Noetix Research Inc.

Geomatics & Remote Sensing

Ice Tutor Technical Description

Noetix Research Inc., 265 Carling Ave., Suite 403, Ottawa, Ontario, K1S 2E1 Canada Tel: (613) 236-1555 Fax: (613) 236-1870

1. Introduction

Ice Tutor was designed and developed by Noetix Research Inc., in partnership with the Canadian Ice Service (CIS). It is an interactive, computer-based training system designed to train students and professionals who need to visually recognize ice types or interpret ice types from RADARSAT-1 SAR imagery. The system was developed by sea ice recognition and SAR interpretation experts. It employs current state-of-the art design methodologies for adult computer-based training tools, and incorporates effective training techniques to maintain student interest and reinforce what has been learned. Ice Tutor is designed in a modular format and is rich in media such as photographs, SAR imagery, and graphics.

The system is based on a hypertext environment, where users may review Chapters or Tests in any order during a training session. In this way advanced users may access the advanced exercises or final tests first to test their level, whereas other users may start wherever they feel they need to. Ice Tutor also employs an easy to use navigation structure with intuitive graphical navigation buttons.

Ice Tutor consists of two modules:

- Visual Ice Recognition
- RADARSAT SAR Interpretation.

2. Visual Ice Recognition

The Visual Ice Recognition module is intended to teach students and professionals to visually identify ice conditions, using high quality photographs taken from both ships and low-flying aircraft. World Meteorological Organization (WMO) terminology is used throughout the module.

The module contains generic information applicable to all geographical areas in which a client may be operating or have an interest. Examples of all the principle ice types (new, grey, grey-white, first-year, old ice, icebergs and ice islands) are provided for both winter and summer conditions. These are supplemented with examples of ridging, various floe sizes, ice concentration, ice openings, and determining state of decay. The module consists of 7 Chapters with over 120 photographs to illustrate ice types and features and for testing purposes. Figure 1 shows the Module Main Menu.

Each Chapter contains both training content (see Figure 2 for a sample training content screen), as well as exercises to reinforce understanding of the materials. Users learn to recognize ice types and their features by interacting directly with photographs, and test their understanding of the material through exercises. Feedback is provided for each response of an exercise, and serves to direct the user to the correct answer and enhance understanding of the material.

Review Tests at the conclusion of each Chapter, as well as a Final Test, are provided for the user to test their knowledge of the material. A Review Test screen is provided in Figure 3. User responses for these tests are tracked, and the system calculates a test score. The score is both displayed on screen and written to a file on hard disk. The file may be accessed by the Training Mentor to review users' progress. See Section 4 for more information on User Tracking and Scoring.

