

Entrepreneurship Support Based on Mixed Bio-Artificial Neural Network Simulator (ESBBANN)

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Abstract. Based on large global databases of support entities for entrepreneurship and their experienced technical staff, a simulation model has been built to predict the potential level for growth and prospects of success for entrepreneurs and companies that ask for public support, in order to adapt services and technical recommendations, to implant a money-saving policy and improving probabilities of economic and financial sustainability.

Keywords: entrepreneurship, artificial neural network, mixed bio-artificial, support, entrepreneurship policy, big data, entrepreneur, artificial intelligence, survival, success, sponsorship, incubated firms.

1 Introduction

Most entities that support entrepreneurs have the same problem in the normal course of their activity: the lack of a correct identification of potential entrepreneurship and a precise detection of capacities and skills profile. In general, they would like to make their service more user-centric. There is a vast amount of information, but the technical support is never able to make correct use of it. We propose a design of Neural Network (NN) that comprises at least one artificial (informatics engineered) component combined with a biological one: the technical staff of support entities for entrepreneurship. We split this NN into two parts¹:

- **Artificial.** An objective data set has been used to build an Artificial NN (ANN).
- **Entrepreneur and project information:** an objective, accurate and reliable piece of information that was collected by some entrepreneurship support entities. We handle up more than 40,000 entrepreneurs and 920 variables from 1999 to 2013.
- **Environment:** a large database of any possible relevant information is included. Official statistics and other data collections which are relevant for entrepreneurs have been used.

Biological. Based on experience and subjective information that has been collected by technical staff of support entities, a Biological Neural Network (BNN) has been defined and connected with our ANN.

¹ See Figure 1.

- **Technical support information:** a subjective piece of data that can be collected by any technical support staff of the entrepreneur or the company. We have designed models based on NNs to explain the relationships between any subjective variable and the other groups of variables (entrepreneur variables, project information and environment aspects).

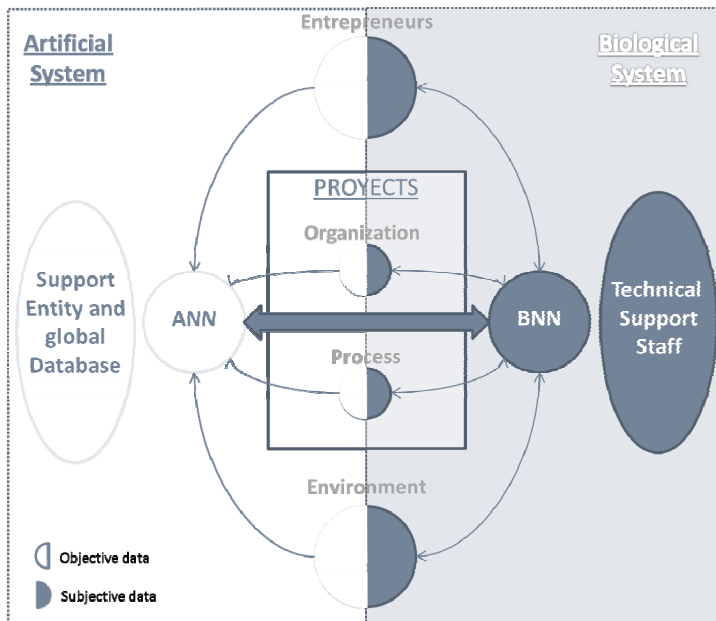


Fig. 1. Operation scheme of entrepreneurship support based on mixed bio-artificial neural network simulator. ANN: Artificial Neural Network. BNN: Biological neural Network.

2 Approach Demonstration

The simulator has been developed by designing an appropriate algorithm and it has been implemented by using the statistical software included into the computational package MATHEMATICA 9. The final results have been adapted to different environments through its Computable Document Format (CDF).

First, different ANN helps us decide the relevant variables, according to their influence over the success for the entrepreneur. Then, another ANN determined the main connections between relevant variables. The final NN integrates all the groups of variables, including them in an algorithm after the corresponding training process.

To authors' knowledge, it is the first time that a mixed neural network model is constructed to predict success for entrepreneurship with more than 95% of accurate predictions. We think this model can be adapted and applied to other situations.

Live Demonstration: Real-Time Motor Rotation Frequency Detection by Spike-Based Visual and Auditory Sensory Fusion on AER and FPGA^{*}

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Abstract. Multisensory fusion is commonly used in various areas of robotic and also for the neuromorphic engineering community to collect information from an environment using different and complementary types of sensor. This demonstration shows a scenario where the motor rotation frequency is obtained using a DVS retina chip (Dynamic Vision Sensor) and a binaural auditory system on FPGA that mimics a biological cochlea. Both are spike-based sensors with Address-Event-Representation (AER) output. A new AER monitor hardware interface allows two operation modes: real-time (up to 5 Mevps through USB2.0) and off-line (up to 20Mevps and 33.5Mev stored in DDR RAM).

