

March 21-25, 2022 San Francisco, CA

FIFA 22's Hypermotion Full Match Capture Driving Machine Learning Technology







*Exclusive To PlayStation[®] 5, Xbox Series X|S & Stadia

March 21-25, 2022 | San Francisco, CA #GDC22







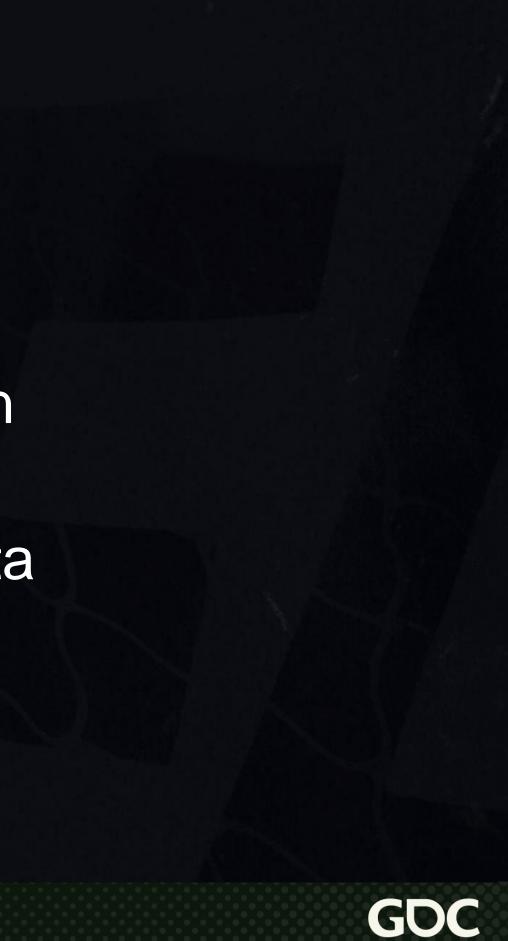
Full Match Motion Capture

Workflow and Animation Data Comparison

Augmenting Motion Data With 3D Ball Data

• Machine Learning: ML FLow

March 21-25, 2022 | San Francisco, CA #GDC22



Full Match XSens Capture

1

۲

+ -----

+ 1.24M

LIVE LIMITLE

March 21-25, 2022 | San Francisco, CA #GDC22



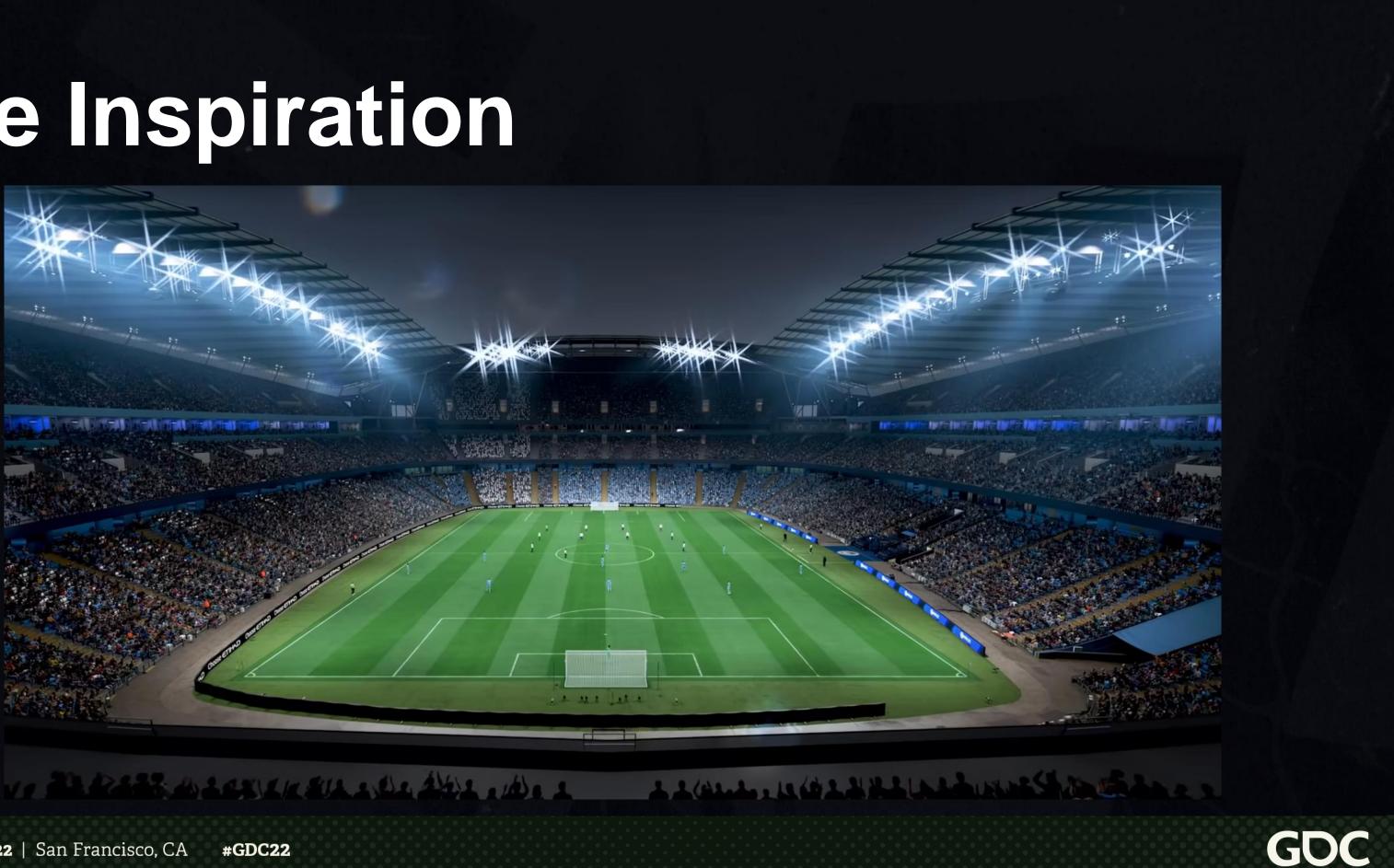
PARIS EST MA



MRIS SA



The Inspiration



March 21-25, 2022 | San Francisco, CA



The Problem

Optical Motion Capture:

- Physical space too small for organic match capture
- Local talent pool is limited
- Competitive atmosphere is missing

Optical Motion Capture





XSens - Prototype







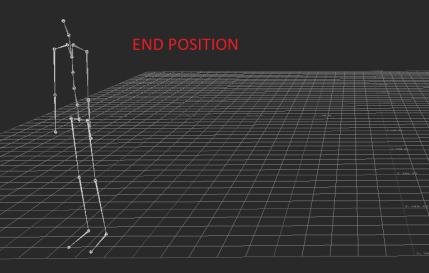
Problems to Solve

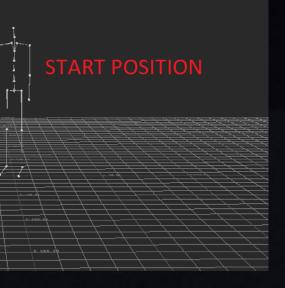
Player Drift:

Sensor based capture solutions experience drift on root. Upwards of 12 feet over 10-minute take.

No Ball Data:

Need to reconstruct ball data from video.









