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WELCOME TO SYNAPSE!

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Greetings!

Now that **NeuralSight**® has been released, with this issue of Synapse we want to share with you information about some of **NeuralSight's** key features and capabilities. We also want to alert our US customers and partners to opportunities in the current Department of Defense Small Business Innovation Research (SBIR) Program Solicitation.

Most important, we thank you for your cooperation and support in 2004, particularly in light of Hurricane Ivan, and we wish you a joyous holiday and prosperous new year!

Remember, you can always reach us at newsletter@neuralware.com - tell us how we're doing, and where we might improve.

Applying the Power of NeuralSight

Increasingly, neural network models are being deployed in applications that require **traceable paths from data files through model results**. Consequently, in addition to handling data files that exceed the record or field count limitations of Microsoft Excel spreadsheets, **NeuralSight** offers extensive new capabilities for organizing and selecting training data records and maintaining an **audit trail of the model development process**.

In this Synapse we offer some guidance for choosing directory structures and exploiting **NeuralSight's** record selection options. In a future issue we'll provide information about using **NeuralSight's** facilities for establishing model performance standards, and evaluating models based on those standards.

Organizing a NeuralSight Modeling Effort

The basic requirement for building and evaluating Prediction and Classification models with **NeuralSight** is to have **labeled** training data (i.e., historical data that has known outcomes), and of course to have a business or research purpose for building models.

After you have decided the basic direction for your model building effort (type of model, number of production models required, etc.), you can quickly configure **NeuralSight** to build and evaluate many models in order to find enough models that meet your performance objectives.

NeuralSight is designed to organize models and related data files using the concept of a *Session*. A *Session* represents a set of high-level model parameters and a set of data files used to train the models (in essence, the *Session* simply keeps a list of models that were built in sequence and which met the performance standards specified during Session configuration). A *Session* is stored on your computer as an *SSSSS.session* file – where you provide the *SSSSS* name for the file. *Models* built in a *Session* are named by a standard naming convention, so that it is easy to identify all models that are related to a particular *Session*. You provide a base model name, then **NeuralSight** appends a sequence number the base name when a model is built. You also specify a folder (directory) on your computer for **NeuralSight** to place *Session* and *Model* files that are created during a model building session.

This and other “administrative” information about a *Session* is entered on the **General** tab in the **Session Configuration** dialog as shown in Figure 1. In addition to specifying file locations and requirements, you also use the **General** tab to specify the type of model you want to build, when **NeuralSight** should stop building models, and (if you are building prediction models whose output will be transformed into categories, you specify category threshold boundaries.

Although it is beyond the scope of this introduction, please remember that **NeuralSight** permits you to assign default folder locations in a *Preferences* file, to help speed up *Session* configuration.