Keywords: Address-Event-Representation, spike, neuromorphic engineering, vision, DVS, retina, cochlea, sensor fusion.

1 Introduction

Several works about spike-based vision and auditory fusion (1,2) have been published in order to present the advantages of spike-based multisensory fusion. This demonstration consists of the system shown in the scheme (fig 1). A circle of metal with a shape drawn is mounted on a DC motor that will be rotating while DVS and binaural cochlea (3) are capturing information from the scene. The two spike-based sensors information are transmitted on board where both are merged and sent to the controller board. Two operation modes are implemented in this controller board: *real-time*, in which all information received from the sensor is timestamped and sent to the jAER(4) application through USB 2.0 board interface; and *off-line*, where sensor information is stored in DDR2 RAM memory, together with precise temporal information, allowing later processing in a PC by downloading it from DDR2.

The captured sensor information is computed in the jAER application to estimate the motor rotation frequency.

2 Hardware Involved

The components used in this demonstration are: a DC motor with a metal circle; a DVS retina; a binaural auditory system that mimics a cochlea; a merger AER board; and the XEM 6010 Opal Kelly board.

^{*} This work has been supported by BIOSENSE (TEC2012-37868-C04-02/01).

The CPLD located at merger AER board joins in its output the two AER sensors information, which are differentiated by most significant bit of event addresses. The new Datalogger/Player circuit captures this information. It is implemented on the Opal Kelly Spartan 6 FPGA. As discussed above, DataLogger/Player circuit allows two operations mode: *real-time* and *off-line*.

In *real-time* mode, the AER data stream from the AER Merge board is time-stamped and sent to a PC directly through a USB 2.0 interface. The maximum amount of information captured can be up to 5 Mevps. This limitation is due to the bottleneck of the USB 2.0 interface.

In *off-line* mode the maximum amount of information captured by the system is higher (about 20 Mevps) because the events are time-stamped and stored immediately in DDR2 memory where the FPGA-DDR2 interface is faster than USB 2.0 interface. Opal Kelly's DDR2 memory has a capacity for 33.5 Mevents.

For both methods the DataLogger/Player circuit splits retina and cochlea data into two different USB EndPoints. In jAER application the information is read from these EndPoints and the motor rotation frequency is estimated combining results from two sensors. Both visual and auditory information will give in parallel two estimation results. They are fused and combined by taking the average.

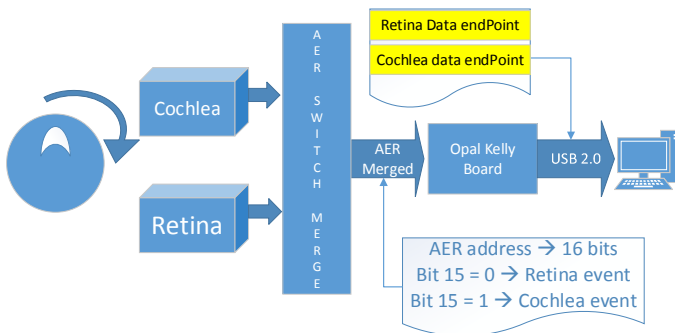


Fig. 1. Complete demonstration scheme in which is shown the information flow. The two yellow rectangles correspond to the two sensor data endpoints.

3 Visitors Experience

Visitors can interact with the system by changing, through a microcontroller, the motor rotation frequency and the DVS and binaural cochlea position, while they are capturing events to estimate the motor frequency.

References

1. O'Connor, P., et al.: Real-time classification and sensor fusion with a spiking deep belief network. *Frontiers in Neuroscience* 7(178) (2013)
2. Yue-Sek, C.V., et al.: Neuromorphic Audio-Visual Sensor Fusion on a Sound-Localising Robot. *Frontiers in Neuroscience* 6(21) (2012)
3. Jimenez-Fernandez, A., et al.: On AER Binaural Cochlea for FPGA: design, synthesis and experimental analysis. *Sensors*, under revision (2014)
4. jAER Open-Source Software Project, <http://jaer.wiki.sourceforge.net/>

