IX Workshop on Probabilistic and Statistical Methods

MÉTODOS ESTATÍSTICOS PARA ANÁLISE DE DADOS DO ESPORTE

Daniel Takata Gomes

ENCE/IBGE

Aula 1: Apanhado acerca das aplicações da estatística no esporte

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Aula 2: Métodos para análise de dados de futebol

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Aula 2: Métodos para análise de dados de futebol

Aula 3: Métodos para análise de dados de esportes individuais

"Assim como no esporte, todos podem brincar de modelar. Se você é o tipo de pessoa que enxerga coisas mais claramente através de analogias com esporte, com o clima, com filmes e músicas, com a natureza ou com qualquer outra coisa, então você está a um passo de se tornar especialista em modelagem."

David Sumpter, livro Soccermatics


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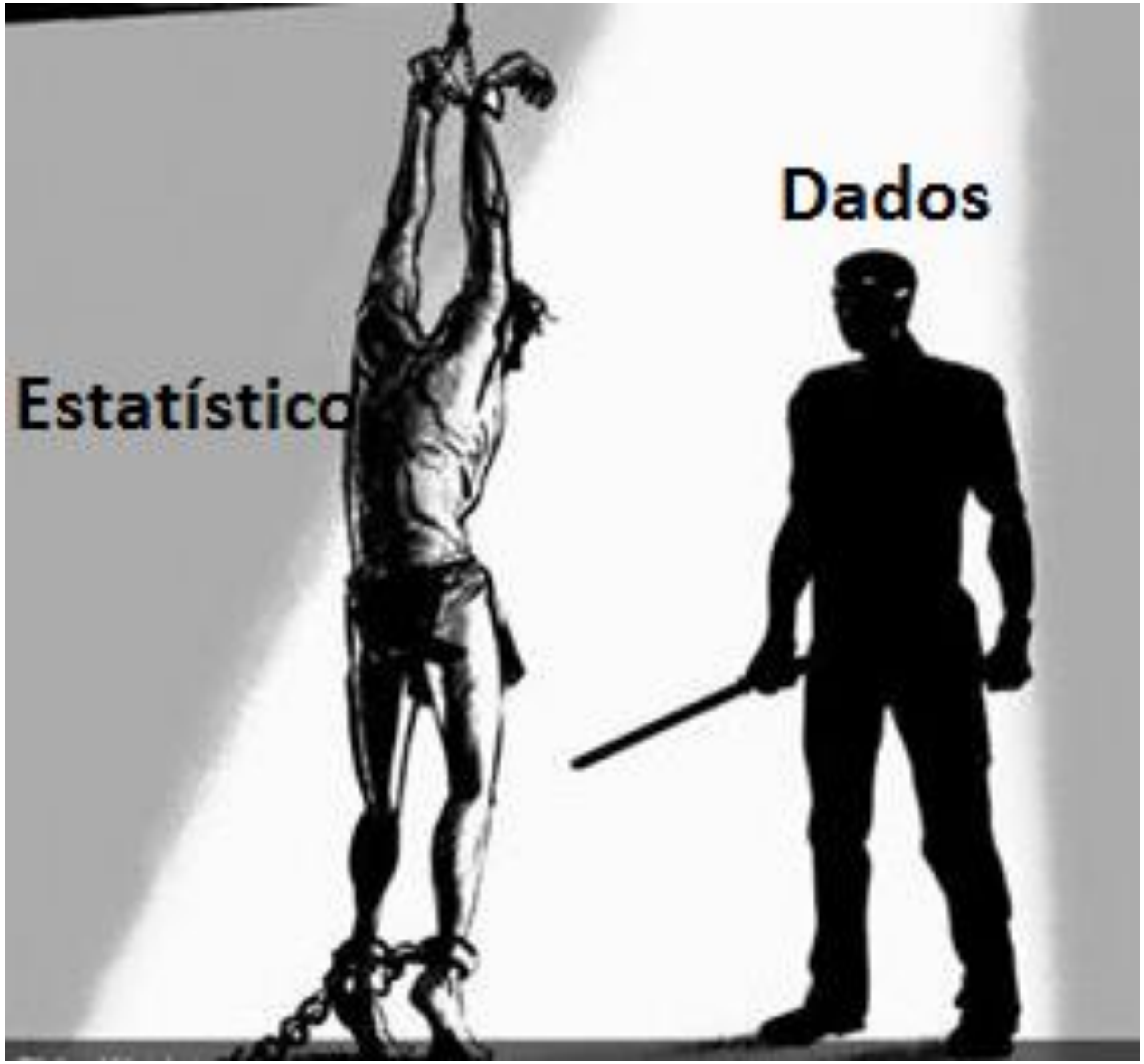
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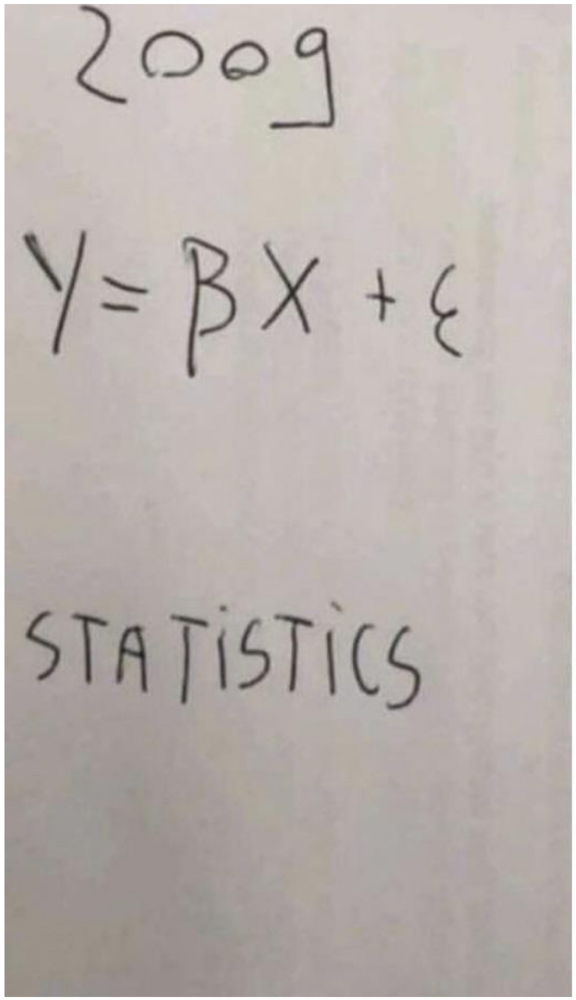