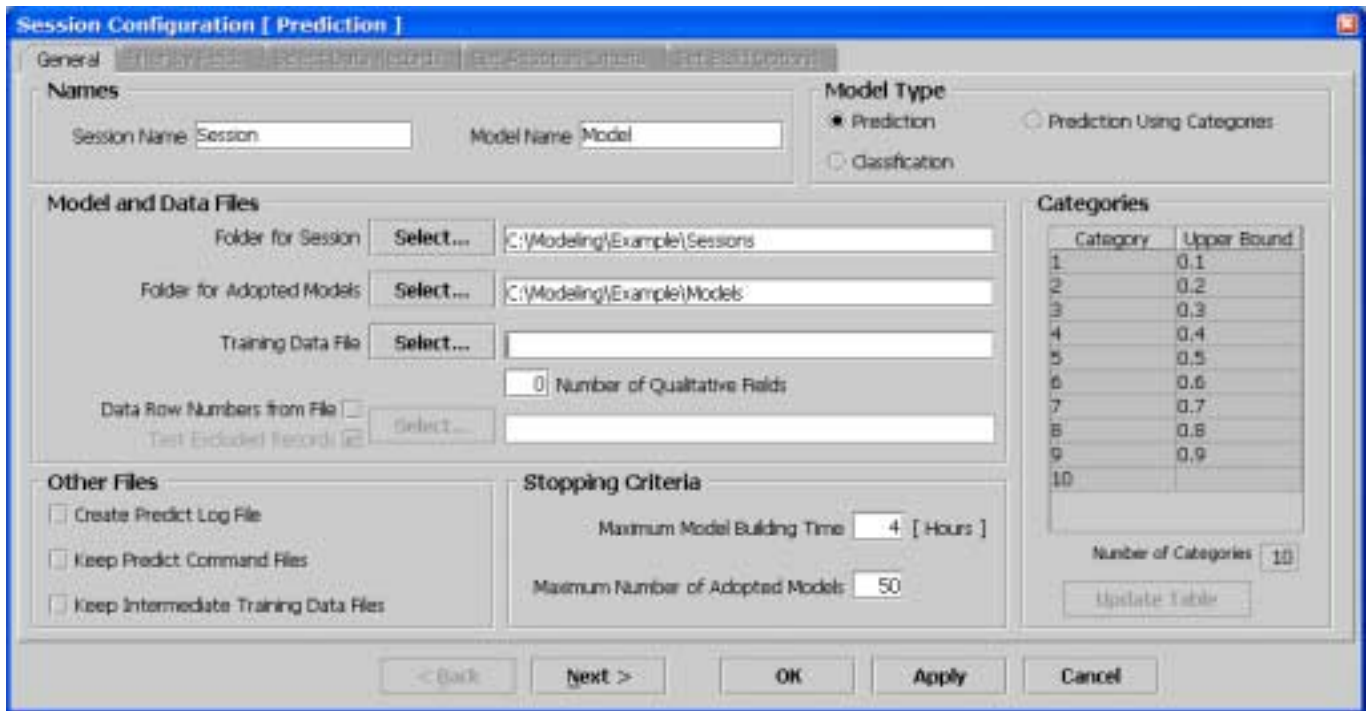


Figure 1 – The **General** tab in Session Configuration dialog

Generally we suggest that you keep all *Session* files in one folder, so that when you want to work with a *Session* that already exists, you can quickly scan available *Sessions* without having to browse to multiple folders.

However, for models associated with a *Session*, we suggest that you create a new folder for each separate set of models. Having a folder for each set of models associated with a *Session* will help you find specific models without having to view all models that *NeuralSight* has created.

NeuralSight expects training data to be in “flat” Comma Separated Value (csv) ASCII files. You specify the file by browsing to it through the Training Data File **Select...** button. *NeuralSight* also expects that the first record in a file contains field names, separated by commas. Field names are required so that subsequent reviews of model performance can be easily related to the training data files.

In addition, *NeuralSight* can accommodate fields that are qualitative, or descriptive, in the model building process. The only restriction is that qualitative fields must be contiguous, and they must be at the beginning of every data record. If a Training data file contains qualitative fields, the number of fields is specified on the **General** tab.

Because *NeuralSight* relies on a simple-to-generate flat file structure, it is easy to integrate *NeuralSight* into automated workflows that extract data from a relational database and format it directly as flat csv files ready to be further processed by *NeuralSight*.

Filtering NeuralSight Training Records by Field Values

NeuralSight offers extremely flexible record selection and processing options for large files with many fields, including filtering records based on qualitative (descriptive) information contained in records.

Filtering is often appropriate when models are being built for situations that involve consumer behavior or commercial operations that span industries. Large relational databases can contain huge numbers of records that comprise the universe of training records, yet it may be appropriate to segregate the entire pool by some selection criteria.

With *NeuralSight's* facility for filtering on qualitative fields, the relational database query that produces the basic csv file can be a very simple query that extracts a large number of records. Then *NeuralSight's* field selection logic can be used to select a subset of records for training.

Figure 2 illustrates filter logic that will select all records that represent Males (SEX == M) from areas with a ZIP code greater than 99900. *NeuralSight* displays qualitative field names (obtained from the first line of the csv file) and also populates the drop-down list with field names to minimize the amount of typing required to formulate filtering expressions. As logical criteria are added, the complete filter expression is displayed in the panel on the right side of the **Filter by Fields** tab. The filter is applied when the Next> button is clicked. Note that excluded records can optionally be included in the independent test (validation) dataset used by *NeuralSight*.

