8). Although

the rights provided by the law to the owners of the copyright are not unlimited in scope, it is illegal to violate any of these rights.

The Copyright statute, 17 U.S.C. § 101 et seq. (effective date: 1978), balances the author's interest against the public interest in the dissemination of information in areas of universal concern, such as art, science, history and business. The grand design of this delicate balance is to foster the creation and dissemination of intellectual works for the general public.

Copyright protection exists in original works of authorship fixed in any tangible medium of expression from which they can be perceived, reproduced or communicated either directly or indirectly by the aid of a machine or device. Our multimedia technology now brings this into special focus. Works of authorship include literary works (books and printed material); computer software; musical works (including accompanying words); video productions (motion pictures, videotapes); sound recordings; and dramatic works (plays).

Note, however, that statutory copyright protection does not include works that have not been fixed in a tangible form of expression such as titles, names, short phrases and slogans; works consisting entirely of information that is common property; and ideas, procedures, methods, concepts, principles, discoveries, systems, devices and processes.

The Copyright Act defines the rights of a copyright holder and how they may be enforced against an infringer. Included within the Copyright Act is the "fair use" doctrine which allows, under certain conditions, the duplication of copyrighted material. While the Copyright Act lists general factors under the heading of "fair use," it provides little in the way of specific directions for what constitutes fair use. The areas of primary concern to us are covered in sections 106 and 107 of the United States Code. Section 106 states the exclusive rights of the owner and section 107, the limitations on those rights, otherwise referred to as "fair use." The following excerpts are taken from Circular 92 of the United States Government.

106. Exclusive rights in copyrighted works

Subject to sections 107 through 118, the owner of copyright under this title has the exclusive rights to do and to authorize any of the following:

1. to reproduce the copyrighted work in copies or phonorecords;
2. to prepare derivative works based upon the copyrighted work;
3. to distribute copies or phonorecords of the copyrighted work to the pubic by sale or other transfer of ownership, or by rental, lease, or lending;
4. in the case of literary musical, dramatic, and choreographic works, pantomimes, and motion pictures and other audiovisual works, to perform the copyrighted work publicly; and
5. in the case of literary, musical, dramatic, and choreographic works, pantomimes, and pictorial, graphic, or sculptural works, including the individual images of a motion picture or other audiovisual work, to display the copyrighted work publicly.

107. Limitations on exclusive rights: Fair use

Notwithstanding the provisions of section 106, the fair use of a copyrighted work, including such use by reproduction in copies or phonorecords or by any other means specified by that section, for purposes such as criticism, comment, news reporting, teaching (including multiple copies for classroom use), scholarship, or research, is not an infringement of copyright. In determining whether the use made of a work in any particular case is a fair use the factors to be considered shall include --

1. the purpose and character of the use, including whether such use is of a commercial nature or is for nonprofit educational purposes;
2. the nature of the copyrighted work;
3. the amount and substantiality of the portion used in relation to the copyrighted work as a whole; and
4. the effect of the use upon the potential market for or value of the copyrighted work.

Although multimedia covers all areas specified above in "works of authorship", we will focus on three areas: Computer Programs, Video Productions (Motion Pictures and Videotapes) and Sound Recordings. The appendices provide definitions of terms and a list of U.S. Government publications on copyright law.

Computer Programs

The growing use and importance of computer software products raises difficult questions about how property rights should be protected. The proliferation of microcomputers, multimedia systems and both local and wide area networks have made the issues even more complicated.

In general, copyright law protects software against copying and distribution, even in the absence of a license agreement, unless it has been placed in public domain. This protection also extends to the documentation which accompanies most software; normally, it is illegal to make a copy of the complete software manual or documentation. Under the law of exclusive rights, only the owner of a copyright has the right to reproduce or distribute software or its documentation.

The following information on computer software is policy developed at Winthrop University based on an interpretation of copyright laws. The policy applies equally to all faculty, staff and students of Winthrop University. The policy includes all application and operating system software used on mainframes, mini-computers or microcomputers or any other computer devices, such as multimedia systems, using programmed software products.