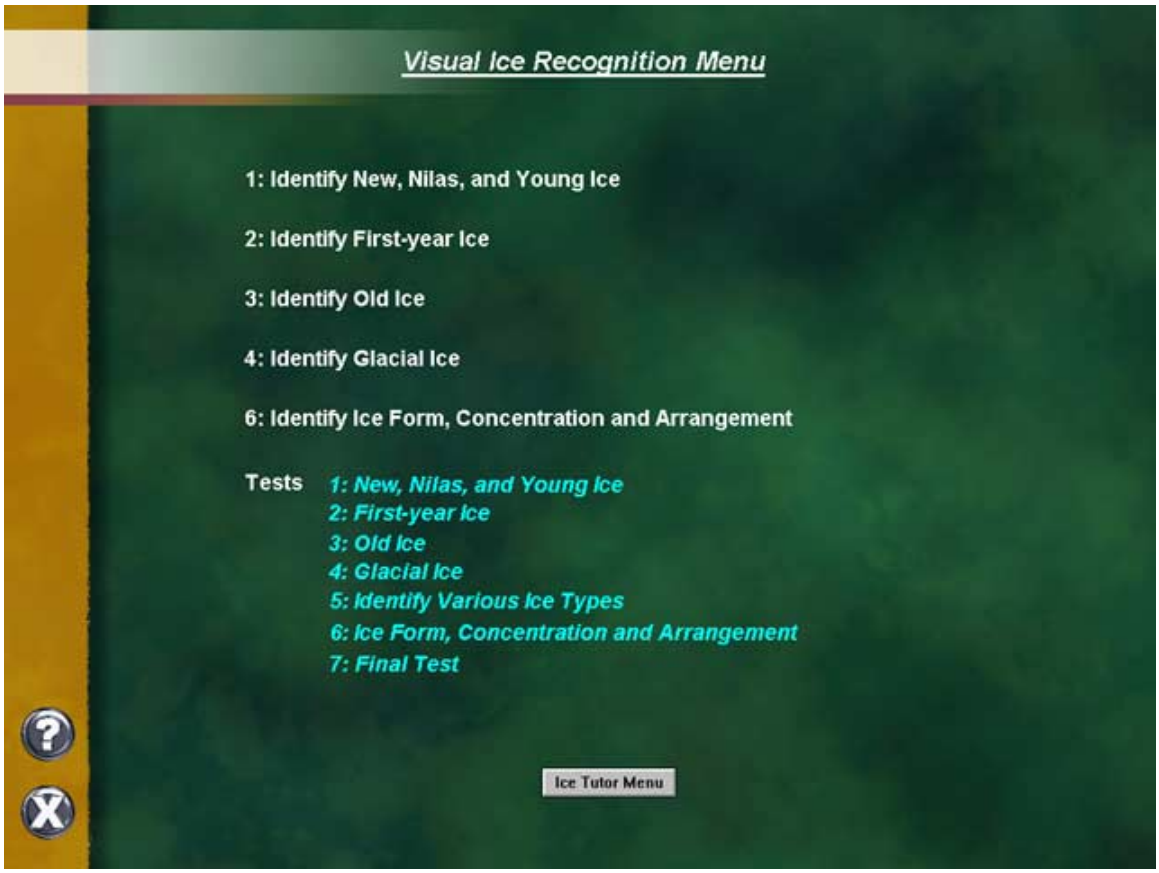

Figure 1. Visual Ice Recognition Menu