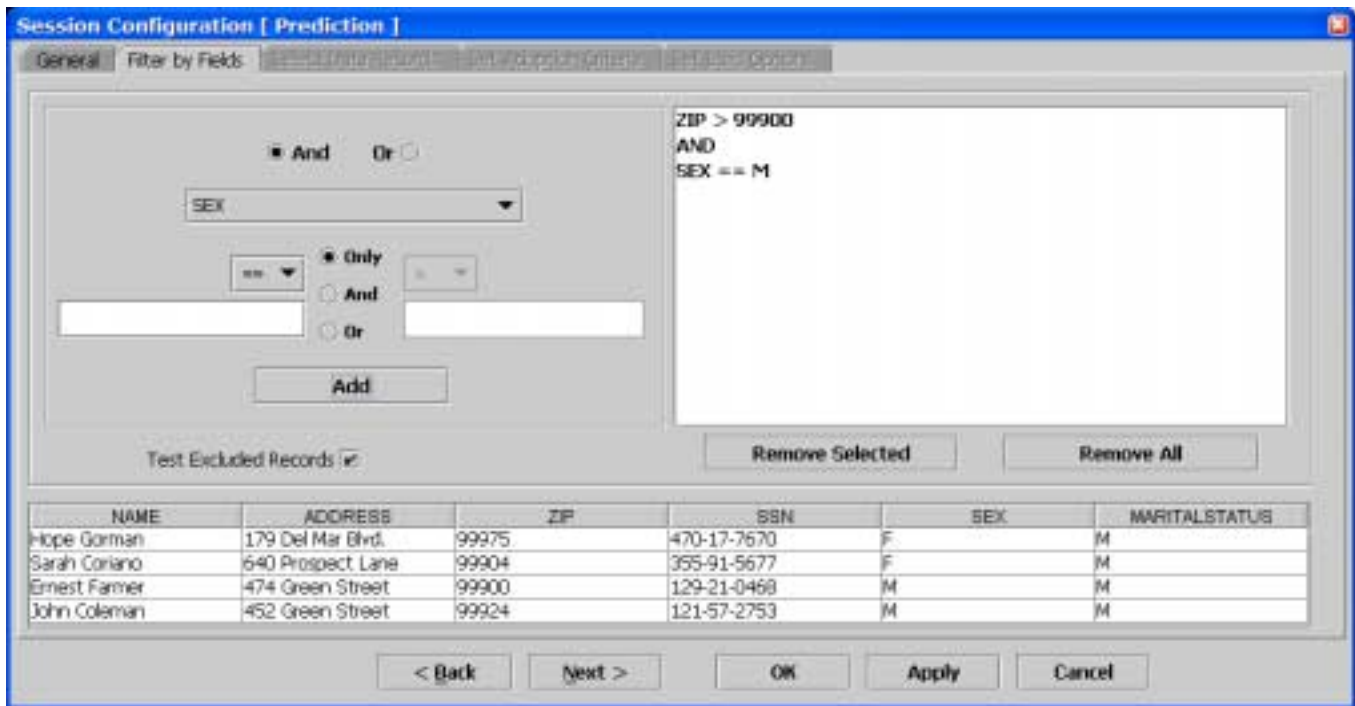


Figure 2 – The **Filter by Fields** tab in Session Configuration dialog

Selecting NeuralSight Training Records

As illustrated in Figure 3 below, the **Select Data Records** tab is used specify the final set of records that will make up the Training Data file (since this example is a prediction model, the tab also permits you to specify model adoption criteria; however, a discussion of adoption criteria is beyond the scope of this document). Note that if data field filtering was performed in the previous step, the set of records available in this step may be fewer than the number of records in the original Training Data file.