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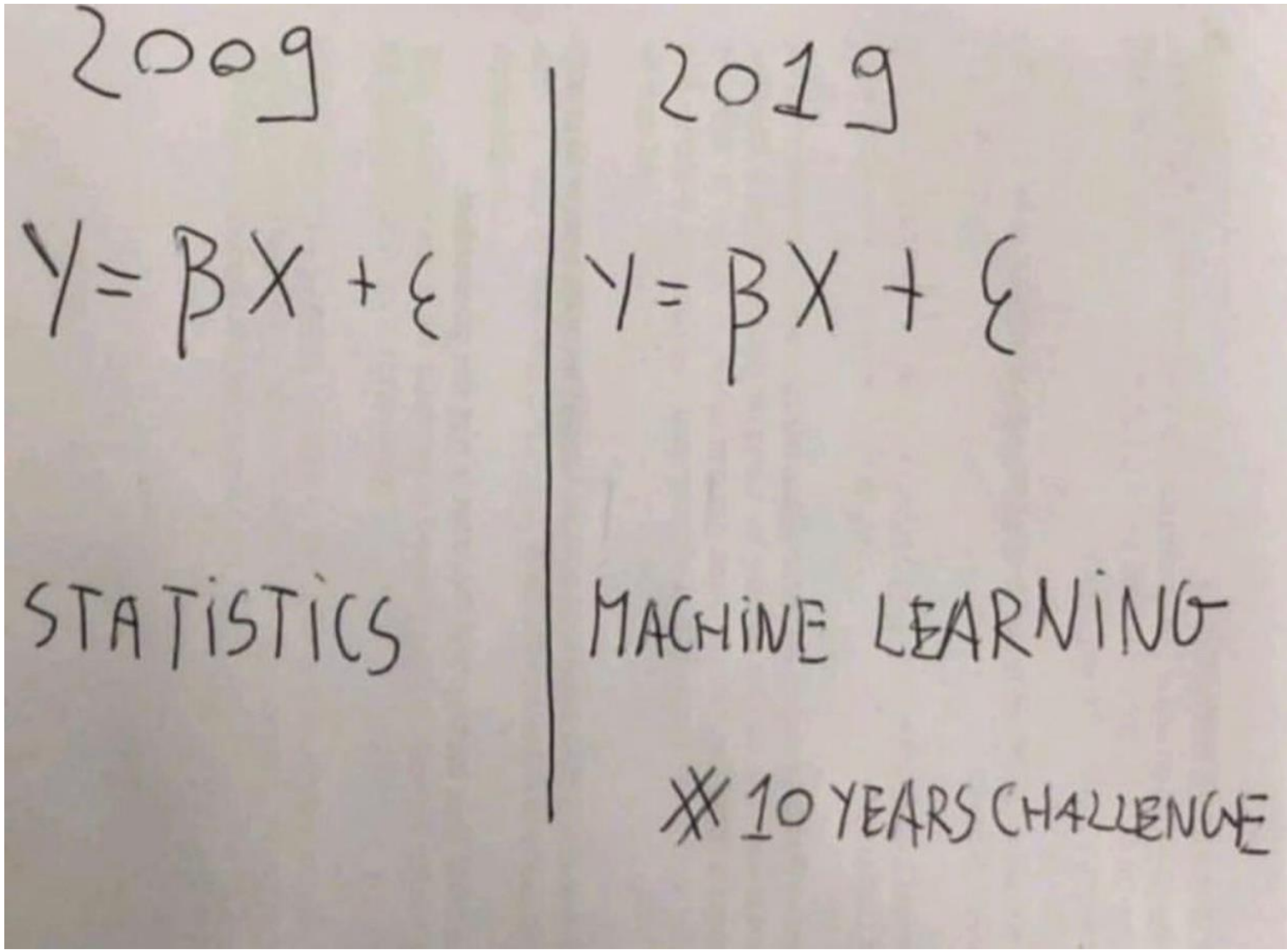
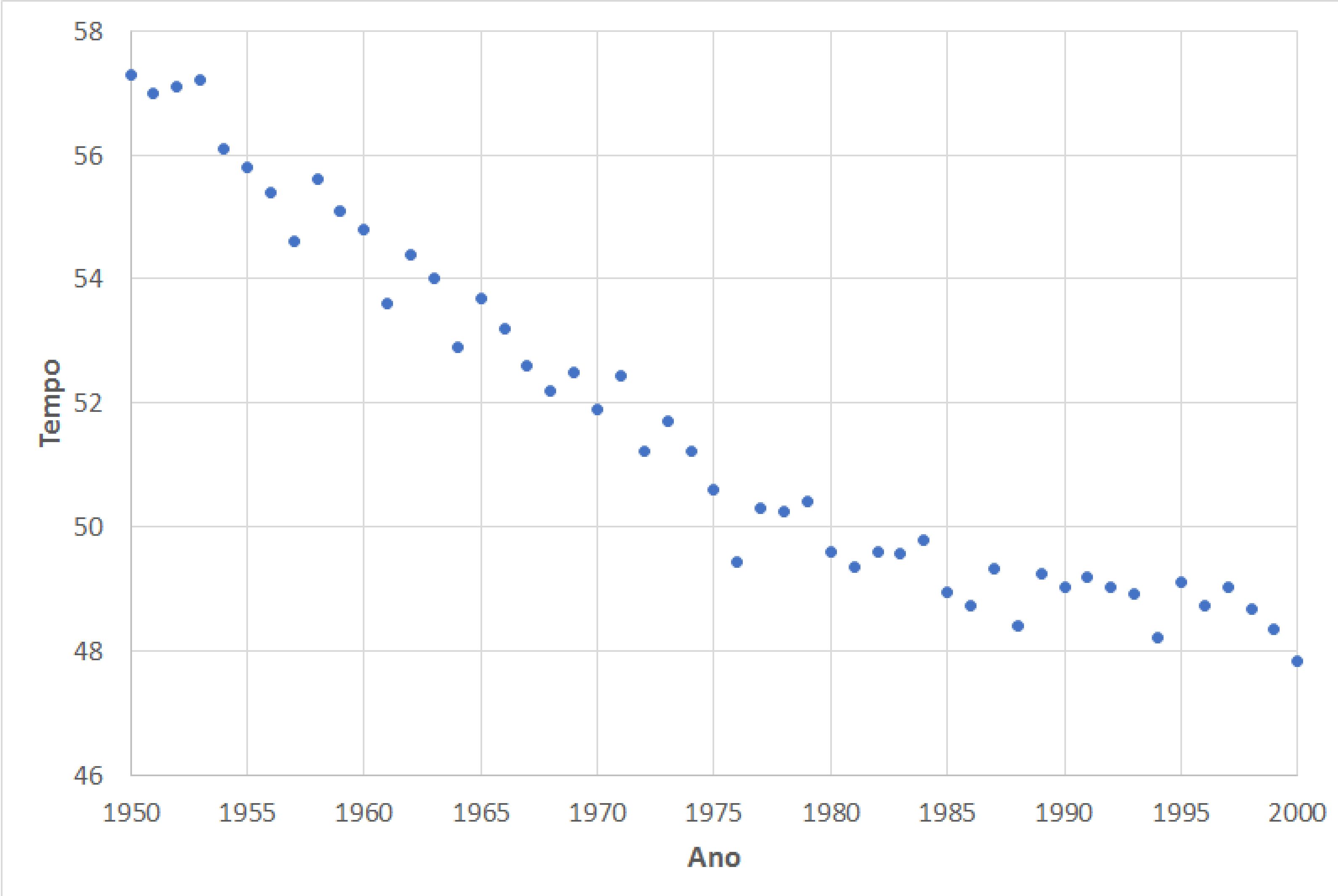


Exclusivo: os tempos que podem rolar em Atlanta!

