SignalPop

MAKING AI EASY FOR C# DEVELOPERS

Why MyCaffe?

- Complete, open-source AI Framework written in C#.
- ► Allows developers to develop their own network layers in C#.
- ► Allows developers to debug nearly all aspects of the Al Framework in C#.
- Provides In-Memory Database for fast training on PC's.
- ▶ All low-level GPU access and Kernels isolated into single replaceable DLL.
- Models compatible with CAFFE and ONNX.
- Over 17,000 downloads on NUGET.

MyCaffe AI Platform

- A complete Al Framework supporting Classification, One-Shot, Recurrent, Reinforcement and Neural Style Transfer Learning.
- Originally, a complete re-write in C# of the CAFFE open-source framework to specifically target Microsoft Windows based systems.
- Extended to support much more than CAFFE offers, including Recurrent and Reinforcement Learning.
- Extremely Modular, making proprietary extensions easy to add without altering the overall Framework.
- Efficient use of GPU resources through a comprehensive low-level C++ module containing all CUDA kernels.
- Robust with over 1,200 automated tests (including nearly all tests included in the original open-source CAFFE project).

MyCaffe AI Platform and ONNX



Source: http://onnx.ai/supported-tools.html#buildModel

Why MyCaffe?

- MyCaffe is **compatible with CAFFE and ONNX** model weights and text descriptions.
- MyCaffe offers similar functionality to other AI Frameworks.

	Company	Languages					Features									
		C++	C#	Python	R	Java	Text	Programmed	CUDA	Convolution	One-Shot	Recurrent	Reinforcement	#C	Plugin	Auto
							Mode	Model	Support	Learning	Learning	Learning	Learning	Layers	Support	ML
MyCaffe	SignalPop		х	x			х	х	х	x	х	х	x	х	х	*
CAFFE	none (UC, Berkeley)	х		х			х	х	х	х	х	х				
TensorFlow	Google	x	х	x	х	х		x	х	x	х	х	x		?	x
PyTorch	Facebook	x		x				x	х	x	х	х	x		?	
СМТК	Microsoft	x	х	x				x	х	x	х	х	x		?	x
MXNet		x		x	х			x	х	x	х	х	x		?	
DL4J						х		x	х	x	х	х	x		?	-

* under development

Source: https://en.wikipedia.org/wiki/Comparison_of_deep-learning_software

- ▶ MyCaffe is extremely **easy to extend** by adding new layers written in C#.
- MyCaffe allows for easy Proprietary extensions via its high modularity.
- With MyCaffe YOU control the changes that are made to the platform.

MyCaffe Extensive Help



Why SignalPop?

- MyCaffe AI Framework, open-source curator with extensive AI knowledge.
- Al Product Producer
 - ► SignalPop AI DesignerTM Extensive AI Debugger and Project Management
 - SignalPop Al Server Client/Server Project and Dataset Management
 - ► SignalPop Universal Miner[™] Ethereum Mining.
- C# Development Ecosystem
 - Extensive On-line Help
 - Extensive Automated Testing
 - Extensive Automated Build System

Built for Evolution Over Time

► Al Systems must **Evolve** over time – the Al **Process** is the key.



- SignalPop provides the foundation needed for each step of the **Process**.
- Allowing adaptation to data and strategy changes over time.

SignalPop Al Designer™

Provides a Visual development environment to design, build, train, test and debug deep learning models.

Data sets	Models	Signals							
Build Quantify	→ Design →	Train/Test Evaluate							
SignalPop AI Designer									

9

- Provides rich debugging features necessary to determine why models fail.
- Supports **proprietary** plug-ins for **Dataset Creation** and **Model Evaluation**.

Managing Datasets

10

Dataset creators.

PCA Visualization to show important components.

▶ TSNE Visualization to show data separation.

SignalPop AI Designer[™] - Managing Datasets



SignalPop AI Designer[™] - Analyzing Datasets

2



SignalPop AI Designer[™] - Analyzing Datasets



Managing Projects

14

- Drag-n-drop visual editing.
- Text script based editing.
- Extensive importing and exporting to MyCaffe, CAFFE and ONNX.
- Project Training, Testing and Test-many.
- ► Train multiple projects simultaneously with threaded architecture.