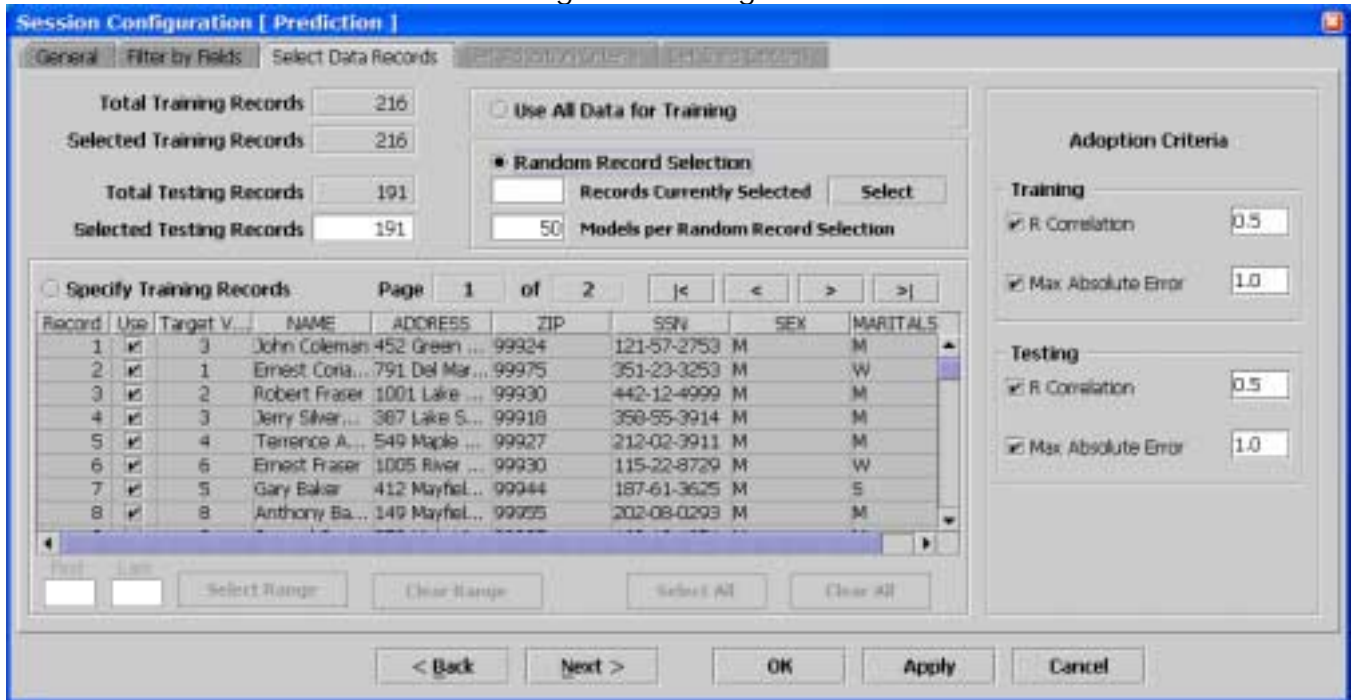


Figure 3 – The Select Data Records tab in Session Configuration dialog

When you have a sufficiently large pool of training data records, we suggest that you employ random record selection, with somewhere between 10 and 100 models between reselections. Basically you should choose a value that will yield a reasonable number of reselections in the time you allot for building models.

Regardless of the Record Selection method you elect to use, **NeuralSight** maintains an easy-to-access account of the specific records used in training and testing every model (stored as a csv file which contains record numbers). This facility lets you examine characteristics of the training and/or test records that produced particular prediction or classification values. The file can also be used to extract the same records from the original base Training Data file, so that the model building process can be replicated.

Future newsletters will offer other hints and tips for undertaking large-scale model development projects. But you don't have to wait for future newsletters. NeuralWare offers in-depth model development and deployment consulting that can help you get your project started on the right track, right now! Contact jack.copper@neuralware.com or bob.everly@neuralware.com to discuss your next model development project.

Small Business Innovation Research

The SBIR program is a federal program that channels research funding to small businesses which have technological expertise applicable to specific research and development areas of interest to government agencies. The Department of Defense solicitation that was recently released contains a number of topics which require advanced signal processing and pattern recognition, in addition to hardware and system design and development. NeuralWare would like to integrate its fast-track model development platforms and experience with appropriate partners' domain knowledge and hardware expertise in response to relevant topics. But hurry - **proposals are due on January 14 2005.**

The SBIR program is a 3-phase funding program that allows small businesses to creatively respond to Department of Defense (DOD) requirements for technological innovation. The selection process is through competitive, peer-reviewed proposals. A Phase I award is typically \$60,000 – \$100,000 for a 6 – 9 month feasibility/proof of concept effort. Phase II awards typically range from \$500,000 to \$750,000 for a 24 month beta prototype development effort.

The Department of Defense considers the following areas "Critical Technology Areas," and virtually all research and development topics in the current solicitation fall into one of these areas.

