

Building CPP's TFlite μ/π Model for use on the ifarm and farm (csh)

- .csh script to create your own halld_recon built with TFlite:

/work/halld/home/acschick/CPPTestBuild/MakeCPPTFlite.csh

- After building TFlite, hd_recon, it will create:
 - Environment.sh (point to this in jobs_recon.config as your env file)
 - Environment.csh (identical to above for using FMWPC_Performance on ifarm)
Inspect these files to see what environment variables are getting set
- Non-trivial to figure out what versions of CMake, gcc, and GlueX software builds required to successfully build halld_recon + tensorflow lite—*this will save you time!!*

Edit FMWPC_Performance.cc

- The plugin that performs the model inference is FMWPC_Performance.

halld_recon/src/plugins/monitoring/FMWPC_Performance/

- I recommend editing the file to have two model cuts—one for muons and one for pions:

```
auto invmass = 1E3*(pip_v4 + pim_v4).M(); // in MeV !
auto &pimu_ML_classifier = cppepem->pimu_ML_classifier;
double model_cut = 0.5;
auto invmass = 1E3*(pip_v4 + pim_v4).M(); // in MeV !
auto &pimu_ML_classifier = cppepem->pimu_ML_classifier;
double model_pi_cut = 0.2;
double model_mu_cut = 0.8;
```

- And also wrapping the whole π/μ histogram portion of the code to remove electrons

```
//----- pion selection -----
if( (pimu_ML_classifier>=0.0 ) && (pimu_ML_classifier<model_cut) )
{
//----- muon selection -----
if( (pimu_ML_classifier>=model_cut) && (pimu_ML_classifier<=1.0 ) )
{
if(MLPClassifierPlus < 0.4 && MLPClassifierMinus < 0.4){
//----- pion selection -----
if( (pimu_ML_classifier>=0.0 ) && (pimu_ML_classifier<model_pi_cut) )
{
//----- muon selection -----
if( (pimu_ML_classifier>=model_mu_cut) && (pimu_ML_classifier<=1.0 ) )
{
```

Make any other edits you see fit, *then* `scons -u install`

Running FMWPC_Performance interactively

Run interactively before attempting to run on the farm.

- source Environment.csh
- setenv INPUT_FILE /cache/halld/RunPeriod-2022-05/rawdata/Run100899/hd_rawdata_100899_009.evio
- setenv MODEL_FILE /group/halld/www/halldweb/html/resources/AI/CPP/2022_05_07_MLP_Base_matched_background.tflite
- hd_root -PPLUGINS=FMWPC_Performance
-PCPPAnalysis:PIMU_MODEL_FILE=\${MODEL_FILE} \${INPUT_FILE}

Running on the farm

- jobs_recon.config
 - Point to raw CPP .evio files for INDATA_TOPDIR
 - Point to Environment.sh created by the *MakeCPPTFlite.csh* script:

```
ENVFILE /work/halld/home/acschick/channels/batch_submission/2022launch/launch/Environment.sh
```

- jana_recon.config
 - Comment out all the other plugins in jana_recon.config and add FMWPC_Performance
 - Set the TFLite model as a plugin parameter by adding the line:

```
CPPAnalysis:PIMU_MODEL_FILE /group/halld/www/halldweb/html/resources/AI/CPPT/2022_05_07_MLP_Base_matched_background.tflite
```

```
bash
source environment.sh
swif2 create <jobname_in_recon.config>
./launch.py jobs_recon.config 100899 100910 (Example run number range)
swif2 run <jobname_in_recon.config>
```

Initial Results

- All events are subjected to the e/π neural net, with a model cut < 0.4 (selecting *not* electrons).
- Pion and muon histograms are then filled according to the model cuts:
 - $MLP < 0.2$
 - $MLP > 0.8$
- π/μ histograms scaled to match integrals