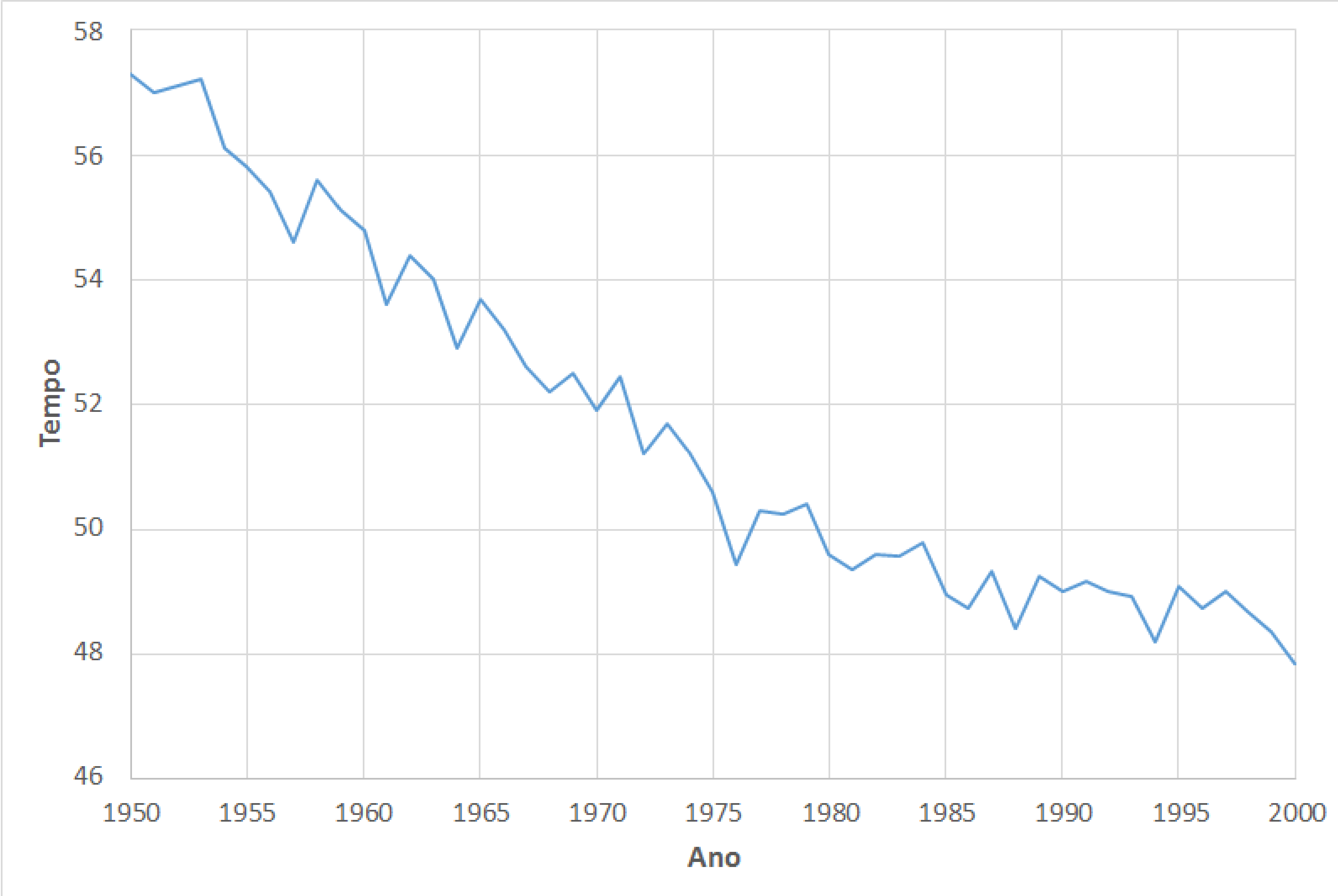
O estudo foi feito pelo sr. Ing. Viktor Svoboda, da Associação Internacional de Estatísticas da Natação (ISSA), que mora na República Tcheca. A análise foi feita em novembro/95. Confira o resultado da pesquisa e faça sua aposta...

Prova	1o. lugar			Final A	Final B
	Previsão	Máximo	Mínimo		
Homens					
50 L	21.78	21.64	22.08	22.38	22.80
100 L	48.39	48.08	48.70	49.36	50.22
200 L	1.46.63	1.45.94	1.47.44	1.48.05	1.50.01
400 L	3.43.20	3.41.77	3.46.32	3.49.33	3.52.65
1500 L	14.41.76	14.36.11	14.54.10	15.12.75	15.26.17
100 C	53.78	53.38	54.18	55.20	56.26
200 C	1.56.83	1.55.91	1.57.77	1.58.76	2.00.60
100 P	1.00.59	1.00.20	1.01.43	1.02.09	1.03.00
200 P	2.10.64	2.09.80	2.12.46	2.14.20	2.15.29
100 B	52.63	52.27	52.99	53.45	54.10
200 B	1.54.89	1.54.09	1.55.79	1.58.58	1.59.98
200 M	1.59.35	1.57.59	2.00.00	2.01.74	2.03.40
400 M	4.10.84	4.08.84	4.12.15	4.18.74	4.21.87
Mulheres					
50 L	24.66	24.39	24.73	25.67	26.16
100 L	54.30	53.90	54.70	55.91	56.61
200 L	1.57.11	1.56.32	1.57.91	1.59.63	2.01.28
400 L	4.05.19	4.03.62	4.07.45	4.11.11	4.15.81
800 L	8.24.17	8.20.94	8.28.24	8.34.24	8.44.35
100 C	1.00.19	59.80	1.01.30	1.02.20	1.03.26
200 C	2.06.55	2.05.53	2.07.59	2.11.76	2.15.19
100 P	1.07.52	1.07.08	1.08.46	1.10.02	1.10.83
200 P	2.24.88	2.24.08	2.27.40	2.30.08	2.32.15