Solving Drift

Local Positioning (LPS)

- WIMU Pro
- Accurate within 5cm







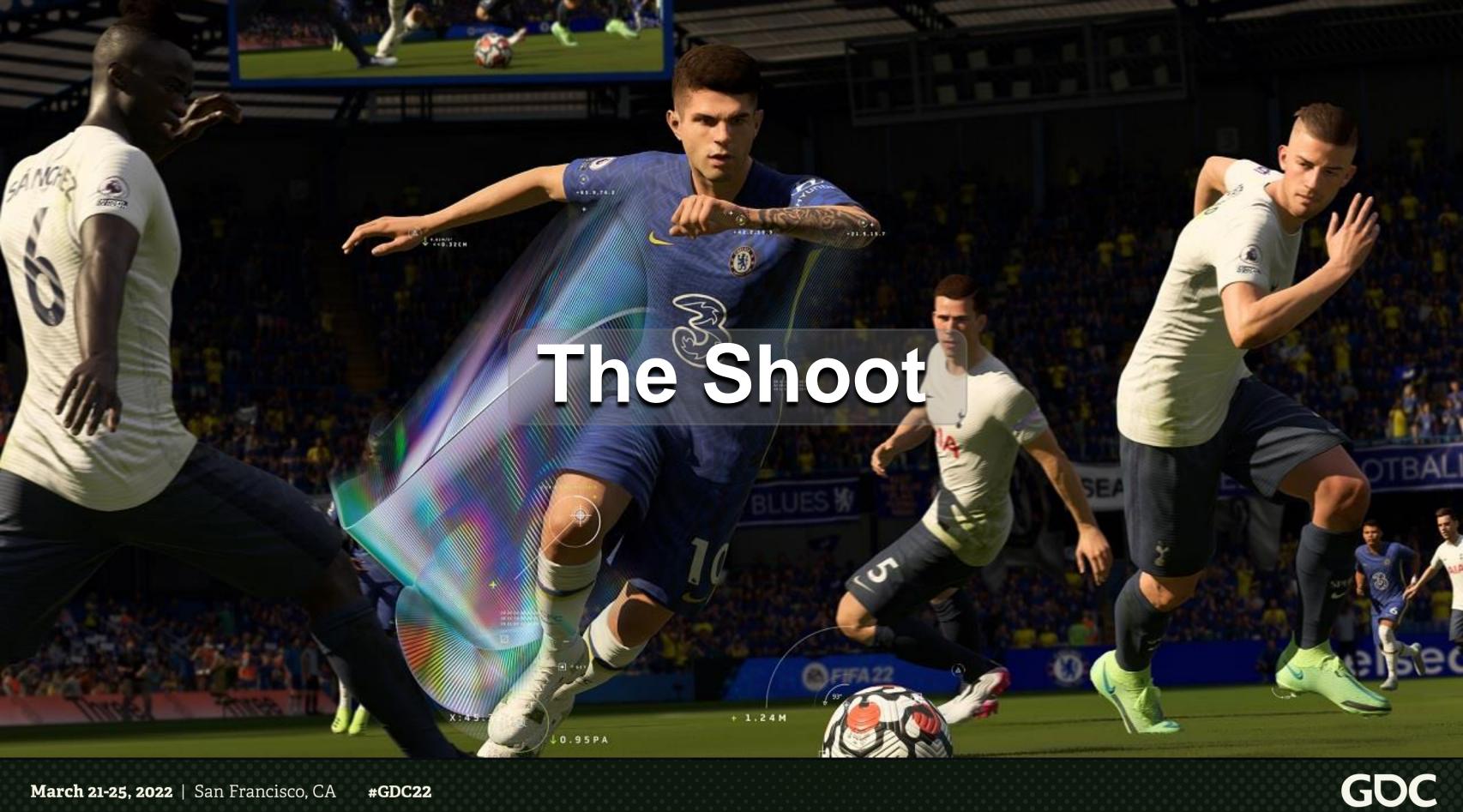
Reconstructing Ball Data

Generate from Video

- Multiple Static Cameras \bullet
- **Computer Vision**
- **Distinctly Colored Ball**









Shoot Requirements

XSens Setup

- Mark Start points and facing for each take.
- Clap at beginning of take to help sync video and XSens data.



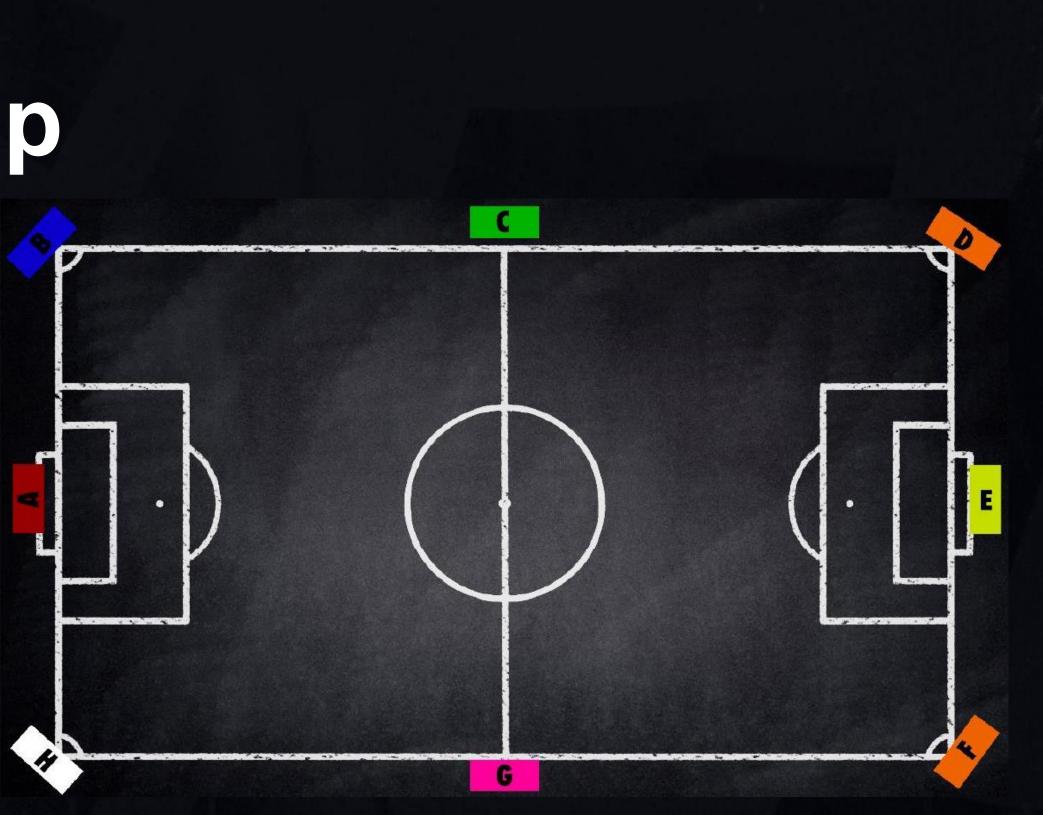




Camera Setup

Considerations

- 8 static 8K cameras (8K @50fps)
- 270MB per second lots of SD cards!
- Video watermarked with absolute timecode to sync XSens/video