Author Index

- Abe, Shigeo 547
Adnan, Tariq 837
Aioli, Fabio 515
Akaho, Shotaro 145
Alalshekmubarak, Abdulrahman 225
Aldine, I. Kamal 121
Alencar Santos, José Daniel 579
Alexandre, Luís A. 265
Ali Al-Jumaily, Adel 837
Almogahed, Bassam A. 523
AlTurki, Musab A. 241
Anguita, Davide 177
Aoyama, Atsushi 467
Araújo, Rui 821
Arie, Hiroaki 9, 363
Arnold, Joshua T. 635
Austin, James 435
Ayad, Omar 587
- Bagheri Shouraki, Saeed 379
Bai, Jinfeng 209
Barančok, Peter 41
Barreto, Guilherme A. 105, 579
Barros, Pablo 403
Bastos-Filho, Carmelo J.A. 667
Bauer-Wersing, Ute 411
Behnke, Sven 395
Bell, Christian 699
Beuth, Frederik 459
Bosaghzadeh, Alireza 595
Boukabou, Abdelkrim 627
Braga, Antônio P. 531
Bremer, Simon 97
Burikov, Sergey 805
Burles, Nathan 435
Butz, Martin V. 683
- Cabessa, Jérémie 57
Cardoso, Jaime S. 105
Casey, Matthew 723
Castro, Cristiano L. 531
Cerezuela-Escudero, Elena 847
Chang, Catie 829
- Chatzis, Sotirios P. 355
Chaves-Maza, Manuel 845
Chen, Zhineng 209
Clares Tomas, Juan Antonio 169
Cong, Jason 281
Conradt, Jörg 97, 161, 379, 691, 821
- Dávila-Chacón, Jorge 619
Dias, Kaushala 475
Dolenko, Sergey 805
Dolenko, Tatiana 805
Donini, Michele 515
Dornaika, Fadi 121, 595
Du, Zhao 773
du Buf, J.M.H. 451
Düll, Siegmund 17
- Efitorov, Alexander 805
Eggert, Julian 185
Endres, Dominik 603
- Farkaš, Igor 41
Faubel, Christian 451
Fedriani, Eugenio M. 845
Feng, Bailan 209
Fernandes, Bruno J.T. 667, 813
Firouzi, Mohsen 379, 691
Fischer, Lydia 563
Fischer, Torsten 153
Fujisawa, Shota 491
Fukushima, Kunihiro 291
Funke, Joachim 387
- García-Ojalvo, Jordi 651
Gardner, Brian 749
Geisler, Stefan 233
Gepperth, Alexander 233, 715
Ghio, Alessandro 177
Ghouti, Lahouari 241
Gibson, Tingting (Amy) 635
Giese, Martin A. 603, 707
Glasauer, Stefan 691
Goel, Kratarth 217
Gros, Claudius 65

- Grüning, André 723, 749
 Gushchin, Kirill 805
 Guthier, Thomas 185
- Hamker, Fred H. 459
 Hammer, Barbara 563, 571
 Handmann, Uwe 233
 Hara, Kazuyuki 499
 Hartono, Pitoyo 339
 Hasler, Stephan 411
 Hayashi, Yoichi 491
 Heath, Scott 635
 Heinermann, Justin 797
 Heinrich, Stefan 193
 Henderson, James A. 635
 Hinaut, Xavier 33
 Hino, Hideitsu 113, 145
 Hocke, Jens 129
 Hollensen, Paul 339
 Holt, Daniel V. 387
 Honkela, Timo 371, 757
 Horimoto, Narutoshi 73
 Hu, Lantao 773
- Ioannou, Panagiotis 723
 Ito, Hana 733
 Izawa, Tomoki 491
- JaJa, Joseph 273
 Jamalian, Amirhossein 459
 Jiang, Liangxiao 555
 Jimenez-Fernandez, Angel 847
 Jimenez-Moreno, Gabriel 847
 Jin, Qin 307
 Jitsev, Jenia 659
- Kakadiaris, Ioannis A. 523
 Kandaswamy, Chetak 265
 Karandashev, Iakov 323
 Katahira, Kentaro 499
 Kawakami, Hajimu 443
 Khelifa, Amine M. 627
 Kitano, Katsunori 733
 Kneissler, Jan 683
 Kopinski, Thomas 233
 Koprinkova-Hristova, Petia 25
 Kosmopoulos, Dimitrios 355
 Kramer, Oliver 137, 797
 Kryzhanovsky, Boris 323
- Kryzhanovsky, Vladimir 169
 Kůrková, Věra 331
 Kuroe, Yasuaki 443
- Laradji, Issam Hadj 241
 Lee, Alexia H. 635
 Lefort, Mathieu 715
 Lemos, André P. 531
 Leßmann, Markus 427
 Li, Chaoqun 555
 Li, Xirong 307
 Linares-Barranco, Alejandro 847
 Linkerhand, Mathias 65
 Lins, Jonas 201
 Liu, Jindong 619
 Liu, Yongqi 773
 Liwicki, Marcus 1
 Lomp, Oliver 451
 Lückehe, Daniel 137
 Luckner, Marcin 483
 Lyu, Siwei 257
- Madany Mamlouk, Amir 829
 Magg, Sven 403
 Malagarriga, Daniel 651
 Malsagov, Magomed 169
 Marques de Sá, Joaquim 265
 Martinetz, Thomas 129
 Masood, Ammara 837
 Matsuda, Yoshitatsu 765
 Mattos, César Lincoln C. 579
 Mayer, Norbert Michael 49
 Mohammed, Redwan Abdo A. 249
 Mokbel, Bassam 571
 Moriyasu, Jungo 611
 Mrázová, Iveta 507
 Müller, Stefan 789
 Murata, Noboru 113, 145, 539
 Murata, Shingo 9, 363
- Nagano, Yoshihiro 467
 Nakano, Ryohei 315
 Nelles, Oliver 153
 Nishioka, Ken-ichiro 765
 Noda, Atsushi 145
- Ogata, Tetsuya 9, 363
 O'Keefe, Simon 435