The policy applies to the following categories of computer software:

a. Purchased Copies. This is defined as those software packages or programs which, when acquired, constitute an exchange of ownership from the seller to the purchaser.

b. Lease-only Versions. These are computer software packages or programs which require that a license fee be paid to the owner by the user. Such fee is considered as a lease payment, and ownership of the computer software or program remains with the seller of the license. These can be single copy versions, site licensed versions or network versions.

c. Evaluation or Demonstration Software. This is defined as those computer software packages or programs which are provided by the owner to the user for evaluation. In such case the prospective user is to use the software free of charge for a specified length of time. Ownership during this period remains with the seller of the license.

d. Shareware. This is defined as those unsolicited computer software packages and programs which are passed to a prospective buyer through the mail or by another individual. This software is to be evaluated, without contract, by the prospective buyer and if retained by the prospective buyer, the seller relies on a "good faith" transfer of a license fee from the user and to the seller of the license.

e. Public Domain Software. This is defined as non-copyright software which is offered for unrestricted use as public domain.

The following quotes define the limitations on exclusive rights regarding computer programs, 17 U.S.C. § 117. It is not an infringement for the owner of a copy of a computer program to make or authorize the making of another copy or adaptation of that computer program provided:

a. that such a new copy or adaptation is created as an essential step in the utilization of the computer program in conjunction with a machine and that it is used in no other manner, or

b. that such new copy or adaptation is for archive purposes only and that all archive copies are destroyed in the event that continued possession of the computer program should cease to be rightful.

Any exact copies prepared in accordance with the provisions of this section may be leased, sold or otherwise transferred, along with the copy from which such copies were prepared, only as part of the lease, sale or other transfer of all rights in the program. Adaptations so prepared may be transferred only with the authorization of the copyright owner.

Purchased Copies.

Copying for purposes of distribution whether it be for resale or for sharing is not permitted. Copying for archive purposes is permitted. Copying which is necessary to the utilization of the computer is permitted.

Lease-only Software.

Single Copy. Using a common copy of software on more than one microcomputer is not permitted, unless the lease agreement specifically states that this is permitted. Copying for purposes of distribution whether it be for resale or for sharing is not permitted.

Copying. Copying to an internal hard disk for purposes of installation is permitted, as is copying for archive purposes.

Network version. Network users are not permitted to copy software used in a network environment. The network administrator may make back-up copies of the software as required by the data network's recovery policy.

Site License. Copying for archive purposes is permitted at the user level. Copying with the intent to resell or share is not permitted. One serialized copy is permitted for use on one microcomputer. Use of a common serially numbered version on more than one microcomputer is not permitted.

Evaluation or Demonstration Software.

Evaluation/demonstration software can be requested for ordering through Dacus Library. Dacus Library will control the evaluation/demonstration software copies, providing for controlled check-out by faculty and staff for evaluation. Copying evaluation or demonstration software without the written consent of the rightful owner is not permitted.

Shareware

Ethical behavior is expected of faculty, staff and students with regard to shareware. If the software is retained or used, the requested license fee should be mailed to the rightful owner.

Public Domain Software

Software which is declared public domain is available for use by the public and therefore is exempt from copyright law.

Video Productions: Motion Pictures, Videotapes

The following guidelines reflect a national committee's (19 organizations appointed by Congress) consensus as to the application of fair use to the recording, retention and use of television broadcast programs for educational purposes. They specify periods of retention and use of such off-air recordings in classrooms and similar places devoted to instruction and for homebound instruction. The purpose of establishing these guidelines is to provide standards for both owners and users of copyrighted television programs.

a. A broadcast program may be recorded off-air simultaneously with broadcast transmission (including simultaneous cable transmission) and retained for a period not to exceed the first 45 consecutive calendar days after date of record-

ing. Upon conclusion of such retention period, all off-air recordings must be erased or destroyed immediately. "Broadcast programs" are television or radio programs transmitted by television or radio stations for reception by the general public without charge.

b. Off-air recordings may be used once by individual teachers in the course of relevant teaching activities, and repeated once only when instructional reinforcement is necessary, in classrooms and similar places devoted to instruction within a single building, cluster or campus, as well as in the homes of students receiving formalized home instruction, during the first 10 consecutive school days in the 45-day calendar day retention period. "School days" are school session days--not counting weekends, holidays, vacations, examination periods, or other scheduled interruptions--within the 45 calendar-day retention period.