1. Air Platforms

Fixed-Wing Vehicles; Rotary-Wing Vehicles; Integrated High Performance Turbine Engine Technology (IHPTET)/Versatile Affordable Advanced Turbine Engines (VAATE); Aircraft Power; High-Speed Propulsion and Fuels.

2. Chemical / Biological Defense

CB Detection; CB Decontamination; CB Protection; CB Modeling and Simulation; Medical Chemical Defense; Medical Biological Defense.

3. Information Systems Technology

Decision-making; Information Assurance; Seamless Communication; Modeling & Simulation Technology; Computing and Software Technology.

4. Ground and Sea Vehicles

Platform and system technologies that support Ground Vehicles; Surface Ship Combatants; and Submarines.

5. Materials / Processes

Materials and Processes for Survivability, Life Extension, and Affordability; Manufacturing Technology; Civil Engineering; Environmental Quality.

6. Biomedical

Infectious Diseases of Military Importance; Combat Casualty Care; Military Operational Medicine; Medical Radiological Defense; Medical Biological Defense; Medical Chemical Defense.

- 7. Sensors, Electronics and Electronic Warfare**
Radar Sensors; Electro-Optical Sensors; Acoustic Sensors; Automatic Target Recognition; Integrated Platform Electronics; Radio-Frequency Components; Electro-Optical Technology; Microelectronics; Electronic Materials; Electronics Integration Technology; EW Threat Warning; EW Self-Protection; EW Control.
- 8. Space Platforms**
Space Vehicles; Launch Vehicles; Space Propulsion [Integrated High-Payoff Rocket Propulsion Technology (IHRPRT)].
- 9. Human Systems**
System Interfaces and Cognitive Processing; Protection, Sustainment, and Physical Performance; Personnel, Training and Leader Development.
- 10. Weapons**
Two broad categories – 1) Conventional Weapons: Countermine/Mines; Guidance and Control; Guns; Missiles; Ordnance; Undersea Weapons; and Weapon Lethality / Vulnerability. 2) Directed-Energy Weapons: Lasers; and High-Power Microwave.
- 11. Nuclear Technology**
Warfighter Support; Systems Effects and Survivability; Test and Simulation Technology; Environments and Effects; Threat Reduction.
- 12. Battlespace Environments**
Terrestrial Environments; Ocean Battlespace Environments; Lower Atmosphere Environments; Space/Upper Atmosphere Environments.

Within each area, the challenges range from basic science through hardware and systems design and development, to analyzing and presenting information to provide actionable knowledge. NeuralWare is of course interested in those topics which have analysis/prediction/classification/knowledge discovery requirements

Complete information about the SBIR program, as well as links to specific topics from the DOD components that are participating in this solicitation can be found at:

<http://www.acq.osd.mil/sadbu/sbir/solicitations/sbir051/index.htm>

We encourage you to review the list of topics to determine whether your technology and expertise could be applied to DOD critical technology areas.

NeuralWare Technology Applications

The combination of NeuralWorks Predict and NeuralSight is a comprehensive fast-track model and neural network application development environment. NeuralWare technology can significantly enhance and leverage domain expert knowledge when applied to the analytic requirements of DOD research interests. In addition, for those interests that entail developing sensor and data acquisition hardware and systems, NeuralWare

technology provides a seamless path from desktop/benchtopy proof-of-principle models through compact embedded modeling applications and enterprise class systems.

NeuralWare is particularly interested in cooperating with organizations that have demonstrated sensor design and development expertise, in order to develop intelligent distributed sensor networks.

For more information and to discuss collaboration possibilities, please contact Jack Copper (jack.copper@neuralware.com or +1 412.278.6290).

Special Offers on NeuralWare Products

NeuralWare is offering special pricing when you purchase any NeuralWare product and a seat in the upcoming **Applying Neural Networks** training class that will be held January 24 - 28 in Pittsburgh. Come learn from NeuralWare experts, as well as your peers, how to take advantage of NeuralWare's ever expanding technology portfolio.

Through December 31, commercial and government customers can take **20% off** the total price for **NeuralWorks Predict**, a 1 year **TAP** subscription, and **Training**, PLUS become eligible for **introductory pricing on NeuralSight**.

For more pricing and other details concerning these special offers, please contact John Wavle, VP of Sales, at john.wavle@neuralware.com or +1.412.278.6292.