LSC D MATCH MATCH' Manifold to Accelerate Template Bank Generation

Introducing LearningMatch and TemplateGeNN...

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LearningMatch: The Aim



Template 1 Mass 1 Mass 2 Spin 1 Spin 2 Match $= \max_{\phi_c, t_c}$ Femplate 2: Mass 1 Mass 2 Spin 1 Spin 2 [emplate Mass 1 Mass 2 Spin 1 Spin 2 Match Template 2 Mass 1 Mass 2 Spin 1 Spin 2

Figure 1: The aim of LearningMatch is to learn the mathematical relationship between the template parameters (specifically the mass and aligned spin of the black holes) and the 'match'.



Image by pikisuperstar on Freepik



TemplateGeNN: The Results



Figure 2: Results from PyCBC template bank verifier.

pikisuperstar on Freepik Image by

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1.0

0.8

o o vered fitting factor



- Simulations are **crucial** for High Energy Physics experiments
- Detailed Simulation is computationally **very expensive**
- Detailed Simulation **not scale** for the future experiment demands



Viable solutions?

- \square Renouncing to increase statistics \rightarrow **lower demand**
- \square Developing faster options for simulation \rightarrow at <u>LHCb</u>, *Lamarr*



M. Barbetti et al.



May 1 + 2

Stellenbosch

Sorbonne

Oxford

Stanford

WC



Â Detailed simulation of the interactions between particles and th high-level response of the LHCb PID system relying all time needed for produc d samples has been analized for Utils has used over SIN of CPU resources for simulation during that tion of particles from collisions (e.g., with Pythial) becomes the new m ON OWNER A Connent approaches de not scale la future needs: MAXIN PIR: por initiands resulting from the NLKM system educe the OPU cost for the simulation of [at least] two other reductions will require speeding up the is the set of the the second set of the second sec Cashed PE2: parameterizes the global high-level response of the PID spite consisting of Cambous and Probabilist - DAV model. 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The validation phase bysically writes on the same distributed come in the production environment O.W. constitute e flock simulation of the Linch PCAL detector is a non-trivial taskof NSI Desire Leave in Superior revel firsh-simulation framework of DHCh, able to affect divital infrastructure for research and inconstion, levenusing extrains HPC. HD - bereventuching radiation, converted photoso, or merged k^0 may lead to have \sim generated particles responsible for \sim necessphared abjects (in generat, with $\alpha \neq \alpha_0$; in the particle-oparitie correlation problem limits the subday of training used for modeling the anomhiguous k-to- k detector response. num is the new resolution and a second of the second of the second of a simulation a simulation of a simulatio and Big Data informations and evolving towards a cloud data-lake model. The Lamar framework is planeering such hybrid worklaads on distributed as and I modular parameterizations designed to molace both the sinals Indersted resources, employing nodes from both NLCS data contents are ↓ Property and the second sec which who we response of the ECAL detector, solutions amarr Tabley resider sat effort is enspire to put a fully parametric simulation of the DAD-score Tacon alger transition - Sector Start transition - Sector Start transition - Sector Start the similate define an exertileted description of the DCU response assuming ordered sequences of photons (clusters, the problem can be m eled with a Transformer model: complaing with the problem topology, the ECAL res with a Graph Beward Betwark (Sh14-mode) based and www-dasted models succeed in determining the regiment as of the LINCE tracking and PID detectors for **charged particles**. We equired to parameterize the response of the SCAL detector due to to **particle correlation problem**. he Lamary pipeline can be salik in two branches: charted particles require tracking and particle identification model eventyment control and to support other me seastral objects need to face the particle-to-conticle conversion proble the existence of an unambiguous (i-to-k) relations with respect to the second state of ried in terms of efficiency and "resolution" (i.e., analytic-level quark t work presented in this cantribution is performed in the framework of is 0 and Speke 2 of the USC project - Centro Rezionaie di Ricersa in High presenter Computing, Big Data and Spaniae Computing, funded by the Constituent European initiative through the Ralian Ministry of Univer-Dickery Jero Reput Retraris (2414 paired to perform dassification tasks to that they can be used to parameterize the fraction of "good" can dates (e.g., accepted, represented, as selected). Issearch, PSRT Mission 4, Component 2, Investment 14, Project code Association: Conditional Generative Adversarial Retworks (GNO) In high-level response of the UKL detector by relying speet () NL-hand modeles. To validate the charged pa Alons at a set of analysis-level reconstructed quantities in have been compared with those polarised from det reparts to partameterize the rege-avec respectse or raction errors, differential log-likelihoods, or reall arced particles the tracking system Lonarr parameterizes the high-level response of the LHCb toading syste lying on the following models The deployment of the NJ-based models follows a transcompilation approach based on a cLLLAC. The models are translated to C Mos, compiled as shored o jects, and then dynamically linked in the LMCh simulation software (Gauss). chevanne et d., cannotine Michael for eh Conf. 254 (2010) 62634, artistölig 202 Anderlini and H. 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Papers .

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The flash-simulation of the LHCb experiment using the Lamarr framework

Poster loc: #93



Plasma diagnostics









Optimization of many parameters / pixel ⇒ Future: More Pixels > 1000 px









Quark/Gluon Discrimination and Top Tagging with Dual Attention Transformer — EuCAIFCon24—

Daohan Wang

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April 30, 2024

AUSTRIAN ACADEMY OF SCIENCES



Dual Attention Mechanism







Model Architecture

- Input features: log *E*, log *p*_T, $\frac{p_T}{p_{TI}}$, $\frac{E}{E_I}$, $\Delta \eta \ \Delta \phi$, ΔR , PID of leading 100 particles.
- The particle attention module ($P \times P$ attention map) and the channel attention module ($C \times C$ attention map) are stacked while maintaining a consistent feature dimension of N = 64 and they can complement each other.
- Particle Dual Attention Transformer: 2 Feature Extractor (1 EdgeConv + 3 Conv2D + 1 AvgPool) + 2 Particle Attention modules + 2 Channel Attention modules + 1D CNN + MLP.