- Oneto, Luca 177
 Otte, Sebastian 1
- Paassen, Benjamin 571
 Parisi, German Ignacio 89
 Parra, Xavier 177
 Persiantsev, Igor 805
 Petříčková, Zuzana 507
 Piater, Justus 419
 Plotkin, Joshua L. 741
 Pons, Antonio J. 651
 Putze, Felix 387
- Quinn, Robert P. 635
- Raitio, Juha 757
 Rativa, Diego 813
 Resta, Marina 781
 Reyes-Ortiz, Jorge-Luis 177
 Richter, Mathis 201
 Rios-Navarro, Antonio 847
 Rivas, Manuel 847
 Rocha Neto, Ajalmar R. da 105
 Rodríguez-Sánchez, Antonio 419
 Runkler, Thomas 17
- Sahoo, J.K. 217
 Saito, Toshimichi 73, 611
 Saleh, Faisal 241
 Samá, Albert 177
 Sandamirskaya, Yulia 699
 Sanguineti, Marcello 331
 Santos, Jorge M. 265
 Satoh, Seiya 315
 Scheel, Norman 829
 Schleif, Frank-Michael 81
 Schneegans, Sebastian 201
 Schöner, Gregor 201, 451
 Schultz, Tanja 387
 Schulz, Hannes 395
 Schwabe, Lars 249, 741
 Shannon, George P. 635
 Silva, Luís M. 265
 Sinha, Ankur 675
 Sintonen, Henri 757
 Smith, Leslie S. 225
 Soares, Alessandra M. 667
 Song, Brian T. 635
- Sonoda, Sho 539
 Sonti, Tharun S. 635
 Šošić, Adrian 185
 Sousa, Ricardo 105
 Spieckermann, Sigurd 17
 Sporea, Ioana 749
 Sprague, Nathan 347
 Staadt, Oliver 249
 Storck, Tobias 699
 Strahl, Jonathan 371
 Struwe, Marvin 411
 Sugano, Shigeki 9, 363
 Sugiarto, Indar 161
 Szedmak, Sandor 419
- Takahashi, Kuniyuki 363
 Tanaka, Yuki 491
 Tani, Jun 9
 Tatsuno, Masami 145
 Taubert, Nick 603
 Terzić, Kasim 451
 Terziyska, Margarita 643
 Tjandra, Hadi 363
 Todorov, Yanko 643
 Tong, Qiuli 773
 Torres, Luiz C.B. 531
 Trappenberg, Thomas 339
 Twiefel, Johannes 619
- Udluft, Steffen 17
- Velychko, Dmytro 603
 Villa, Alessandro E.P. 57, 651
 Vohra, Raunaq 217
- Wagner, Paul 371
 Walther, Valentin 65
 Wang, Jack Jianguo 675
 Wang, Qi 273
 Wang, Shasha 555
 Waniek, Nicolai 97, 821
 Watanabe, Norifumi 467
 Weber, Cornelius 89, 403, 789
 Wermter, Stefan 33, 89, 193, 403, 619, 789
 Wersing, Heiko 563
 Whalley, Andrew 635
 Wiles, Janet 635

Willert, Volker 185
 Windeatt, Terry 475
 Würtz, Rolf P. 427

Xiao, Bingjun 281
 Xiong, Hanchen 419
 Xu, Bo 209
 Xu, Jieping 307

Yamaguchi, Kazunori 765
 Yamaoka, Hiroki 73
 Yang, Gang 307

Zdunek, Rafał 299
 Zell, Andreas 1
 Zhang, Xing 257
 Zhelavskaya, Irina 169
 Zheng, Youwei 741