

96025

Time-Sensitive Material, Please Expedite

This is a confidential, proprietary, nonpublic document that may not be communicated in any way without the consent of the University of Minnesota Office of Patents and Licensing

Send the completed, signed form and all attachments to:

Office of Patents & Licensing
Minnesota Technology Center
1100 Washington Avenue South, Suite 201
Minneapolis, MN 55415-1226
Phone: 612/624-0550 Fax: 612/624-4843

Disclosure Evaluation, and Patenting and Licensing Procedure

Within ten working days of receipt of the completed disclosure form by the Office of Patents and Licensing, a technology transfer associate will contact the inventors. The associate will then initiate evaluation of the invention's patentability and marketability, and may contact industrial representatives for nondisclosing discussions of the field of the invention. The associate may also present the disclosure under confidentiality agreements to potential licensees and to members of the Technology Evaluation Council, a group of Minnesota business and industry leaders who assist the Office of Patents and Licensing by providing nonbinding advice on technology transfer matters. The inventors will be kept informed of the evaluation process and may be asked to provide reasonable assistance (e.g., to participate in patent and literature searches and to assist in discussions with industry contacts).

Following a thorough review of the invention's patentability and commercial potential, the associate will contact the inventors with the University's decision on whether to apply for patent protection of the invention. This decision normally will be made within two to three months of submission of the completed disclosure, unless additional information or research is needed before a reasonable decision can be made. If the University decides to file a patent application, the inventors will be asked to assist the associate and outside patent counsel in preparing the application(s). It can take anywhere from one to three or more years for a patent application to be approved and issued or denied by the U.S. Patent and Trademark Office (USPTO). The inventors will be kept informed of the patenting process and may be asked to help the University's patent counsel respond to any questions or objections the examiner may make against claims made for the invention. Patent prosecution will be directed by the Office of Patents and Licensing. Communication among the USPTO, outside patent counsel, and the inventors will be coordinated by the associate handling the invention.

The associate may begin contacting potential licensees as soon as possible to discuss the interest of their companies in acquiring a license to the invention, sometimes before a patent application is filed. Terms of license agreements transferring rights to use and commercialize the invention also will be negotiated by the Office of Patents and Licensing, with the inventors closely involved. Often an interested company will want to support further research on the technology to bring the invention closer to commercializability. A contract for this research will be negotiated and administered by the Office of Research and Technology Transfer, assisted by the inventors and the technology transfer associate.

A packet of materials describing the University of Minnesota Office of Patents and Licensing and its procedures, the patent process, related policies, and the rights and obligations of University inventors may be obtained from technology transfer associates or by calling 612/624-0550.

A copy of this form will be sent by the Office of Patents and Licensing to the department chair(s) and the dean(s) of the college(s) in which the inventor(s) developed the technology.

Please type. If more space is required, please attach additional pages with reference to the continued item. This form is available as an electronic file which can be downloaded from the Office of Research and Technology Transfer's Gopher server.

If you have questions about the Invention Disclosure form, please contact the Office of Patents and Licensing, 624-0550.

1. TITLE AND DESCRIPTION

Provide a title and brief description of the invention, stating in nontechnical language the key features of your invention, its most important uses, and how it improves on existing technology or practice. Please attach supporting documents that provide a more complete description of the invention (manuscripts, diagrams, data, etc.) and that describe its advantages and differences over existing technology.

Title: Maximum transition-run (MTR) codes for data storage systems

Description:

This invention describes a coding scheme which improves data quality and/or storage capacity of existing digital data storage devices such as magnetic computer disk drives and professional and consumer tape recorders. This coding scheme eliminates certain error-prone binary data patterns from the allowable set of input data patterns that are to be recorded in the storage medium. As a consequence, the final bit error rate, the most important performance measure of any digital recorder, is improved significantly when the original data bits are reproduced. This improvement in the bit error rate can also be traded for an increase in storage density if the error rate performance of the recorder is already satisfactory. More specifically, the proposed code, which we will call the maximum transition-run (MTR) code, imposes a limit on the maximum number of consecutive transitions that can occur in the written magnetization pattern in magnetic recording. Our analysis indicates that the performance improvement is most significant when the maximum number of consecutive transitions is limited to two. The MTR code with a constraint length of 2 will allow "dibit" transitions in the magnetization pattern, but will not permit "tribit" or longer runs of consecutive transitions. When we combine this coding scheme with a certain class of sequence detectors to recover written data in high density recording, we can achieve a significantly better bit-error-rate (BER) performance than existing code/detector combinations such as (0,G/I)code/PRML and (1,7) RLL code/peak detector combinations. Computer simulations have been used to demonstrate the performance advantage of the MTR code combined with a specific detector known as the fixed delay tree search with decision feedback over the existing code/detector combinations. According to the NRZI format, in which a magnetic transition is represented by binary "1" and no transition by binary "0", the proposed code constraint is equivalent to limiting the maximum runlength of 1's. To facilitate timing recovery, the usual maximum runlength constraint is also imposed on 0's. Runlength limited (RLL) codes have existed in the data storage field for some time, but they have been used either to control the maximum and minimum separations between adjacent magnetic transitions or to limit the minimum size of the written marks (in the case of optical recording). Also, none of the existing RLL codes attempts to eliminate error-prone binary patterns in an effort to increase the "minimum distance". Therefore, this invention is fundamentally different from the existing RLL codes.

Key words to use in patent and literature searches:

run-length-limited code, (d,k) code, fixed-delay tree search

2. DEVELOPERS

List all who have actively participated in developing the invention (including students, post-docs, scientists and non-University of Minnesota personnel). A final determination of status as an inventor will be made if and when a patent application is drafted. Please inform Patents and Licensing of any changes in the information below.