Evolução dos tempos dos líderes do ranking mundial dos 100m livre masculino



Evolução dos tempos dos líderes do ranking mundial dos 100m livre masculino

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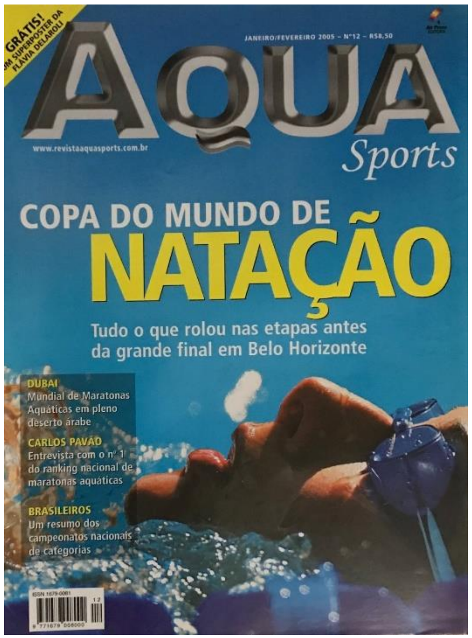
Mestrado: Estatística (Unicamp)

Doutorado: Estatística (USP)

Ocupação atual: Professor e pesquisador na
Escola Nacional de Ciências Estatísticas (ENCE/IBGE)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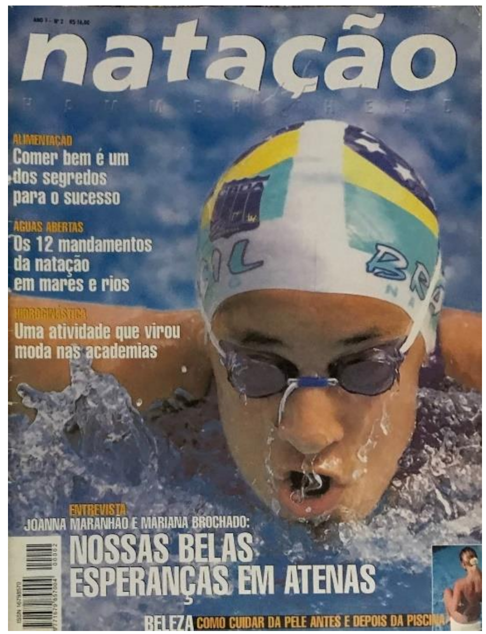
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Os 12 mandamentos
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Uma atividade que virou
moda nas academias
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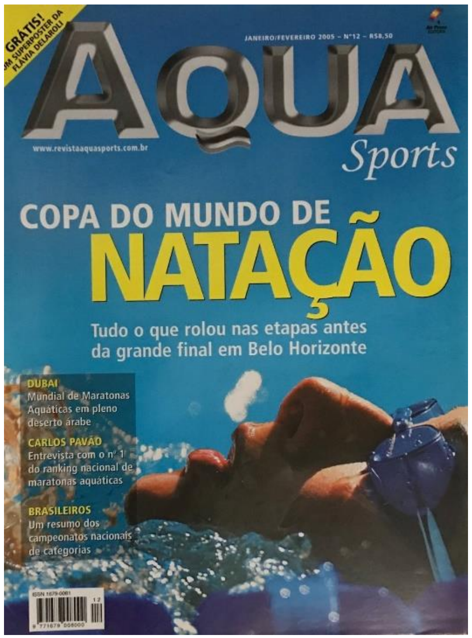
JOANNA MARANHÃO E MARIANA BROCHADO:
NOSSAS BELAS
ESPERANÇAS EM ATENAS
BELEZA COMO CUIDAR DA PELE ANTES E DEPOIS DA PISCINA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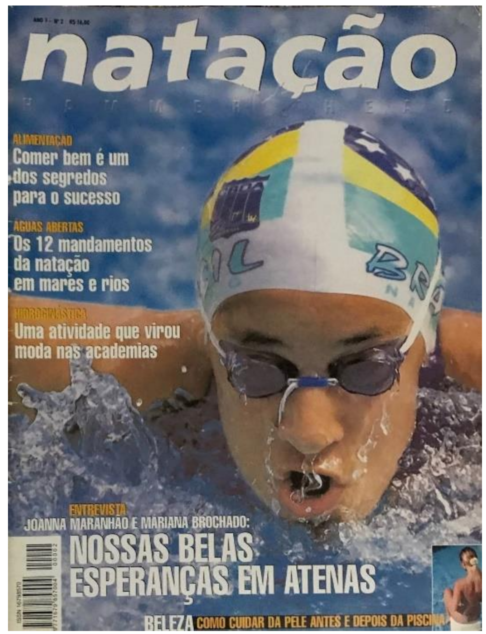
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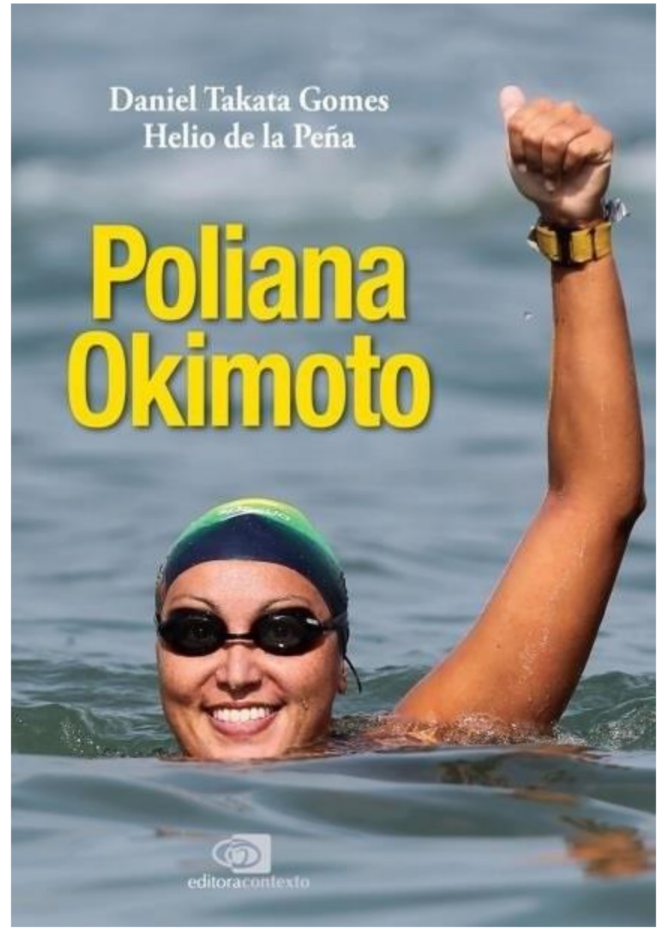
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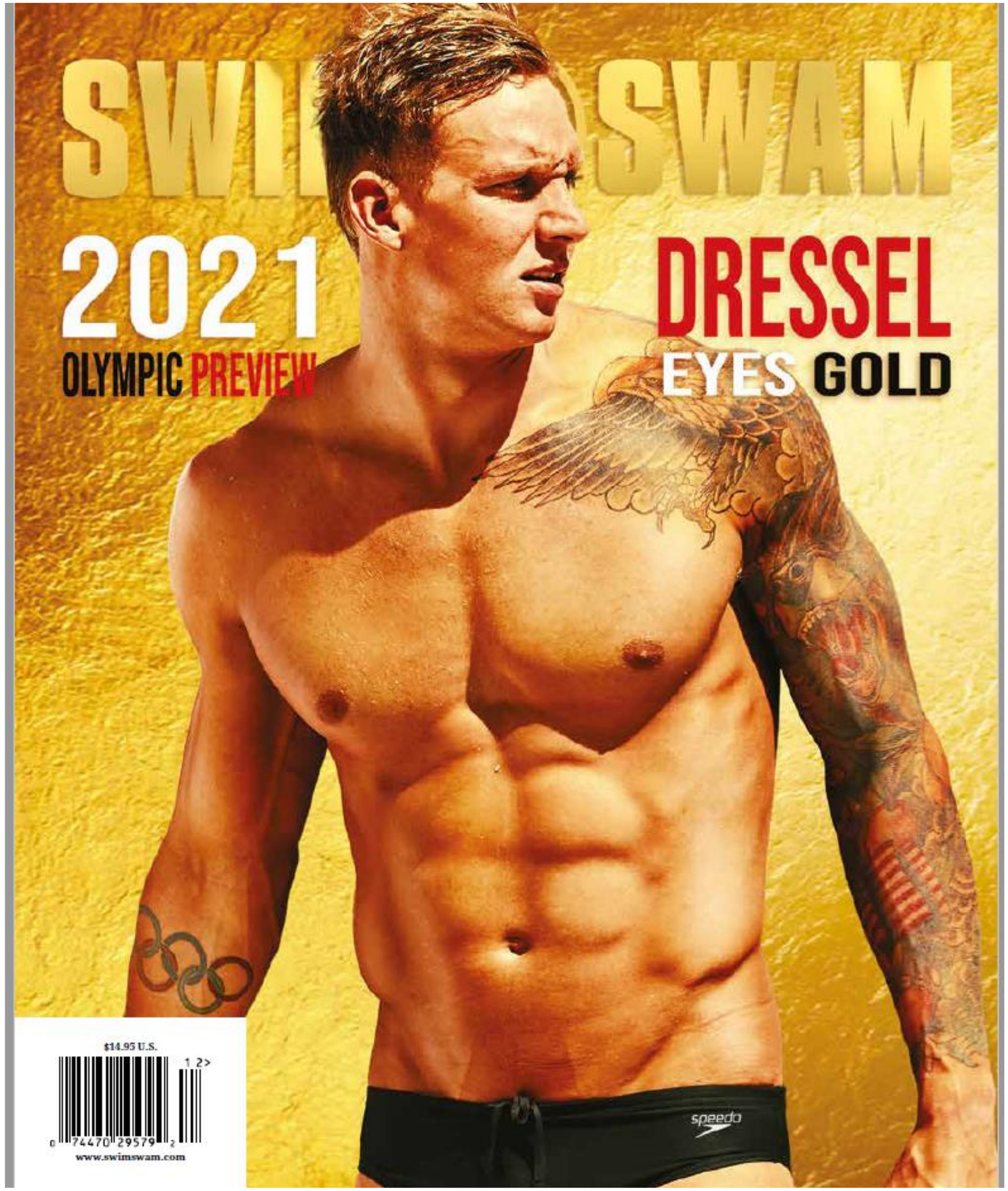
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Narrador
Daniel Takata
Comentarista