c. Off-air recordings may be made only at the request of and use by individual teachers and may not be regularly recorded in anticipation of requests. No broadcast programs may be recorded off-air more than once at the request of the same teacher, regardless of the number of times the program may be broadcast.

d. A limited number of copies may be reproduced from each off-air recording to meet the legitimate needs of teachers under these guidelines. Each such additional copy shall be subject to all provisions governing the original recording.

e. After the first 10 consecutive school days, off-air recordings may be used up to the end of the 45 calendar day retention period only for teacher evaluation purposes, i.e. to determine whether or not to include the broadcast program in the teaching curriculum, and may not be used in the recording institution for student exhibition or any other non-evaluation purpose without authorization.

f. Off-air recordings need not be used in their entirety, but the recorded programs may not be altered from their original content. Off-air recordings may not be physically or electronically combined or merged to constitute teaching anthologies or compilations.

g. All copies of off-air recordings must include the copyright notice on the broadcast program as recorded.

Sound Recordings

A sound recording is a work which may be fixed on a physical medium such as a phonorecord. The phonorecord may be a tape, cassette tape, cartridge or disk. In this section, reference to a phonorecord will be relative to that device upon which a sound recording is fixed.

The owner of a copyright of a phonorecord has the exclusive rights to distribute copies of the phonorecords of the copyrighted work to the public by sale or other transfer of ownership, or by rental, lease or lending 17 U.S.C. § 106(3).

Notwithstanding the provisions of 106(3), the fair use of the copyrighted work, including such use by reproduction in copies or phonorecords for purposes such as criticism, comment, news reporting, teaching (including multiple copies for classroom use), scholarship or research, is not an infringement of copyright. Factors to be considered in fair use are were given earlier (§ 107. Limitations on exclusive rights).

The owner, by purchase or transfer of ownership, of a particular phonorecord obtained under section 106(3) is entitled without the authority of the copyright holder to sell or otherwise dispose of that phonorecord. The owner, however, may not dispose of directly or indirectly the phonorecord sound recording for purposes of commercial advantage by rental, lease or lending. Nothing in the preceding sentence shall apply to the rental, lease, or lending of a phonorecord for nonprofit purposes by a nonprofit library or nonprofit educational institution, 17 U.S.C. § 109(b)(1).

The Expert System Prototype: Copyright Law Advisor

Our expert system prototype, entitled "Copyright Law Advisor", encapsulates knowledge in the area of copyright law and intellectual property rights. The expert knowledge was derived from a document published at Winthrop University concerning the legal and fair uses of intellectual property across the campus. Since the expert knowledge had already been gathered, the job of the knowledge engineer became one of structuring the knowledge using the knowledge representation scheme supported by the expert system shell (VP-EXPERT).

The Copyright Law Advisor is menu-based. When the system is running, it presents the user with general information as to how to use the system. It then provides a menu of options from which the user can select an action. Specifically, the user can choose to read information on the fair use of copyrighted materials or the rights of owners of copyrights, to consult with the Copyright Law Advisor to learn how copyrighted materials can be legally used, or to exit from the system. A consultation is an interaction of a user with an expert system. A consultation begins when the user requests information from the system When the user chooses to consult with the Copyright Law Advisor, the system will prompt the him/her for the information it needs. This information will regard the type of intellectual work involved and the purposes for which the user may want to use or copy it.

The current version of the prototype incorporates knowledge on copyright law associated with computer software and data and video and sound recordings.

Conclusion and Future Directions

Our goals in developing this expert system were to create an electronic version of the information contained in the Winthrop University Policy on Copyrighted Material and to create a system that would be useful as an instructional resource. This prototype now includes copyright information regarding computer software, video productions, and sound recordings. We plan to enhance the system to include copyright information pertaining to other types of protected works. The Copyright Law

Advisor will be made available to campus personnel as an on-line reference source. For the study of expert systems and copyright law, appropriate instructional areas might include Computer Science or Management Information Systems.

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APPENDIX A: DEFINITIONS

(Material extracted in whole or in part from Title 17 of the United States Code)

Audiovisual works are works that consist of a series of related images which are intrinsically intended to be shown by the use of machines or devices such as projectors, viewers, or electronic equipment, together with accompanying sounds, if and regardless of the nature of the material objects, such as films or tapes, in which the works are embodied.