SignalPop AI Designer[™] - Managing Projects: Visual Editor



SignalPop AI Designer[™] - Managing Projects: Visual Editor



SignalPop AI Designer[™] - Managing Projects: Transfer Learning

SignalPop Al Designer - Direct Connection to '.\SQLEXPRESS' \sim File Manage View Window Help 🧉 🗟 🥔 🛐 🐂 🚰 🛠 🏭 🚳 🗐 🔷 | 🕨 = 11 • 1 X Getting Started Developer News prj-DEFAULT-Inception • × Datasets DEFAULT Project: Inception (open) TripletNet Name Channels Size CIFAR-10 0.947 32×32 -
CIFAR-10 Import Weights X 0.842 28 × 28 **Easily import** inception_v1 0.737 MNIST.20 28×28 팀 SGD Weight File: C:\ProgramData\MyCaffe\Import\Models\InceptionV1\inception-v1-9_weights.mycaffemodel 0.632 MNIST.3 ch 28×28 Accuracy = -100.00% (0) Input Blobs Target Blobs 0.526 weights from MNIST.30 28×28 ---- 9 Progress = 0.00% 0.421 MNIST Target.3 ch 28 x 28 Name Shape Name Shape 0.316 ■ VOC0712 3 -1 x -1 blob_0 (64, 3, 7, 7) ✓ conv1/7x7_s2... (64, 3, 7, 7) **CAFFE** or ✓ conv1/7x7_s2... blob_1 (64) (64) 0.105 blob_2 (64, 64, 1, 1) ✓ conv2/3x3_re.. (64, 64, 1, 1) 0.000 blob_3 ✓ conv2/3x3_re.. (64) (64) **ONNX** for fast blob_4 (192, 64, 3, 3) ✓ conv2/3x3_1. (192, 64, 3, 3) 0.84 blob_5 (192) ✓ conv2/3x3_1. (192) 0.74 Gyms ✓ inception_3a.. blob_6 (64, 192, 1, 1) (64, 192, 1, 1) 0.63 transfer Gym Name blob_7 ✓ inception_3a... (64) (64 0.53 blob_8 Cart-Pole (96, 192, 1, 1) ✓ inception_3a... (96, 192, 1, 1) 0.42 ATARI blob_9 learning (96) inception_3a.. (96) E n 39 blob_10 🖲 DataGenera (128, 96, 3, 3) ✓ inception_3a... (128, 96, 3, 3) 0.21 blob_11 (128)✓ inception_3a... (128) blob_12 (16, 192, 1, 1) ✓ inception_3a... (16, 192, 1, 1) Processors blob_13 (16) ✓ inception_3a... (16) BASESTATION888 (67.11 GB) blob_14 (32, 16, 5, 5) ✓ inception_3a.. (32, 16, 5, 5) ID0 Quadro RTX 8000 (51.14 GB - P2P on, compute 7.5) - 47.41 GB fre blob_15 ✓ inception_3a... - ID1 GeForce RTX 2080 Ti (11.81 GB - P2P off, compute 7.5) - 9.69 GB f (32) (32) ID2 TITAN Xp (12.80 GB - P2P on, compute 6.1) - 12.48 GB free, 30 C^o blob_16 ✓ inception_3a... (32, 192, 1, 1) (32, 192, 1, 1) blob_17 ✓ inception 3a... (32) (32) blob_18 (128, 256, 1, 1) inception_3b.. (128, 256, 1, 1) blob_19 inception_3b.. (128)(128) blob_20 inception_3b.. (128, 256, 1, 1) (128, 256, 1, 1) > Hide Details Check All Matches Uncheck All Include internal blobs Cancel Save OK 1 Resource Templates Solve Progress AlexNet_32x32 (Solver) open training testing running Accuracy View Testing Type:
 Default
 Test Many
 Create Results 🛢 local AlexNet 56x56 (Solver) ATARI (Solver) - 💾 ATARI DQN-NoisyNet (Solver) Show output from: DEFAULT-Inception - 式 (i) Status (i) Warnings 🛛 🙆 Errors Maximum Lines: 2000 AutoEncoder_28x28 (Solver) AutoEncoderPool_28x28 (Solver) Source Message - AutoEncoderPoolRun_28x28 (Solver) (i) DEFAULT-Inception conv2/3x3 1 does not need backward computation. CartPole (Solver) (i) DEFAULT-Inception conv2/3x3 reduce 2 does not need backward computation - CartPole DQN-NoisvNet (Solver) (i) DEFAULT-Inception conv2/3x3_reduce_1 does not need backward computation Char-RNN LSTM (Solver) (i) DEFAULT-Inception pooll/norml 1 does not need backward computation –💾 Char-RNN LSTM cuDnn (Solver) (i) DEFAULT-Inception pool1/3x3_s2_1 does not need backward computation. Char-RNN LSTM_SIMPLE (Solver) (i) DEFAULT-Inception conv1/7x7_s2_2 does not need backward computation. DANN_28x28 (Solver) (i) DEFAULT-Inception conv1/7x7 s2 1 does not need backward computation. GoogleNet_56x56 (Solver) (i) DEFAULT-Inception This network produces output loss LeNet_28x28 (Solver) (i) DEFAULT-Inception Network initialization done - NIN Xu 32v32 (Solver (i) DEFAULT-Inception Project 'Inception' loaded $+ \times$ + + × • Solutions Dataset Creators > 💣 Properties 🛠 Toolbox 🏭 Resources 🗔 Debug 🐼 Data < CUDA: not loaded