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DANIEL TAKATA
Comentarista


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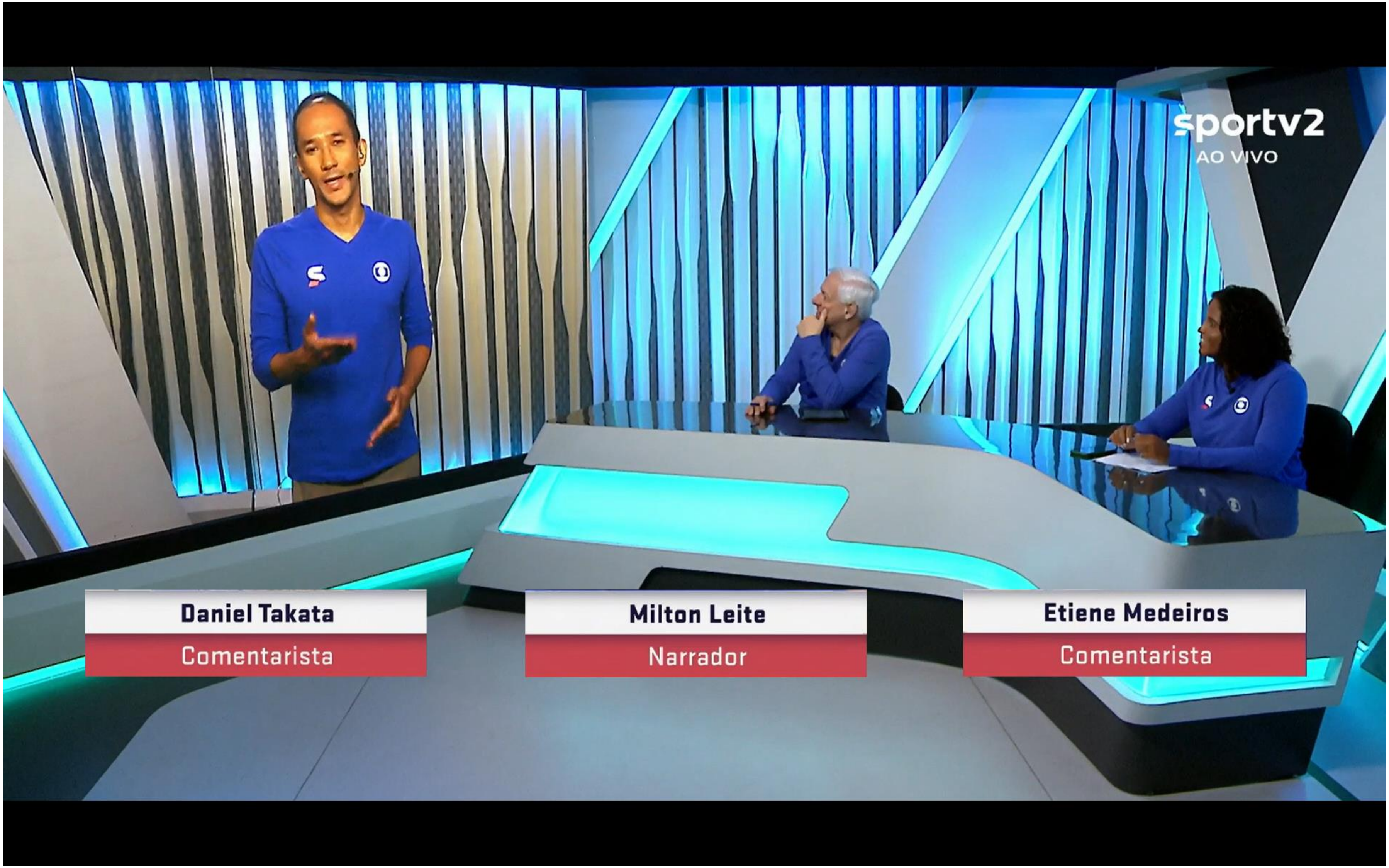
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E o que isso tem a ver com estatística?