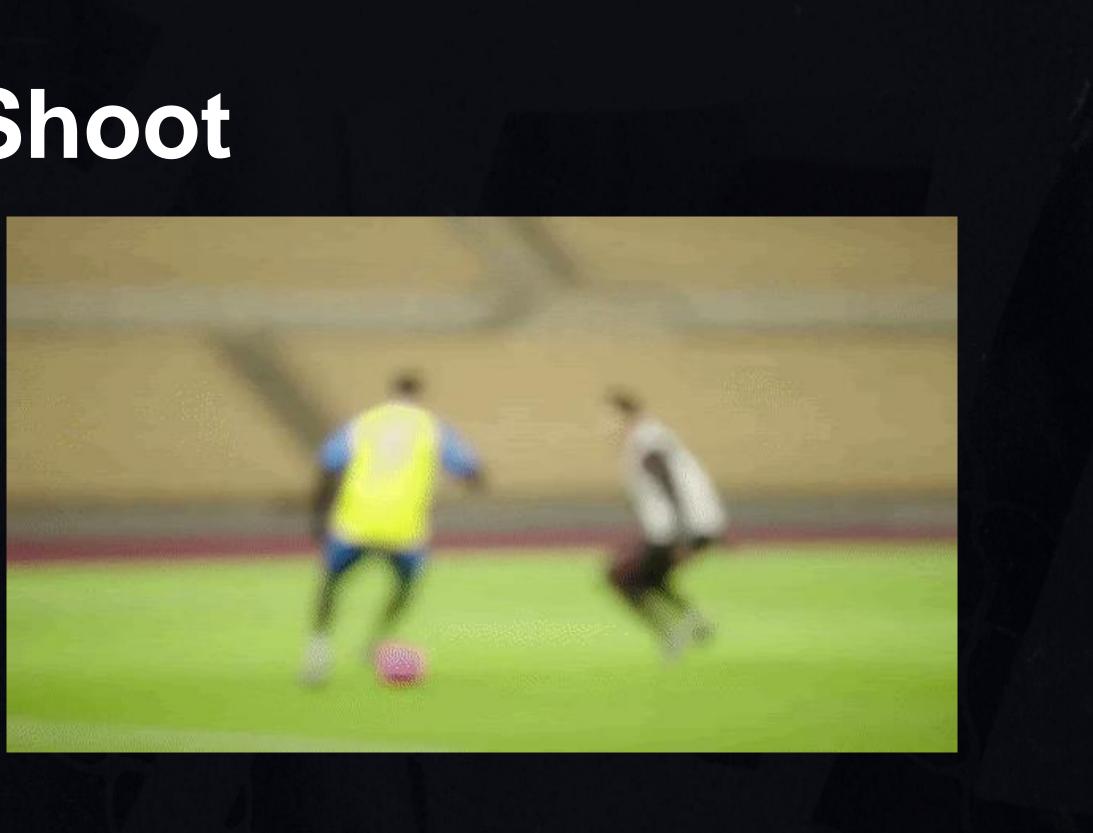




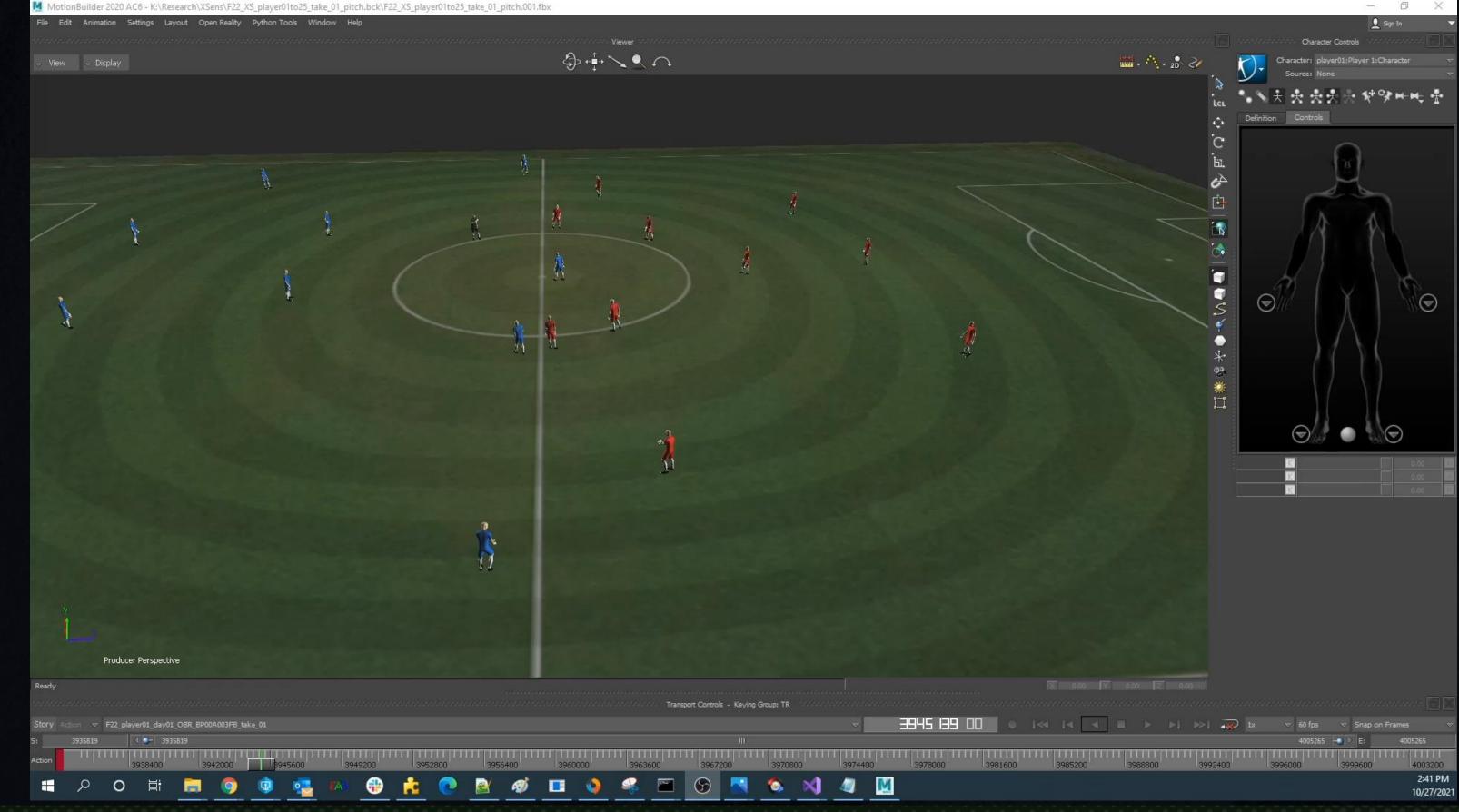
During the Shoot

Takes

- 10-15 minute takes
- Referee responsible for ending take
- High intensity and fidelity







March 21-25, 2022 | San Francisco, CA #GDC22



Animation Workflow FAI Emirate fit title





Uncategorized Motion

New Animator Workflow

- **Optical Mocap Workflow:**
 - Order takes from shot list.
 - Work on short specific animations. \bullet
- Full Match Capture: Giant blob of data with no context or way to search.
- Need to build a shot list.