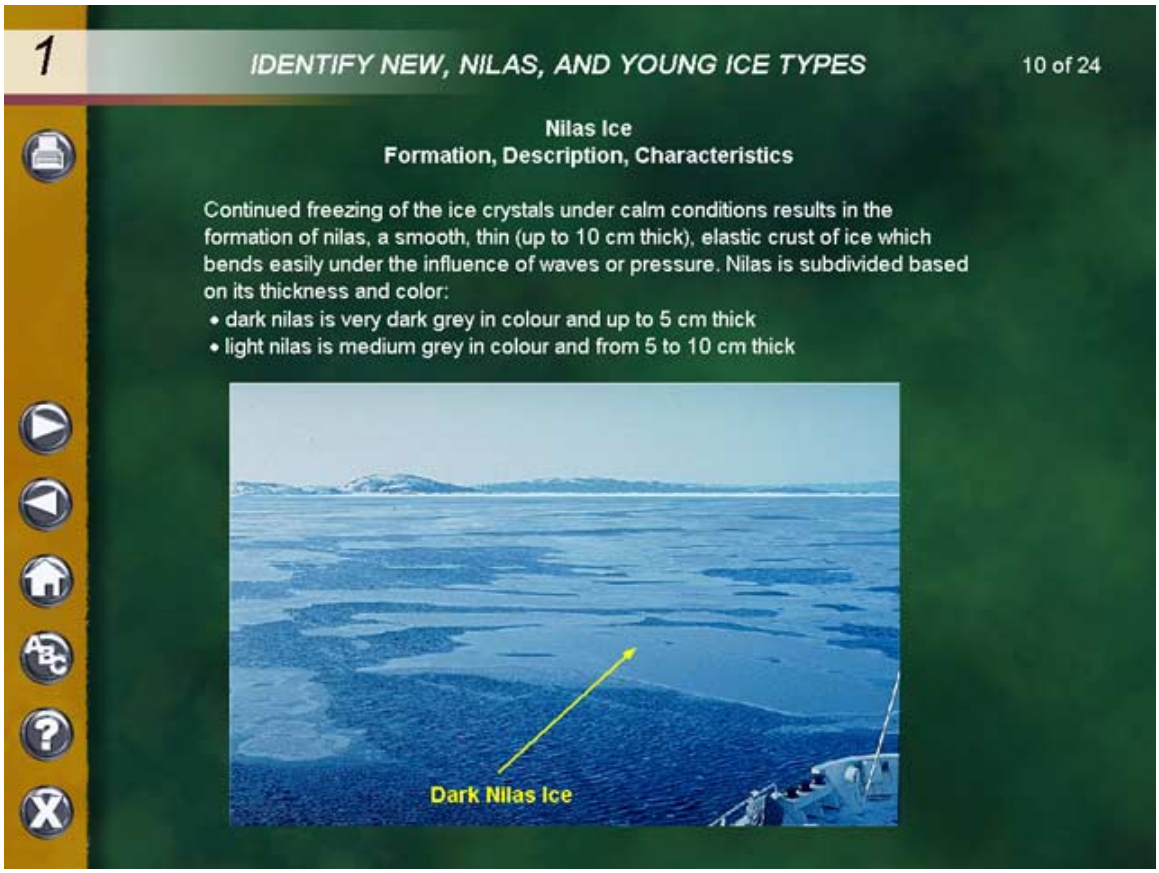

Figure 2. Sample screen from Visual Ice Recognition Module.