E o que isso tem a ver com estatística?

Resposta: tudo!

BEST SWIMMING

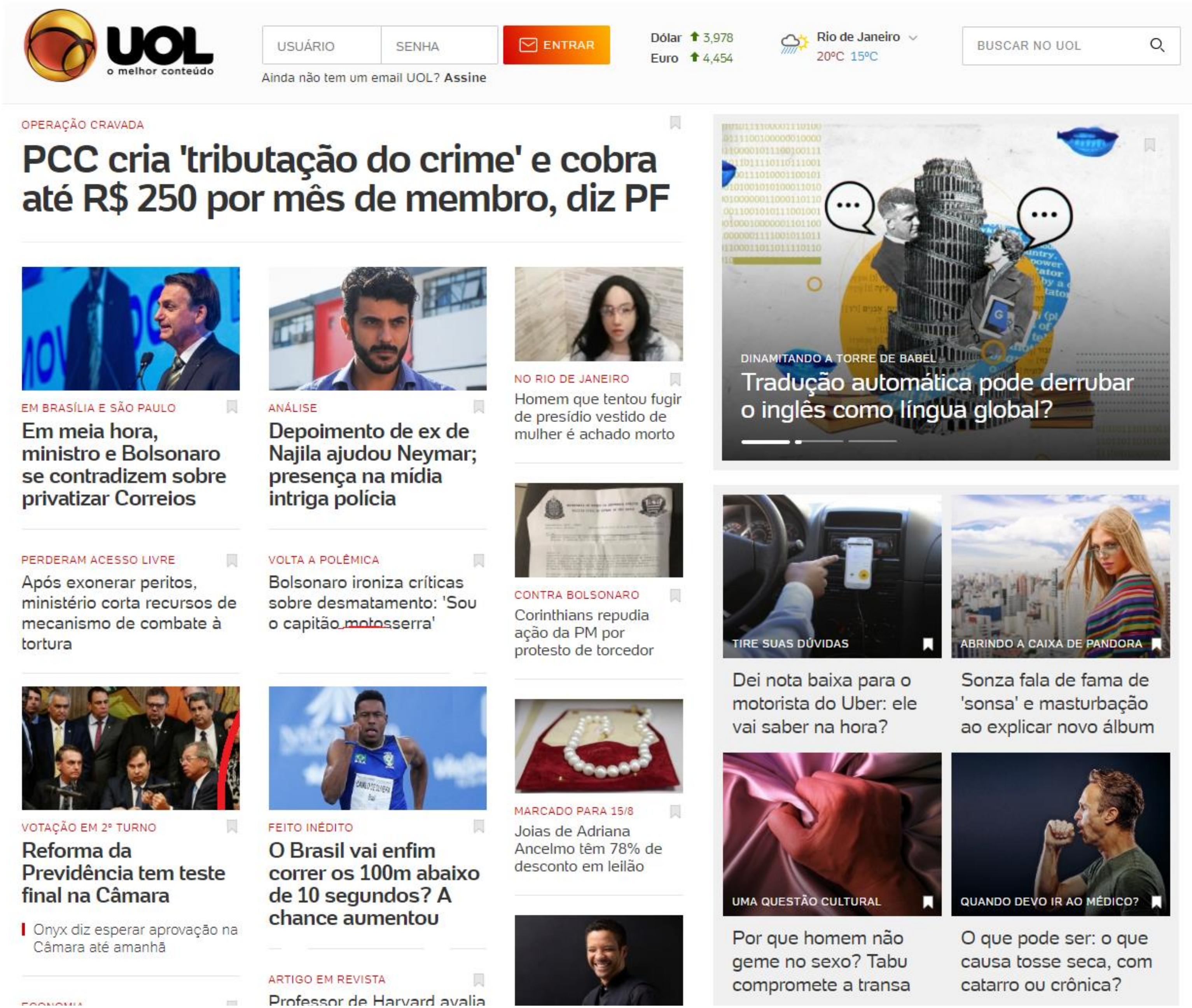
BEST MEMÓRIA ESPECIAIS

Best Memória: Hoje é Dia do Estatístico

Por **Alex Pussieldi** - maio 29, 2019

94 0

Nada melhor do que homenagear Daniel Takata, o maior estatístico que a natação brasileira já produziu. Takata está com site novo e um canal no Youtube. Veja a postagem de hoje que faz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Após exonerar peritos, ministério corta recursos de mecanismo de combate à tortura

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Por que homem não geme no sexo? Tabu compromete a transa