SignalPop AI Designer[™] - Managing Projects: Training



Rich Visual Debugging

19

- Visualize weights.
- Visualize model impact.
- Visualize layer data and timing.
- Visualize data flowing between layers.

Evaluate model performance with 'evaluators'.

SignalPop AI Designer[™] - Managing Projects: Debug Weights and Resources



SignalPop AI Designer[™] - Managing Projects: Debug Label Impact

21



SignalPop AI Designer[™] - Managing Projects: Debug Individual Layers

22



SignalPop AI Designer[™] - Managing Projects: Visualize Encoding Separations







SignalPop AI Designer[™] - Managing Projects: Debug Layer Blobs



Easily visualize data ranges in histogram or image form.

24

SignalPop AI Designer[™] - Managing Projects: Debug Data and Diff flow between Layers

25



SignalPop AI Designer[™] - Managing Projects: Evaluator Extensions



27

Distributed Training – Al Mining

Easily distribute AI training work-loads to other computers.

- Train multiple model configurations simultaneously
- Light-weight install on remote computer No Database Required!

SignalPop Universal Miner[™] - Distributed Al





29



SignalPop Universal Miner[™] - Distributed AI



© 2020 SignalPop LLC, All rights reserved. www.signalpop.com

30

Highly Modular

31

Easily extended datasets – create your own dataset plug-ins.

- Easily extended evaluation create your own model evaluator plug-ins.
- Examples follow for the Finance Industry.

SignalPop AI Designer[™] - Very Extendable: Datasets



SignalPop AI Designer[™] - Very Extendable: Datasets



SignalPop AI Designer[™] - Very Extendable: Evaluators



Evaluator plug-ins:

- Create custom plugins to evaluate trained models

34

SignalPop AI Designer[™] - Data Pipeline

35



SignalPop AI Designer[™] - Very Fast: Near Real-Time Financial Analysis



37

The Software Stack and Availability

Software Item	Focus	Availability	License	
MyCaffe AI Platform				
Source Code	General AI	Open-Source	Apache 2.0	
Binaries	General AI	Open-Source	Apache 2.0	
SignalPop AI Designer				
Source Code	General AI	Proprietary	n/a	
Binaries	General AI	Purchased	SignalPop	
SignalPop AI Designer - Finance Datas	et Creator Plug-in			
Source Code	Finance Specific	Proprietary	n/a	
Binaries	Finance Specific	Proprietary	n/a	
SignalPop AI Designer - Finance Evaluation	ator Plug-in			
Source Code	Finance Specific	Proprietary	n/a	
Binaries	Finance Specific	Proprietary	n/a	

Resources

- MyCaffe Al Platform
 - Whitepaper published on ArXiv (<u>https://arxiv.org/abs/1810.02272</u>)
 - MyCaffe NUGET Package (<u>https://www.nuget.org/packages?q=MyCaffe</u>) 17,500+ downloads.

38

- MyCaffe GitHub Site (<u>https://github.com/mycaffe</u>)
- MyCaffe Programming Guide (<u>https://www.signalpop.com/mycaffe</u>)
- MyCaffe Online Help (<u>https://www.signalpop.com/onlinehelp/mycaffe/html/index.html</u>)
- ONNX Supporting Framework (<u>https://onnx.ai/supported-tools.html#buildModel</u>)
- SignalPop Al Designer
 - SignalPop AI Designer™ Download (<u>https://www.signalpop.com/products/</u>)
 - SignalPop Al Designer Getting Started Guide (<u>https://www.signalpop.com/wp-content/uploads/2017/10/Getting-Started.pdf</u>)
 - SignalPop AI Designer™ Tutorials (<u>https://www.signalpop.com/Tutorials</u>)