Workflow – Finding Animation



March 21-25, 2022 | San Francisco, CA #GDC22





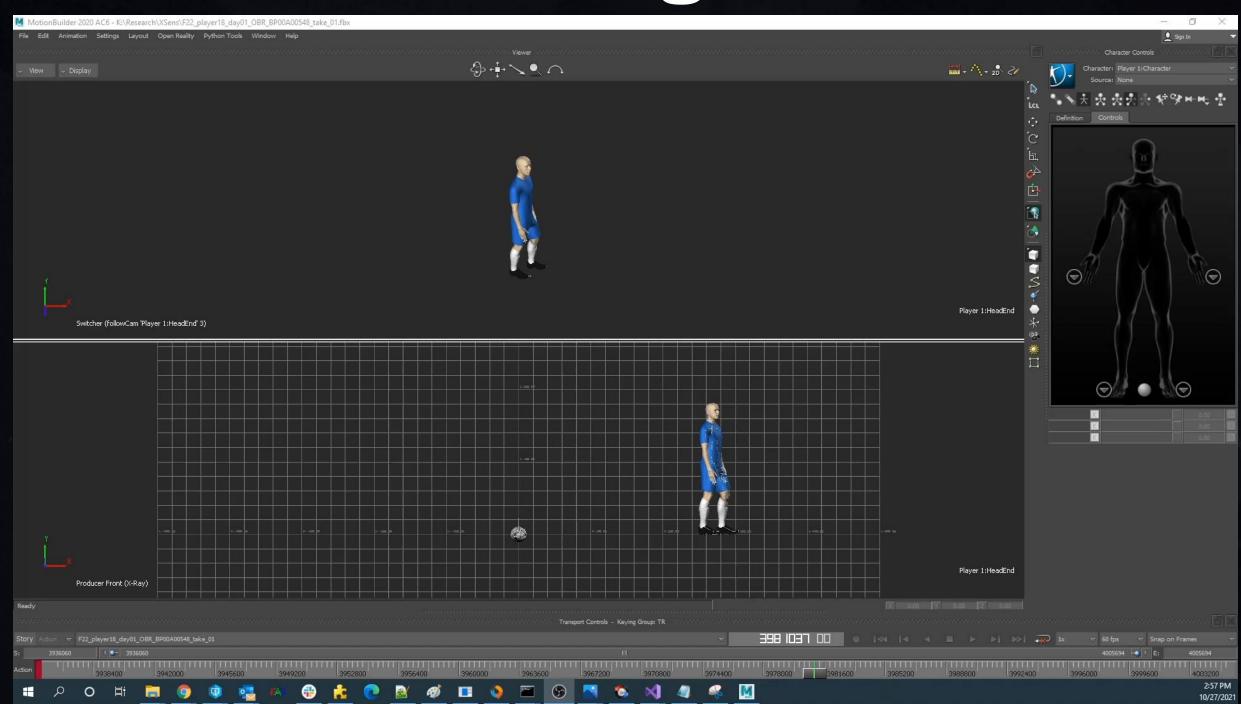
Workflow – Finding Animation







Workflow – Finding Animation







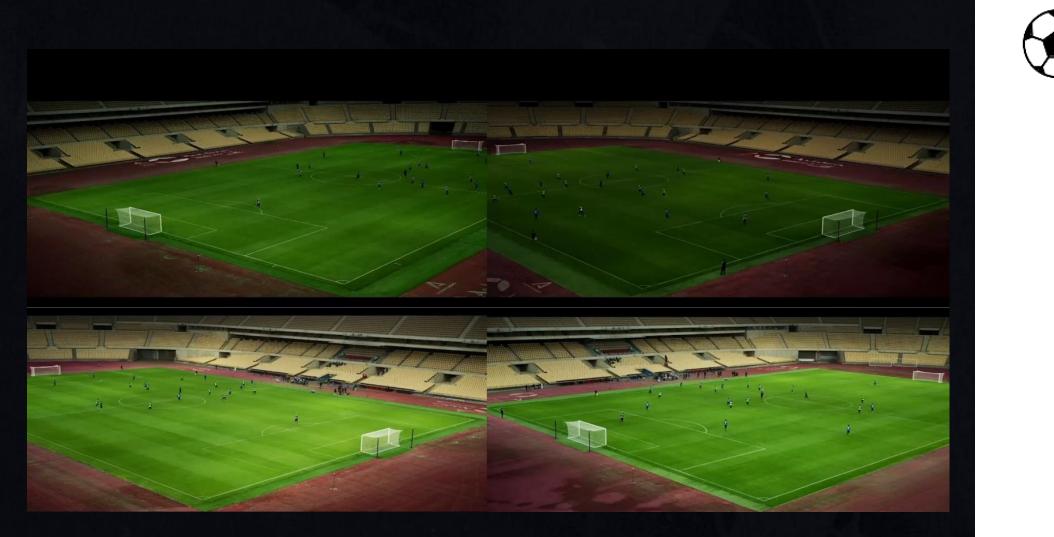
Generating Ball Data from Video

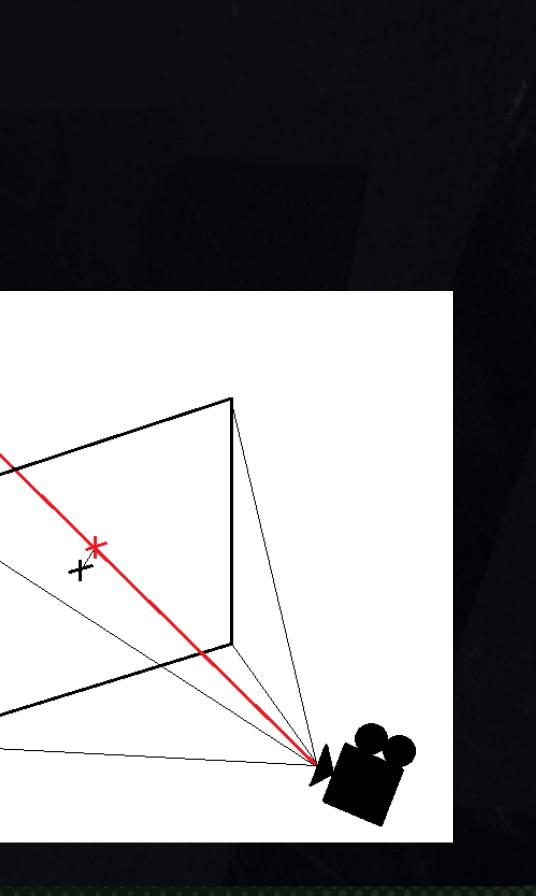




Projection

Projection matrix: 3D -> 2D, but also 2D -> 3D

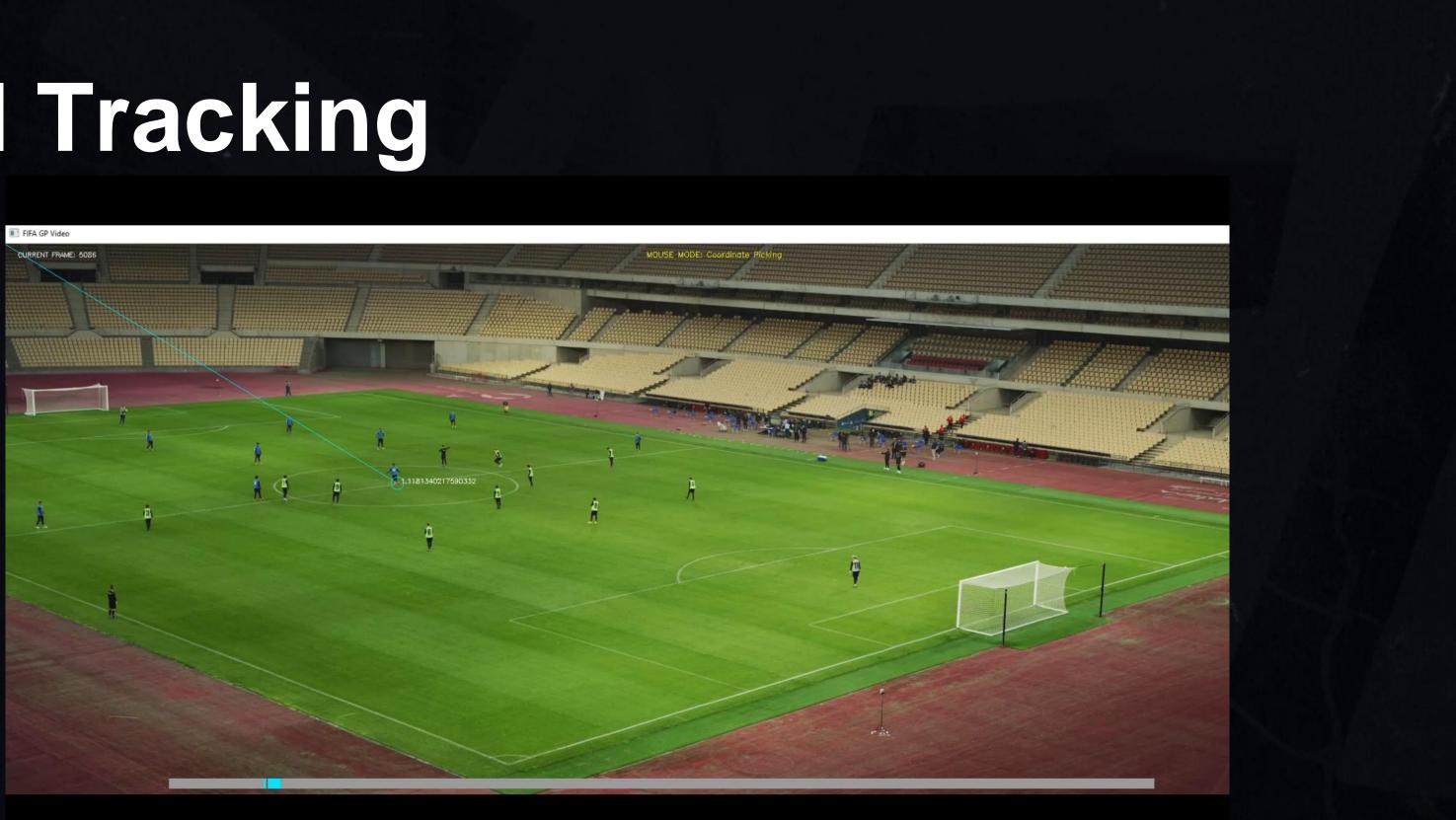








Ball Tracking







Tracking Pipeline

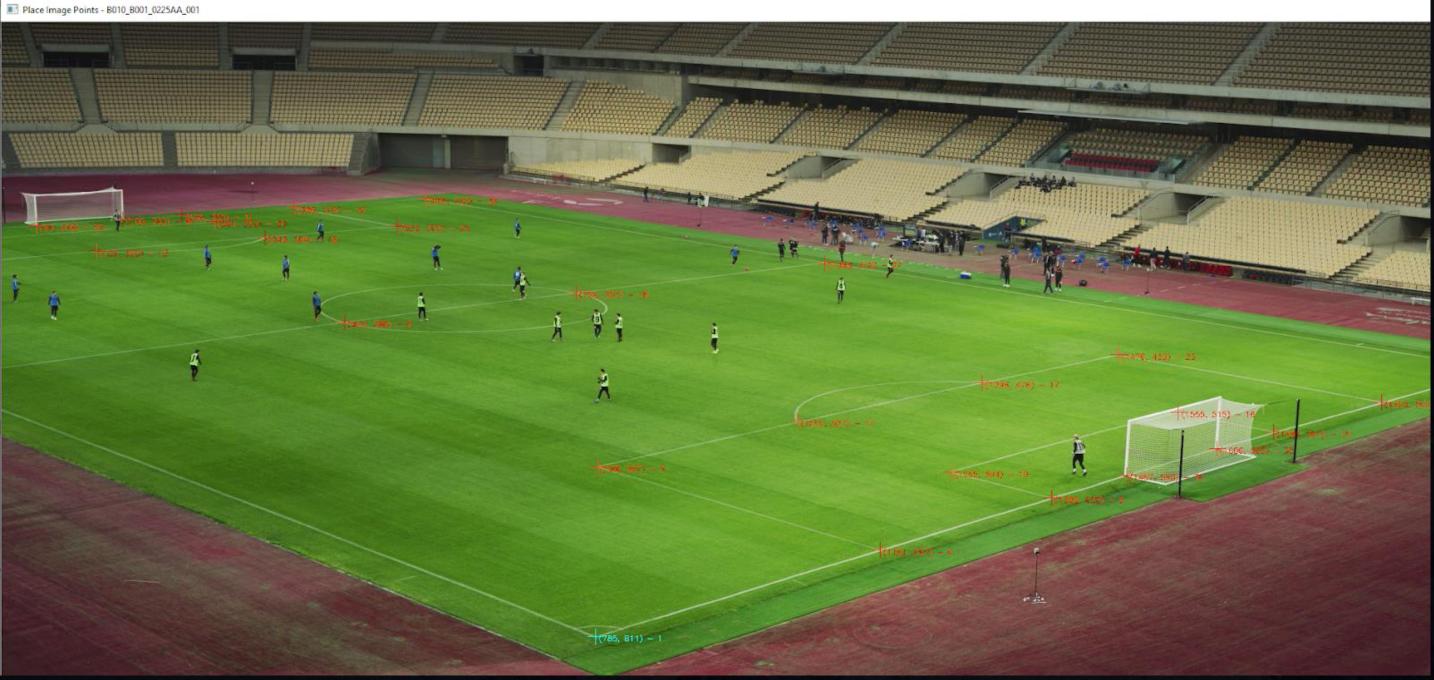


March 21-25, 2022 | San Francisco, CA #GDC22





Camera Calibration











PA RIS SAINT-GE

All

HEFA FOUN

6

Ball Physics

March 21-25, 2022 | San Francisco, CA #GDC22





Tuning Physics

Iteration Loop

- Launch game ball side-byside real trajectory
- Compare and live-tune physics parameters