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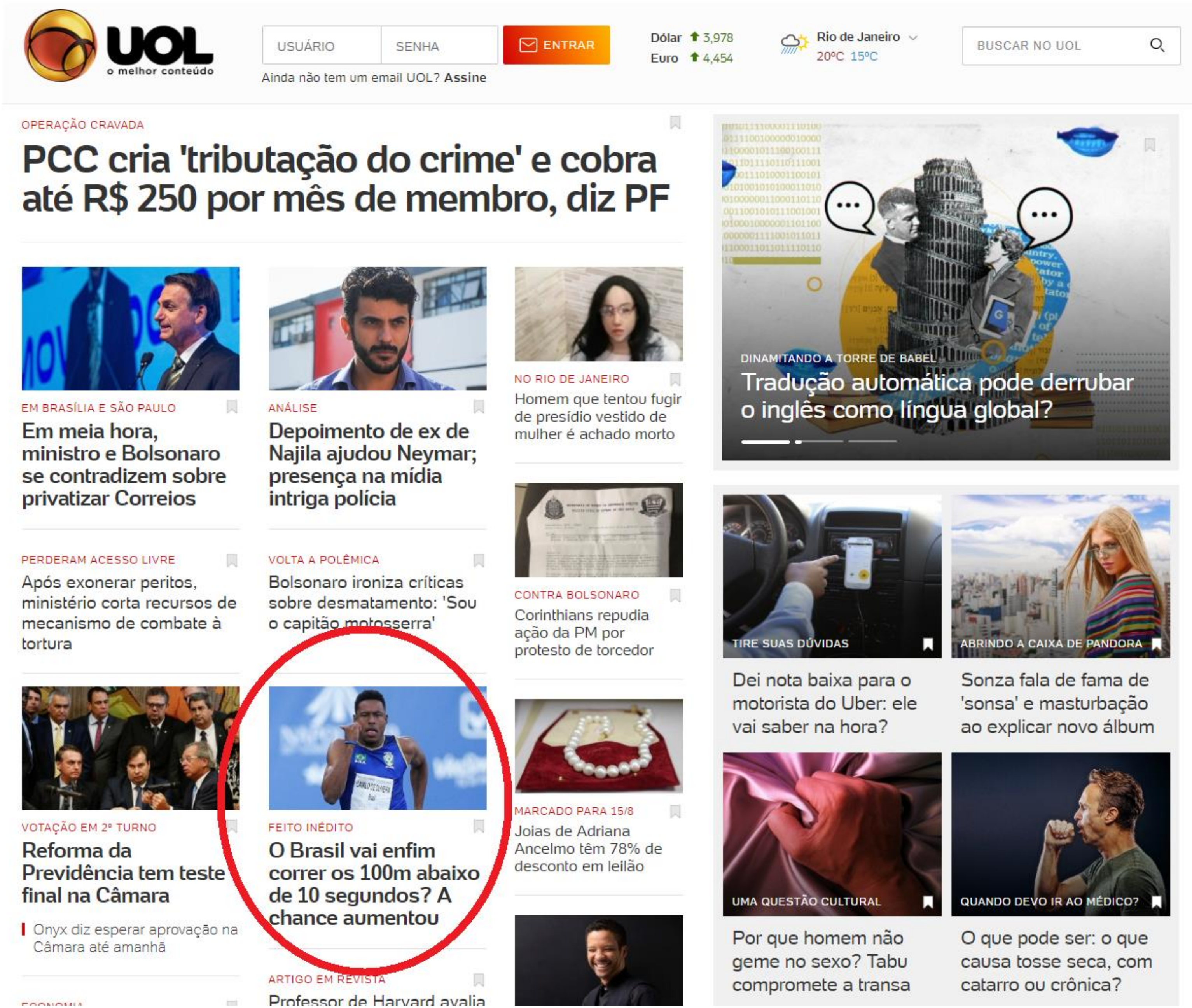
O que pode ser: o que causa tosse seca, com catarro ou crônica?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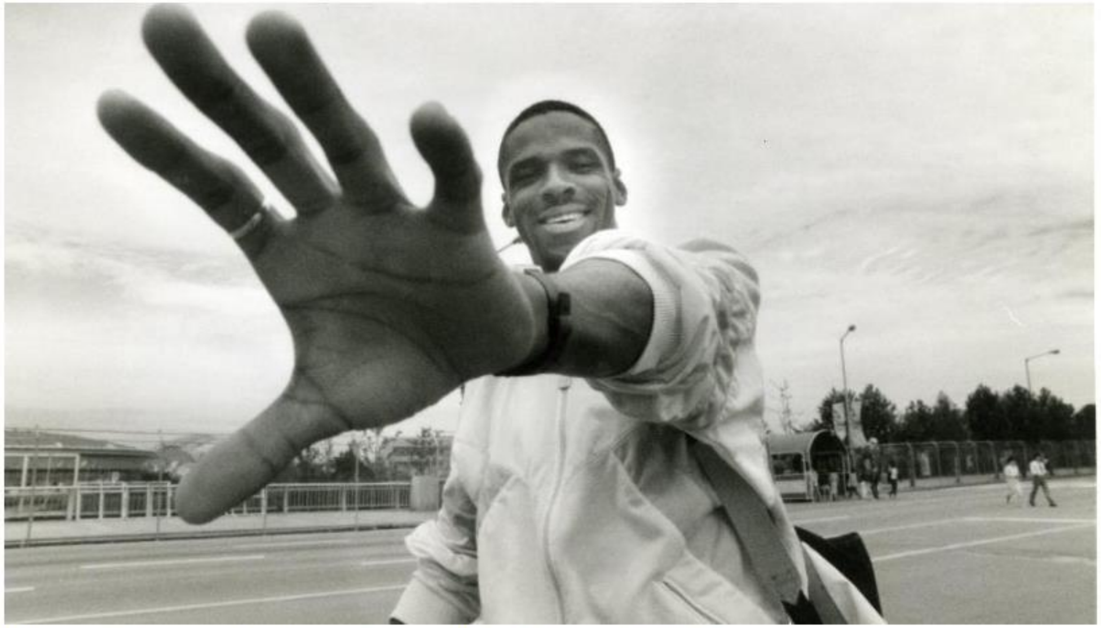
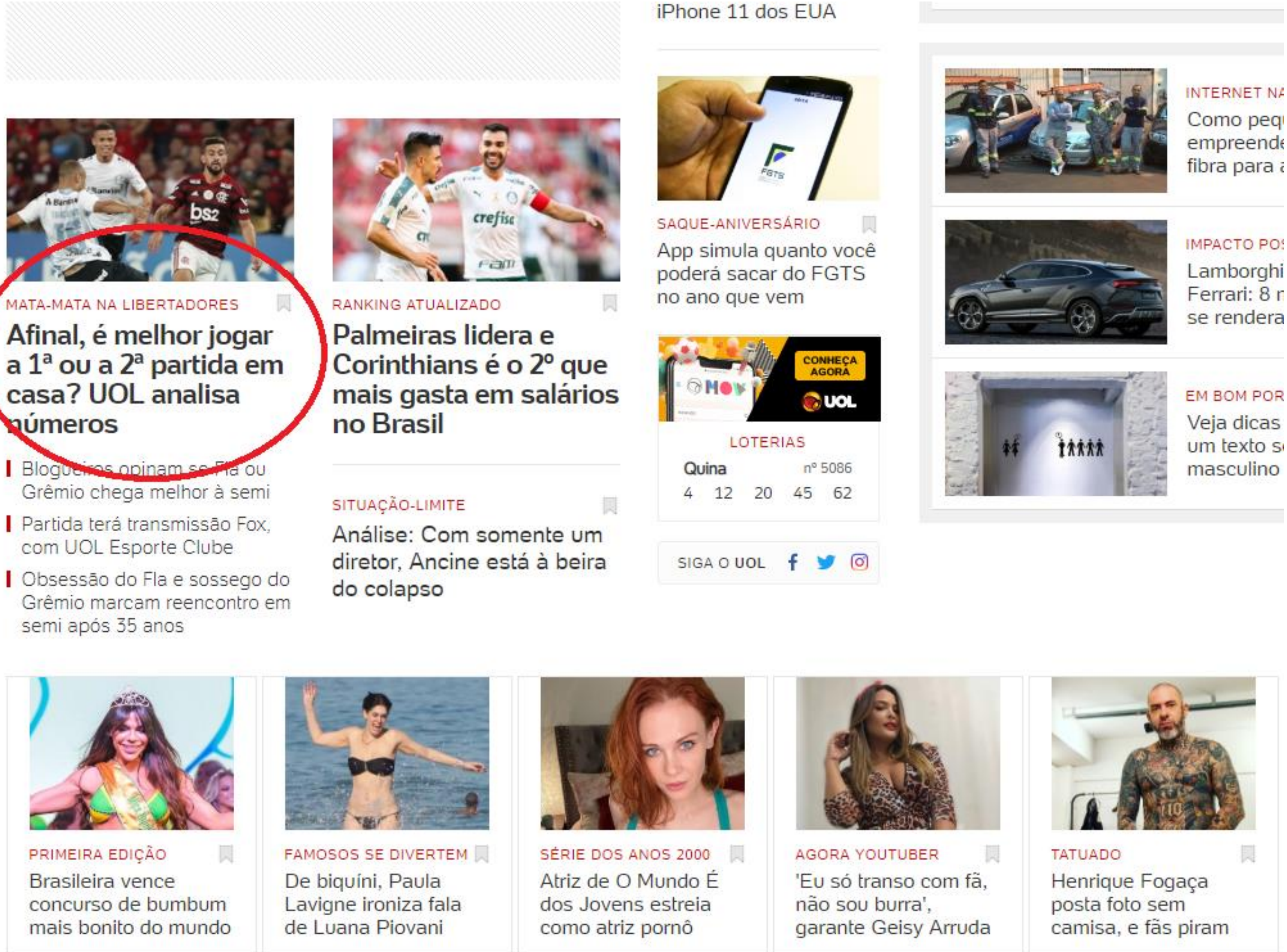