Copies are material objects, other than phonorecords, in which a work is fixed by any method now known or later developed and from which the work can be perceived, reproduced or otherwise communicated, either directly or with the aid of a machine or device. The term "copies" includes the material object, other than a phonorecord, in which the work is first fixed.

Copyright owner, with respect to any one of the exclusive rights comprised in a copyright, refers to the owner of that particular right.

A work is created when it is fixed in a copy or phonorecord for the first time; where a work is prepared over a period of time, the portion of it that has been fixed at any particular time constitutes the work as of that time, and where the work has been prepared in different versions, each version constitutes a separate work.

A derivative work is a work based upon one or more preexisting works, such as a translation, musical arrangement, dramatization, fictionalization, motion picture version, sound recording, art reproduction, abridgment, condensation or any other form in which a work may be recast, transformed or adapted. A work consisting of editorial revisions, annotations, elaborations or other modifications, which, as a whole, represent an original work of authorship, is a "derivative work."

A device, machine or process is one now known or later developed.

To display a work means to show a copy of it, either directly or by means of a film, slide, television image or any other device or process of in the case of a motion picture or other audiovisual work, to show individual images non-sequentially.

A work is fixed in a tangible medium of expression when its embodiment in a copy or phonorecord by or under the authority of the author is sufficiently permanent or stable to permit it to be perceived, reproduced or otherwise communicated for a period of more than transitory duration. A work consisting of sounds, images or both, that are being transmitted, is "fixed" for purposes of this title if a fixation of the work is being made simultaneously with its transmission.

The terms including and such as are illustrative and not limitative.

A joint work is a work prepared by two or more authors with the intention that their contributions be merged into inseparable or interdependent parts of a unitary whole.

Motion pictures are audiovisual works consisting of a series of related images which, when shown in succession, impart an impression of motion, together with accompanying sounds, if any.

Musical works are works which include any accompanying words and are fixed in some tangible medium of expression. Musical works include both original compositions and original arrangements.

Phonorecords are material objects in which sounds, other than those accompanying a motion picture or other audiovisual work, are fixed by any method now known or

later developed, and from which the sounds can be perceived, reproduced or otherwise communicated, either directly or with the aid of a machine or device. The term phonorecords includes the material object in which the sounds are first fixed.

Pictorial, graphic and sculptural works include two-dimensional and three-dimensional works of fine, graphic and applied art, photographs, prints and art reproductions, maps, globes, charts, diagrams, models and technical drawings, including architectural plans. Such works shall include works of artistic craftsmanship insofar as their form but not their mechanical or utilitarian aspects are concerned; the design of a useful article, as defined in this section, shall be considered a pictorial, graphic or sculptural work only if and only to the extent that, such design incorporates pictorial, graphic or sculptural features that can be identified separately from, and are capable of existing independently of the utilitarian aspects of the article.
Publication is the distribution of copies or phonorecords of a work to the public by sale or other transfer of ownership, or by rental, lease or lending. The offering to distribute copies or phonorecords to a group of persons for purposes of further distribution, public performance or public display constitutes publication. A public performance or display of a work does not of itself constitute publication.

To perform or display a work publicly means:

1.to perform or display it at a place open to the public or at any place where a substantial number of persons outside of a normal circle of a family and its social acquaintances is gathered; or

2.to transmit or otherwise communicate a performance or display of the work to a place specified by clause or to the public by means of any device or process whether the members of the public capable of receiving the performance or display receive it in the same place or in separate places and at the same time or at different times.

Sound recordings are works that result from the fixation of a series of musical, spoken or other sounds, but not including the sounds accompanying a motion picture or other audiovisual work, regardless of the nature of the material objects, such as disks, tapes or other phonorecords, in which they are embodied.

A transfer of copyright ownership is an assignment, mortgage, exclusive license or any other conveyance, alienation, or hypothecation of a copyright or of any of the exclusive rights comprised in a copyright, whether or not it is limited in time or place of effect, but not including a nonexclusive license.

A computer program is a set of statements or instructions to be used directly or indirectly in a computer in order to bring about a certain result.