- Repeat











Machine Learning: ML Flow







+ HEADING_FORCE

7.12 G

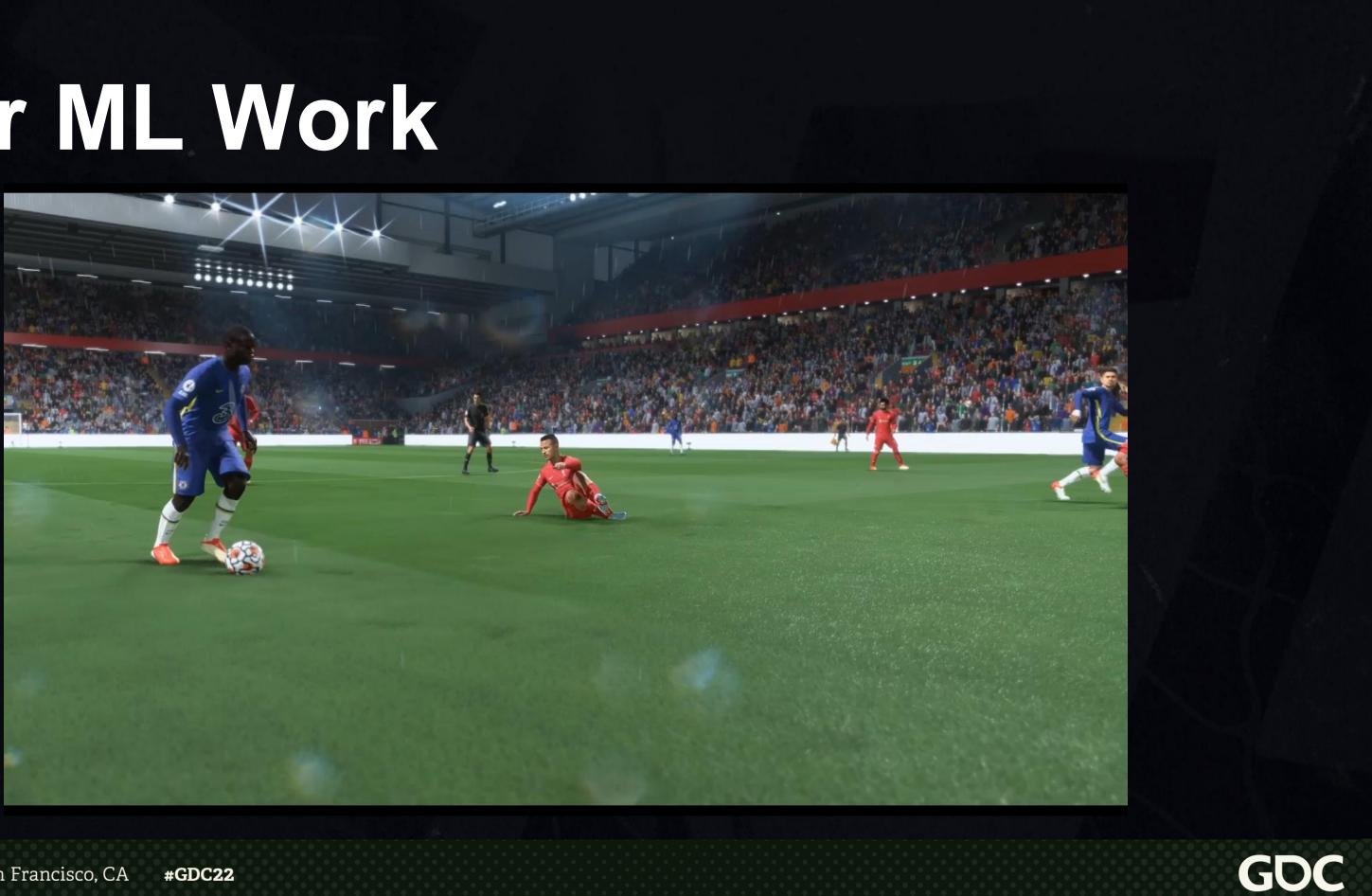
18_POINT_POSITIONAL_BATA 54 96 30







Prior ML Work





Generic ML Runtime

Why do we need a generic runtime?

- Supports many more operators in the DNN
- Allows more experimentation





March 21-25, 2022 | San Francisco, CA #GDC22



Seed, 2031021101 GameTiok: 9394, Clock[00:43] Home [1] 0 - 0 [17] Away at Stadium[100] Saved Input: Single [REDORD] GameType_TechngGame cameta: orbitcambehavior target: balk(0) y;0

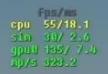
1.57 1.57 1.57 (PAUSED) Replay Frame: 9528.97 Althory fide(226)



#StepCycle_Sprint_Gagan_0:54.50 mir:0 <PTM_Database_normal_Kevin_ToJogSprint_coundation.ConstantCycle[0]>

NO GDA

..