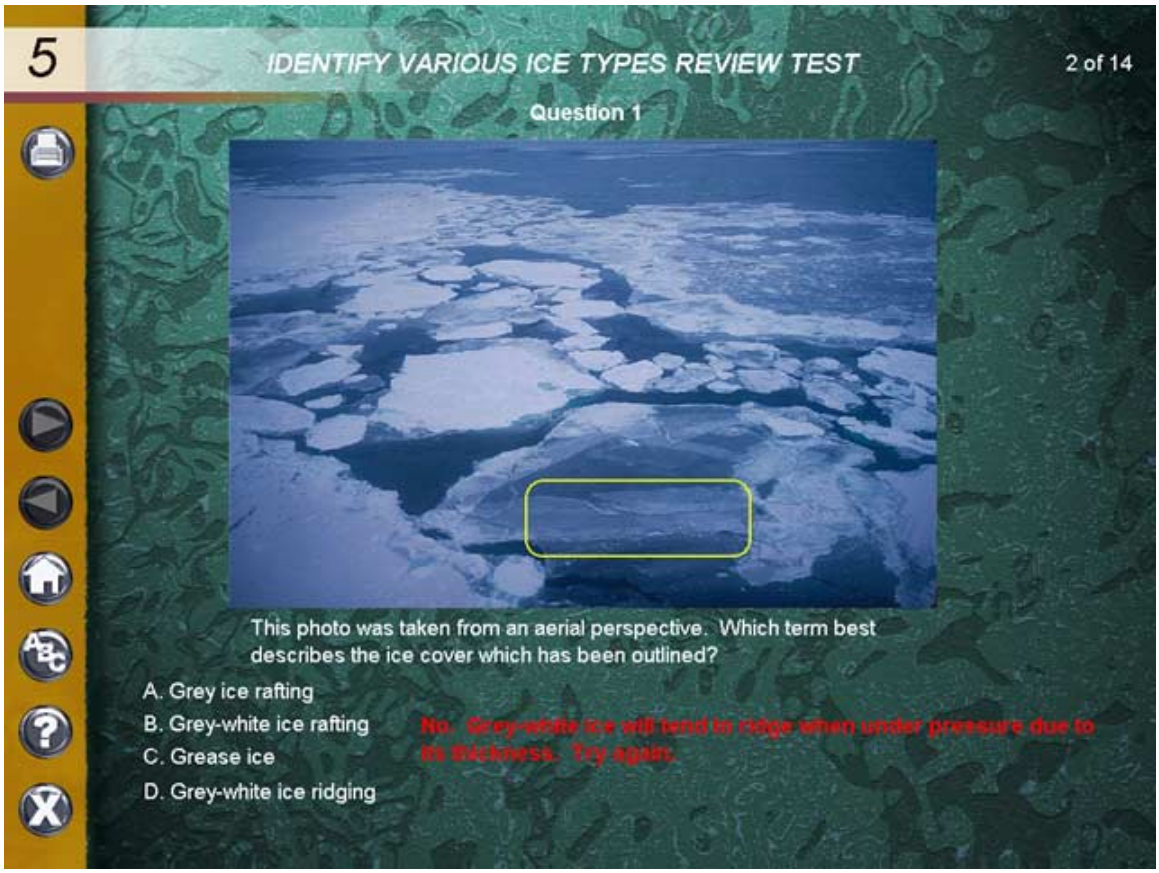

Figure 3. Sample screen from Visual Ice Recognition Module Review Test showing test structure and feedback.

3. RADARSAT SAR Interpretation

The RADARSAT SAR Interpretation module is designed to instruct users to identify and interpret ice types and features within RADARSAT-1 SAR imagery. Sea ice formed in-situ in the Gulf of St. Lawrence/Canadian East Coast Regions and the Canadian Arctic are covered. Radar signature characteristics for the major ice types are presented and discussed, and reinforced with the use of digital SAR imagery. The Module contains over 120 SAR images, which are used to illustrate concepts and within exercises and tests.

The module consists of 3 sub-modules, each containing several Chapters and Review Tests, and one Final Test. Figure 4 shows the RADARSAT SAR Interpretation Module Menu. The first sub-module is oriented towards understanding the capabilities of the RADARSAT-1 SAR sensor and the fundamental types of interaction between sea ice properties and microwave energy. This leads into learning to interpret features or objects that characterise each of the ice types. Topics covered include:

- the sensor and target parameters which influence backscatter from ice

- radar-sea ice interaction mechanisms
- radar image interpretation principles as related to sea ice
- the effect of resolution and near and far range on interpretation
- description and specifications of RADARSAT-1

Subsequent sub-modules instruct the user on how to interpret SAR imagery of specific geographical areas. These regional Chapters focus on the unique ice regimes found in each area. Users are presented with a description of the SAR signature characteristics of different ice types and features. Interactive exercises throughout the Chapters encourage and challenge the user to apply their new found knowledge to solve real-life interpretation exercises using on-screen, high resolution RADARSAT-1 SAR images. The Review Tests and Final Tests are set up in the same way as the Ice Recognition Module.