A.

Name: Jaekyun Moon Social Security No: REDACTED
Position: Associate Professor
Work Address: Department of Electrical Engineering, 200 Union St., S.E., Minneapolis, MN 55455
Home Address: 250 Calson Pkwy, #209, Minnetonka, MN 55305
Work Phone: 612-625-7322 Fax: 612-625-4583 Home Phone: 612-473-1859
Departmental Affiliation(s): Electrical Engineering
Research Center Affiliation(s):

B.

Name: Barrett Brickner Social Security No: REDACTED
Position: Research Assistant
Work Address: Department of Electrical Engineering, 200 Union St., S.E., Minneapolis, MN 55455
Home Address: 415 Erie St., S.E., APT 101, Minneapolis, MN 55414
Work Phone: 625-3474 Fax: 612-625-4583 Home Phone: 612-623-3036
Departmental Affiliation(s): Electrical Engineering
Research Center Affiliation(s):

C.

Name: Social Security No:
Position:
Work Address:
Home Address:
Work Phone: Fax: Home Phone:
Departmental Affiliation(s):
Research Center Affiliation(s):

D.

Name: Social Security No:
Position:
Work Address:
Home Address:
Work Phone: Fax: Home Phone:
Departmental Affiliation(s):
Research Center Affiliation(s):

3. FUNDING

List all sources of funding (external and/or internal) that were used to fund the research resulting in the invention. It is important that this information is accurate and complete because sponsors may have certain rights in the invention.

Source	Agency Grant Number	University Account Number
Seagate Technology	39000629	1743-522-6230
National Storage Industry Consortium/ARPA	50000115	1732-522-6173

4. PUBLICATIONS

List the titles and dates of possible publication(s) of the invention (past or future) and attach copies of published or submitted versions. Publication includes any papers, theses, conference presentations, or abstracts anywhere in the world that describe all or part of the invention. The date of publication is the date the material was or will be made available to others (excluding editors, conference sponsors, or others involved in preparing the article or presentation). For example, publication occurs when a journal is first mailed, when a thesis is catalogued, or when conference participants may obtain an abstract. If not certain when a future publication may occur, please estimate the earliest date possible and mark as ESTIMATE.

Please inform the Office of Patents and Licensing of any changes in publication dates. To retain the potential for foreign protection, U.S. patent applications must be filed BEFORE any description of the invention is published.

Publications: J. Moon and B. Brickner, "Maximum transition-run codes in magnetic recording," International magnetics Conference, Seattle, Washington.
Date: 12-4-95 (manuscript not available yet)

5. PUBLIC OR COMMERCIAL USE/SALE

Describe all previous or planned public or commercial use/sale and give the date of such use.

Description:

Date:

None

6. PRIOR ART

Attach copies of any literature and patent searches done by the inventors and any articles, patents and product descriptions concerning technologies closely related to the invention. A survey article on the field of the invention is particularly useful.

Attached articles:

- 1) Kees A. S. Immink, "Coding techniques for the noisy magnetic recording channel: a state-of-the-art report," IEEE Transactions on Communications, vol. 37, no. 5, May 1989.
- 2) Paul H. Siegel and Jack K. Wolf, "Modulation and coding for information storage," IEEE communications magazine, vol. 29, no. 12, December 1991.

7. COMMERCIAL MARKET

Describe the current and/or potential commercial market for the invention. Also, on the next page, provide the names and telephone numbers for any contacts in industry you know of with whom a representative of the Office of Patents and Licensing could discuss the commercial possibilities for the invention. There will be no disclosure of proprietary information during these conversations without protection for the confidentiality of the disclosure.

Commercial Market:

This invention can potentially improve the storage capacity of current and future magnetic recording devices substantially (by 15% - 40%) without increasing the cost. This invention can find applications in computer disk drive industry (currently enjoying a \$ 27 billion market, world wide), computer linear tape drive industry (a \$ 3.8 billion industry), and professional and consumer video recording industry (with a world wide revenue exceeding \$20 billion). Digital storage is an essential component of the "information super-highway" and has been playing an increasingly important role in both professional and consumer markets utilizing any type of digital technology. Because of its direct applicability to digital storage systems, this invention no doubt has an enormous commercial potential.

Explore Litigation Insights

Docket Alarm provides insights to develop a more informed litigation strategy and the peace of mind of knowing you're on top of things.

Real-Time Litigation Alerts



Keep your litigation team up-to-date with **real-time alerts** and advanced team management tools built for the enterprise, all while greatly reducing PACER spend.

Our comprehensive service means we can handle Federal, State, and Administrative courts across the country.

Advanced Docket Research



With over 230 million records, Docket Alarm's cloud-native docket research platform finds what other services can't. Coverage includes Federal, State, plus PTAB, TTAB, ITC and NLRB decisions, all in one place.

Identify arguments that have been successful in the past with full text, pinpoint searching. Link to case law cited within any court document via Fastcase.

Analytics At Your Fingertips



Learn what happened the last time a particular judge, opposing counsel or company faced cases similar to yours.

Advanced out-of-the-box PTAB and TTAB analytics are always at your fingertips.

API

Docket Alarm offers a powerful API (application programming interface) to developers that want to integrate case filings into their apps.

LAW FIRMS

Build custom dashboards for your attorneys and clients with live data direct from the court.

Automate many repetitive legal tasks like conflict checks, document management, and marketing.

FINANCIAL INSTITUTIONS

Litigation and bankruptcy checks for companies and debtors.

E-DISCOVERY AND LEGAL VENDORS

Sync your system to PACER to automate legal marketing.