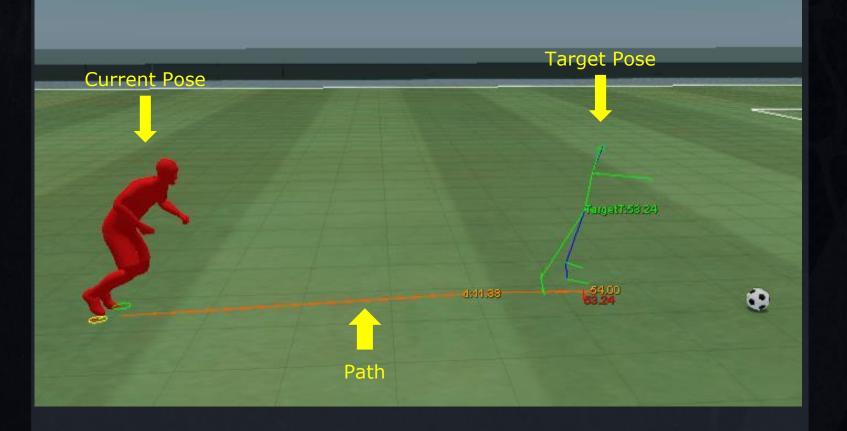


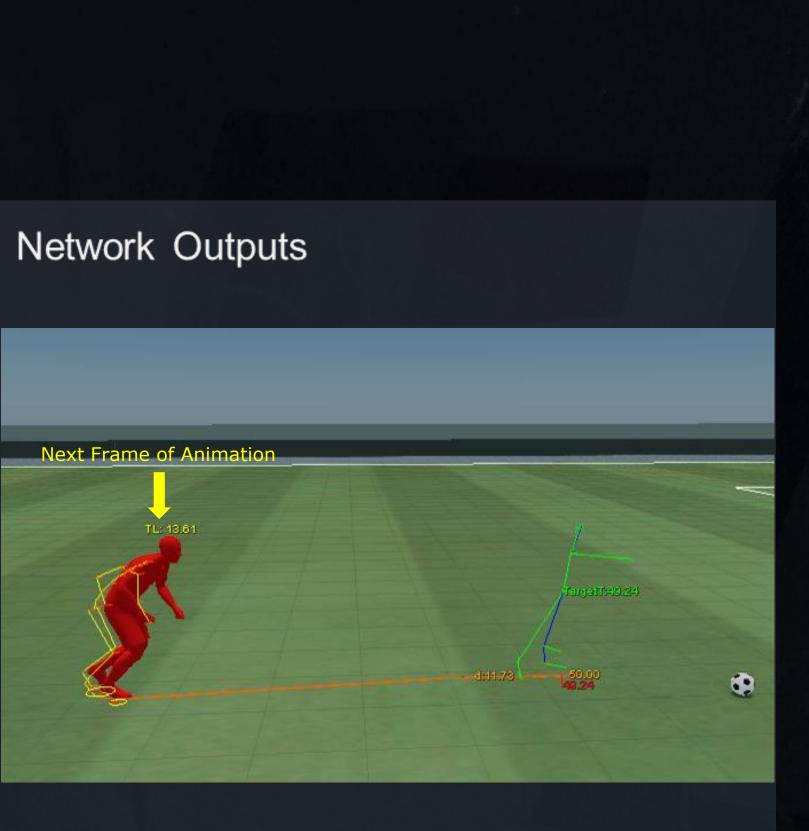




Inputs/Outputs

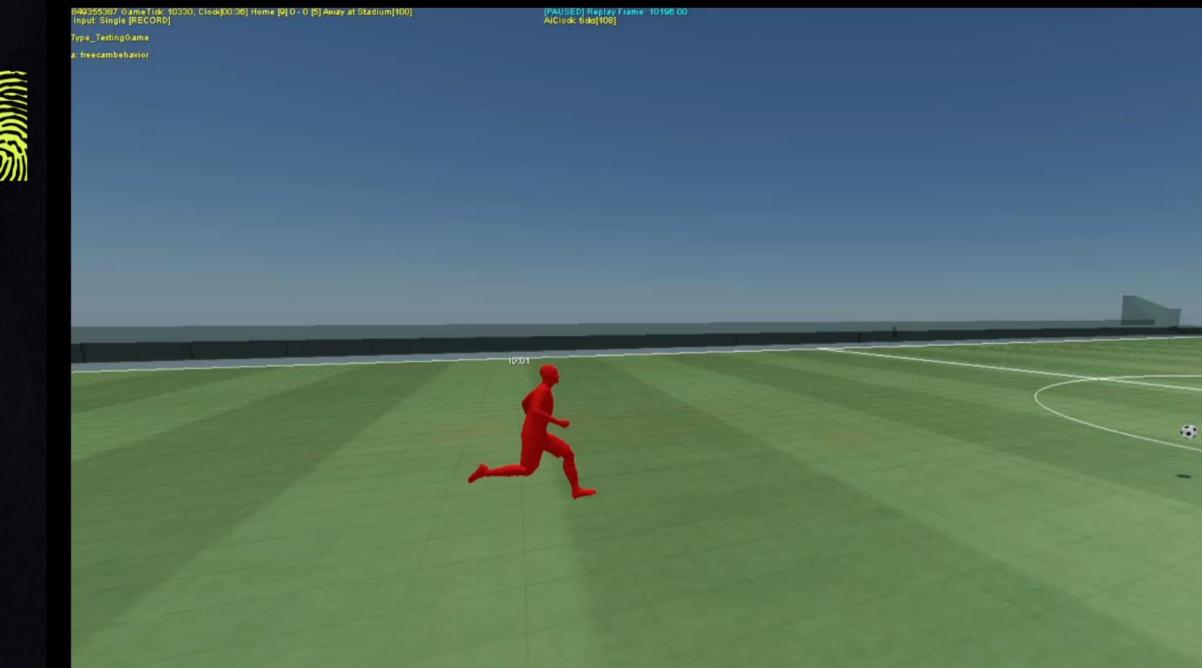
Network Inputs

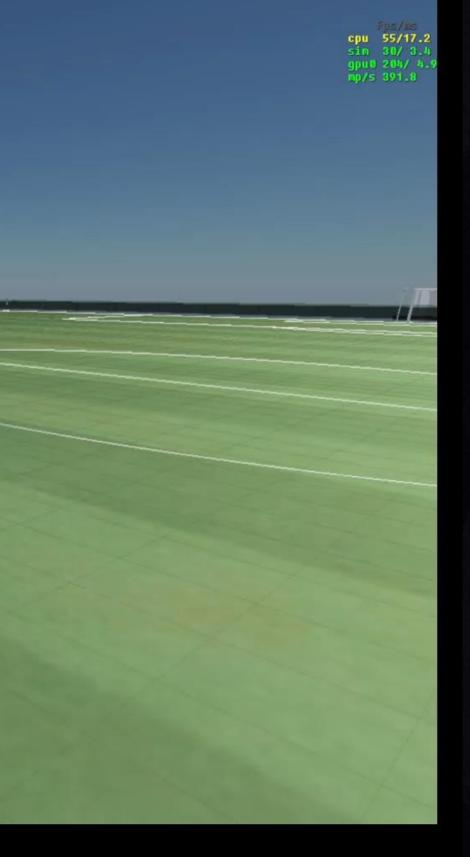




March 21-25, 2022 | San Francisco, CA #GDC22







116163





Source of Inputs

() Alterbad

File Debug Debugtmen Options Bug Report Controller Mentality TeamM Tactics Help

A sear the second second

states in the local division in Provent 2 group Type II have II without a Target Time, 50 Scotter, Target 4 group Type 1 have II without a Target Time, 50 Scotter,