Figure 4. RADARSAT SAR Interpretation Menu

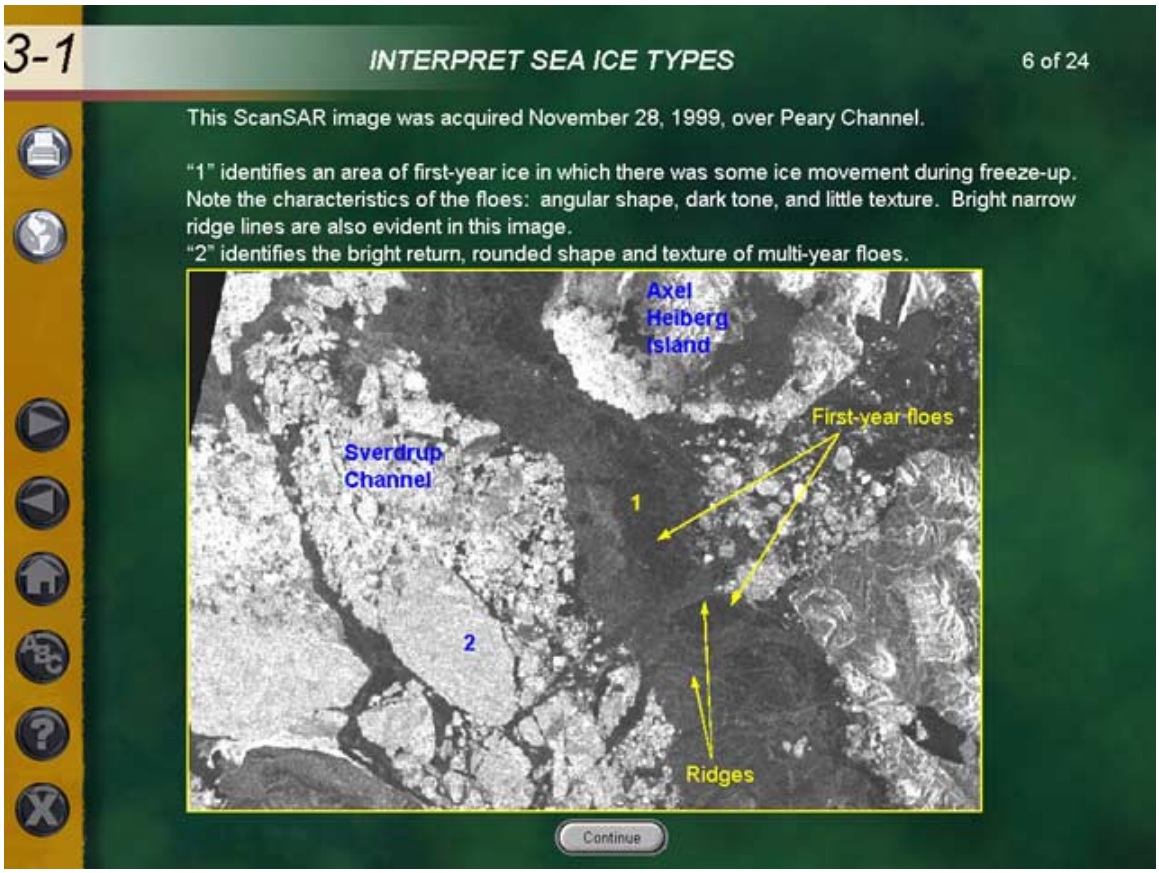

Figure 5. Sample screen from Ice Interpretation Module.

4. User Tracking and Test Scoring

The system has been designed to track and score a student's progress, such that a Training Mentor can review student test results and manage training progress.

Files containing the student's progress and test results are written to the */windows/a5w_data/* directory, which is located on the hard drive on which the Ice Tutor is installed. For each user, a folder is created within this directory. Within each folder two new files are created: USERINFO.DAT and QUIZ.DAT.

USERINFO.DAT: This file contains the user's name and password. This is useful if the user has forgotten his password. Other fields within this file should be ignored as they are for internal tracking purposes only.

QUIZ.DAT: This file contains information on all Tests the user has completed. It logs the results of each question within a Test, as well as displays the final score for the test. A sample quiz.dat file is included in Figure 6 below.

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Module                  Submodule   Chapter
SAR Imagery Interpretation    1     1

UserName:   John Smith
Quiz Date:  28/03/00
Quiz Time:  9:42 AM
Question    Attempts

1           2
2           1
3           2
4           1
Number of Questions     4
Quiz Score: 50%   or 2 out of 4
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Module                  Chapter
Visual Ice Recognition  1

UserName:   John Smith
Quiz Date:  28/03/00
Quiz Time:  12:25 PM
Question    Attempts

1           3
2           1
3           1
4           1
5           1
6           2
Number of Questions     6
Quiz Score: 66.66666666667%   or 4 out of 6
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Figure 6. Sample QUIZ.DAT file.

5. Technology

The Ice Tutor was developed using Macromedia's Authorware 5 Attain. This software is a comprehensive multi-media and hypertext training development platform which enables the development of sophisticated interactive training tools.

System Requirements for the Ice Tutor are:

- Pentium processor recommended
- 64 MB RAM recommended
- Microsoft Windows 95, 98 or NT
- Windows-compatible mouse or other pointing device
- CD-ROM drive for installation
- 85 MB free hard disk space for installation

- A graphics adapter card capable of displaying 32-bit colour at 1024 x 768 pixel resolution.