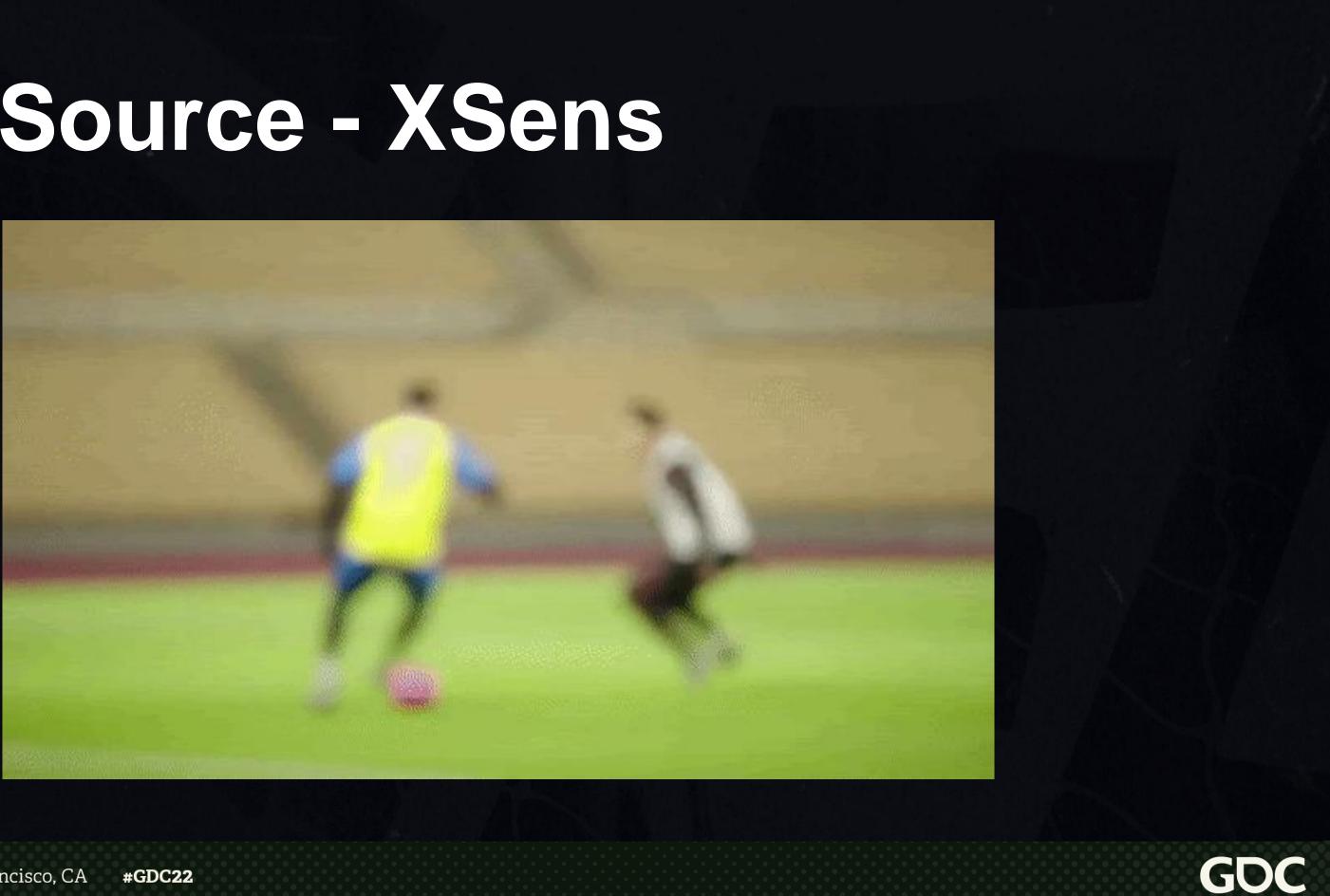
Plannad all Number 22

FIFAData/FIFAData/FIFAData Source 4/96399 - Build 4/96399 - DavidNong - 2821-2 PR7 - Release - ///ifa/gp/nl





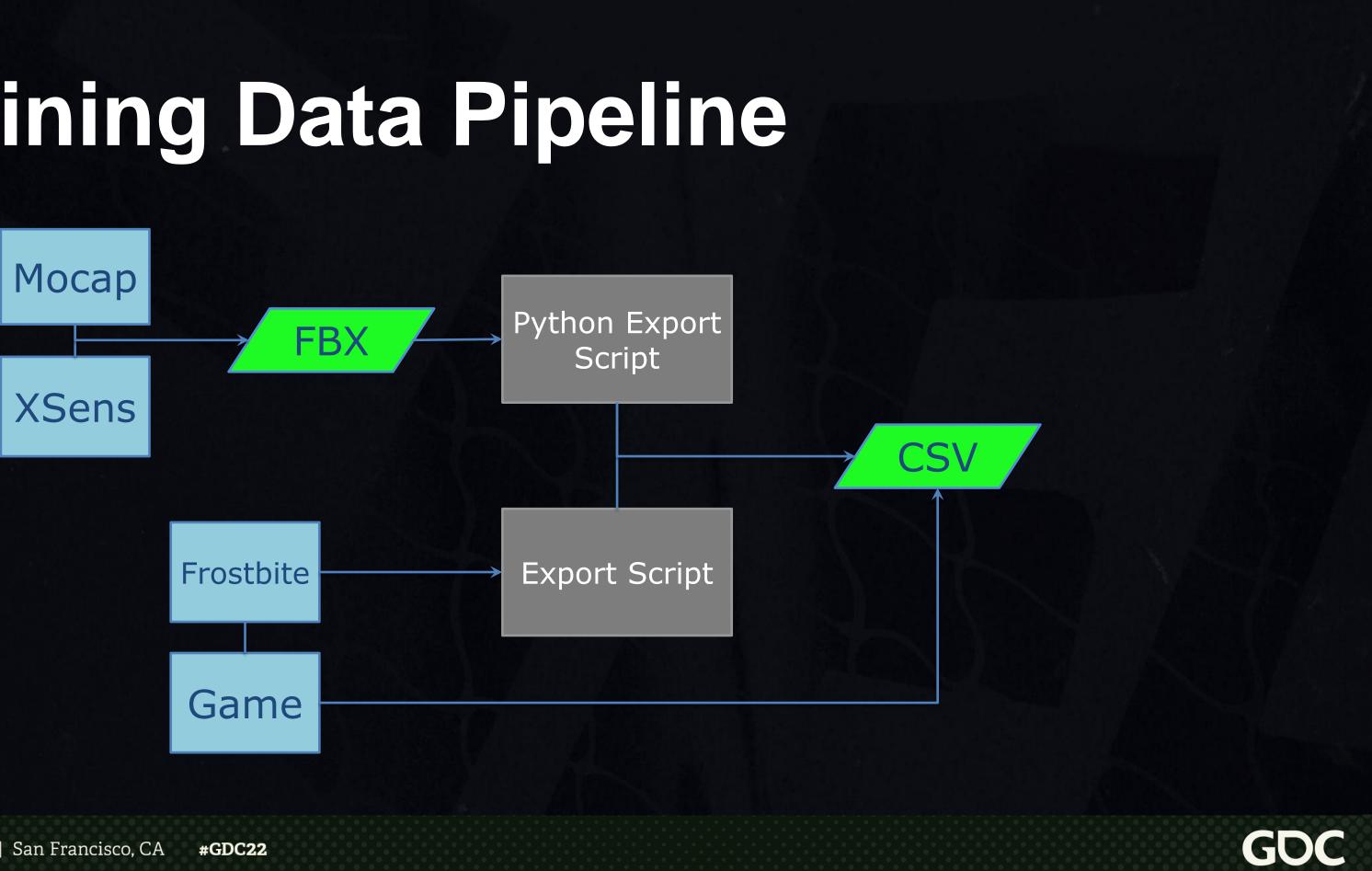
Data Source - XSens



March 21-25, 2022 | San Francisco, CA #GDC22



Training Data Pipeline



March 21-25, 2022 | San Francisco, CA



Training Deep Neural Network

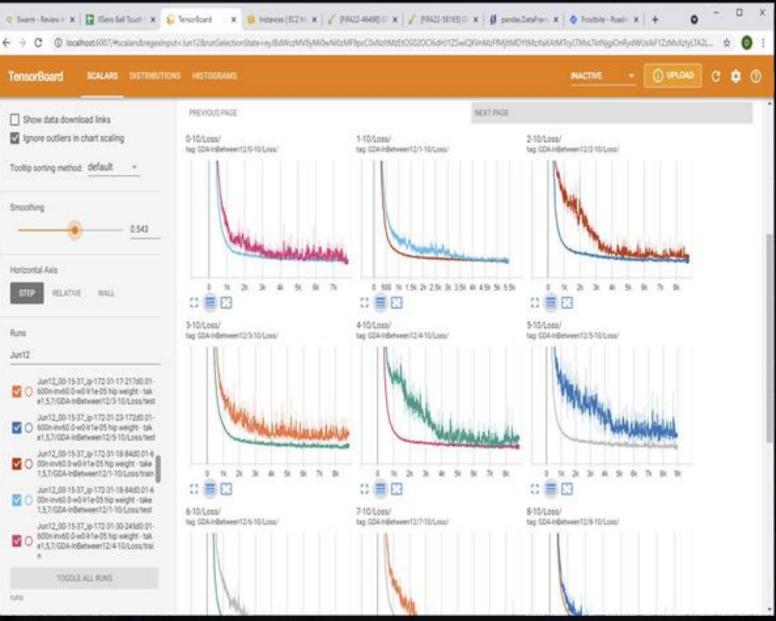
Runs

Jun12

v1

aws

O PyTorch







Identifying Problems – Stress Test

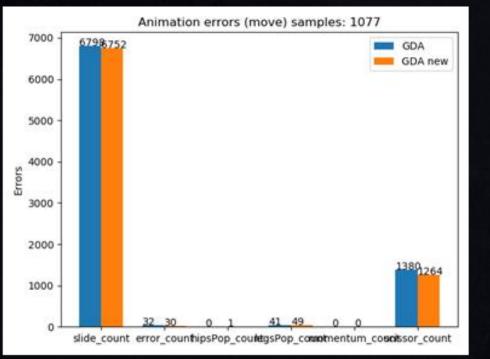
^Y Žz-1.57 FIFAData/FIFAGame - Source 4727735 - Build 4727735 - dbouchard - 2020.0 - Release

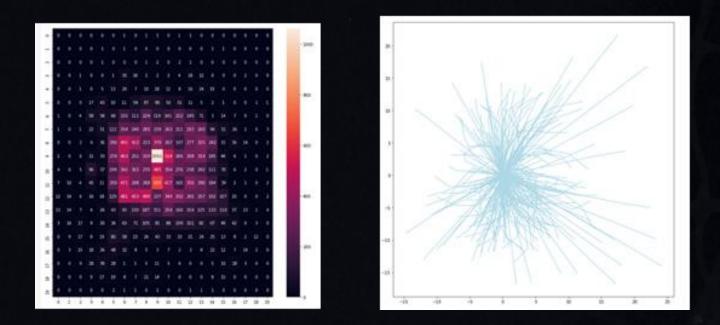


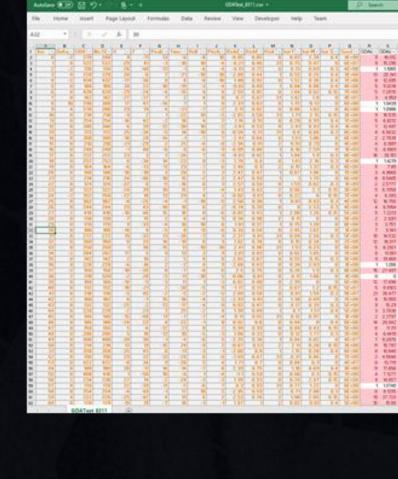




Stress Test – Reviewing Results







	1.1	1.1	12.1	12	22	122	1.2	5.45	1.25	5.45	1.12	12.25	1.25	1.22	1.25	14.1	125	100	2.3	12		12
ć	Louis	-	-	-			2000	1	2000	-	-	1.00					-	4 100 10	2.016	-		
ē,	120%					8	¥	8	4	N		ē 1	0	8 I I			1	2.819	1667			
2	14,54					0	0		0.	8. ·		0	e		1.100	1.09		1700	1108			
2	3374	- 2	0.00		- 1	· · · ·			2-	÷	2		2010	100			-	5.4029	1000			
ŝ	8 0045	- 0				0	ê	0	0	0	÷	0 1	0					0	- 4		0	- 0
ŝ	1.7478			1.0		8	ē	8	s	0	1	ē 1	0	1000	3.08	1207		2,7908				
2	1.04(10)				-			<u>. </u>	<u>*</u>	÷	<u>.</u>							1,1004				
2	1.0804		~~ 2					· · · ·	2		2 ····	2000	-			- 2			-	- 2	- 2	- 1
í	4.3437					0			Ø			8	0		1			4.7254		- 1	- 8	- 1
ć	10028					ŧ	ę	Ð	0			£	0	F	1.1008	1208		Alett				
1	1.104	-	1244	1.10				-	1											- 1		- 1
1	18.967	- 2	- 2	-			E		2-	2	1		2					3417				-1
1	1 190			- 12	- 11	5	ā.		6	ā	8	6.	2		12,3003	1,2003	-	23.71	101	- 2		- 7
	21419		1.1		1	k			¥	*		E	8	•	1.000	10664		16.276	TTRA		- ÷	- 1
1	THE					K			B			B			1.1479			10.004				
1	14279			-	-	2	2	-	2	2	5					10501		24307		- 3	- 5	
1	1,000			100	-			÷	-	÷	÷				0.00	1763		1 102		- 2	100	- 2
ĩ	2100	1.1	- 2			2				*				1000	1.18				-	- 1	140	140
t	14306				- 11	R		8	8.			B			1.1080	1100	1	13582	TIME			
8	17018					8	ŧ	B	0	B	B	ē	Ø	100054	2.000	1.1781						
g	2 2040				-		-	5	2	S	s	· · · · ·			6.247			A 122				
1	ALTER	- 2			-		-		÷	Q	2			-	a part of	2.04	- 1		180	- 1	-2	-1
đ	1.0408				1.1	0	0		0		0	6	0				1	11000				
H	12100						8	8	0			£	8		6 B			- 0				
2	14803					8		ŧ	R		1		ŧ									
1	3 947		- 2	- 1	- 3		2	-			2				1.12102	1162		1114	12246	- 1	1300	100
ī	4.7317		22.2	100	- 1				10						1 MPE		-	3.8755	11100		1	
1	1.0079		10 B		1.1	6			4			6 1	6		6 1			3.8054	1 5 76	1	1905	1885
1	3.4498				1.1	£	æ	8.	0		8.	8 I	8 I		1 0			14.345	88.00			
2	1444	- 2		-	-	0	8	8	0	8	8	g	5			- 3	-	11.000	1.000			
ä	1,206		- 2		-	0	-	-	2	÷	-						- 6	1.00	1.000	- 1		- 1
ï		- 2	- 2	- 1		6	2	÷	÷	2			2		1 APR			1234		- 1		- 1
é	4 2008				1.1	0	0	0	0	Ø	0	0 1	0	8	1 0	1.0	1.1	4.8	1942	0		
1	4 3 8 7				-	8			R	8		ē	ē		1.1070			10.041				
2	3807			-				5		3	5			1000	Alber	1.1404		8407		- 1		-
	1 1000				-	-	÷	-	-	2		· · · · ·	. · · · ·		1 1000	100		14728		- 1		- 2
i	1.4005		112						8			£						2.400		1		
	1,2716					£		8	8.	4		ē	8		1.105							
9	2,2794	. 0				8	*					e					1.1		1.245			
	14043		- 1	-	-		2		-	2	-						-	12388	-	- 1	- 2	
ŝ	11296		100	1400	-		÷	-	1		1	- · · · ·			1.0004	1000	1	1.004		- 2	- 2	- 1
ñ	1500				-	6	8	8	4	4		6		8.717 E	1 100			1.000	120.000	- 6	- R	
ŝ	24505				- 1	8		8	0	0	¥	Ø. 1	a		b 0		1.1	1.052	17,00	- 0		- 4
1	4.76546				- 23	8	a		R	0	÷	ē	a - 1	1223	13276			1405				
1	1074			-	_		-	-	2	10					10007	19077		1,11		- 1	- 2	
1	8,0007			- 1		-	2	-	ā			· · · · ·	0			10054		1000		- 2		- 1
1	35346		100	100				8	4				8							1		- 1
ġ	1,0746	. 0				8	4	8	6	÷	÷	ē. 1		ŧ., 1	A		1		19/5		. 8	. 4
2	10475				_	ł	ŧ	B	¥	*					1.11004	1804		2.908	1908			
1	3.556			-	-		2		2-	-	-					- 1	-	6.280	Card a	- 1		- 2
1		-	100	-		-	2000		T	(Training	-	1000	-	-		_	-	-		_		
			-	-	-		1.41.1			1.1.1			-					-				



GDA with Xsens takes First Iteration

OCHELSEAFC

March 21-25, 2022 | San Francisco, CA

#GDC22

CHELSEA FC O





Closing Thoughts

March 21-25, 2022 | San Francisco, CA #GDC22





What Worked

Positives

- Highly competitive match captured
- Animation was high quality
- Unique animations
- Ball data successfully generated
- Improved ball physics using real world examples
- Lots of data for training ML networks





What Needs Work

New Challenges:

- Identifying, selecting, exporting \bullet animation
- Huge file sizes





In Conclusion

Overall Thoughts

- Proved out new capture technique \bullet
- Used real world data to improve game
- Built our first Full Body ML animation \bullet system





We're Hiring

Electronic Arts

March 21-25, 2022 | San Francisco, CA #GDC22