Robson Caetano acena na Vila Olímpica durante a realização dos Jogos de Seul-1988
Imagem: Wilson Melo/Folhapress

Daniel Takata*
Colaboração para o UOL,em São Paulo
06/08/2019 12h00

Lá se vão 31 anos. Na disputa do Ibero-Americano de 1988, na Cidade do México, o legendário Robson Caetano completou os 100m rasos em 10 segundos cravados.Cravados, mesmo. À época, essa era uma marca muito expressiva. Até aquela data, apenas seis corredores, na história, haviam corrido a distância abaixo dos 10 segundos. Um deles, o canadense Ben Johnson, teria suas marcas anuladas posteriormente por doping.



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AGORA YOUTUBER

'Eu só transo com fã, não sou burra', garante Geisy Arruda

TATUADO

Henrique Fogaça posta foto sem camisa, e fãs piram

Mata-mata: afinal, é melhor jogar a primeira ou a segunda partida em casa?

Filipe Luís e Galhardo disputam uma jogada em Flamengo x Grêmio
Imagem: Alexandre Vidal/Flamengo

UOL
Daniel Takata
Colaboração para o UOL, em São Paulo
02/10/2019 04h00

Essa é uma questão recorrente em mesas redondas e até em conversas de bar sobre futebol. Um time que joga a primeira partida em casa pode fazer um resultado e controlar o adversário na partida seguinte. Por outro lado,

WHAT IF THE SUPER SUITS HAD NEVER EXISTED?

BY DANIEL TAKATA

It has been 11 years since the high-technology suits were banned from swimming.

Such suits were used by almost every elite swimmer in 2008 and 2009 and helped them to break several world records. Some of these records still stand as of today, such as Cesar Cielo's 50 and 100 freestyle, Michael Phelps' 400 IM, and Federica Pellegrini's 200 freestyle.

There was much discussion at the time about the effect of the suits on the swimmers' performances. In this article, we try to estimate this effect through data and statistical analysis.

THE SUITS' IMPACT

In 2008, Speedo launched the LZR Racer suit, adding polyurethane panels to its existing design, replacing the Teflon coating used in previous models. The more polyurethane the suits had, the less drag they created. The result was that 55 world records were broken in that year in long course meters, 25 during the Beijing Olympics.

In 2009, other manufacturers like Jaked and Arena went further and made their suits entirely with polyurethane, allowing the swimmers to glide through water even faster.

Sixty-seven world records were broken that year in long course meters, 43 at the World Championships in Rome, the most ever.

In the beginning of 2010, FINA banned those suits for good. Now, swimsuits have to be made only with textile material, no polyurethane.

But the effects of those suits remain strong. As of today, several of the fastest performances of all time were registered in that period. Some world records still remain untouchable.
The list below shows the current world records in individual events in long course meters from 2008 and 2009.

Men		
Cesar Cielo (BRA)	50 freestyle	20.91
Cesar Cielo (BRA)	100 freestyle	46.91
Paul Biedermann (GER)	200 freestyle	1:42.00
Paul Biedermann (GER)	400 freestyle	3:40.08
Zhang Lin (CHN)	800 freestyle	7:32.12
Aaron Peirsol (USA)	200 backstroke	1:51.92
Michael Phelps (USA)	400 medley	4:03.84

Women		
Federica Pellegrini (ITA)	200 freestyle	1:52.98
Liu Zige (CHN)	200 butterfly	2:01.81

As of today, we have nine world records that have lasted 12-13 years. Putting that into perspective, all of the seven current men's world records set in that period make the top 10 list of the longest standing swimming world records of all time in men's individual events.

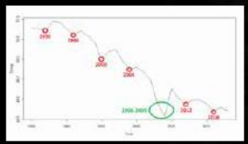
In other words, if it weren't for the suits, maybe most of those records were not so much ahead of their time. It is safe to say that the effect of the suits is undeniable.

The question is inevitable: If the swimmers were not using high-tech suits in 2008-2009, what would be their times? How many world records from that period would still stand?

MODELING THE DATA

Let's take a look of the evolution of the men's 100 freestyle over the years. The following graph shows the average time of the fastest 100 swimmers in each year since 1990.

AVERAGE TIME OF THE FASTEST 100 SWIMMERS IN EACH YEAR IN THE MEN'S 100 FREESTYLE, SINCE 1990



The decreasing pattern is evident, as we would expect. But we can observe another interesting aspect.

Every four years, it is possible to notice a dramatic drop in the average time. Which is not coincidence, since it corresponds to the Olympic years. The only exception is the period 2008-2009: The times decrease from 2007 to 2008, and decrease even more from 2008 to 2009, which is unusual, since 2009 was not an Olympic year. Of course, the suits were the cause.

The same pattern is observed in all other events included in the Olympic program. That is why, in this analysis, only these events are considered. We do not take into account the 50 strokes events, nor the men's 800 freestyle and the women's 1500 freestyle, which will make their first appearance this year at the Tokyo Olympics.

In a statistical perspective, we can estimate the decreasing trend over the years and the seasonal effect each four years, using data from 1990-2007 and 2010 on, to estimate the times from 2008-2009 period in "normal" conditions, in other words, without super suits.

The statistical model is called ARIMA (Autoregressive Integrated Moving Average), one of the most used models to adjust time series data.

Since the 2009 suits were faster than the 2008 suits, different effects were considered for each of those years.

In the men's events, there were swimmers who preferred to use only the leg suit, and others used the full body suit. A very careful data analysis was conducted to estimate the percentage of swimmers who used each type of suit in each event, using data from the major competitions.
It is important to notice that we are able only to calculate the average effect of the suits. The suits' effects could vary from swimmer to swimmer, and the individual effect is impossible to measure without a designed experiment.

The table below shows the adjusted world records:

Event	WR Holder	Current WR	Adjusted Time
Men's 50 freestyle	Cesar Cielo (BRA)	20.91	21.46
Men's 100 freestyle	Cesar Cielo (BRA)	46.91	47.78
Men's 200 freestyle	Paul Biedermann (GER)	1:42.00	1:43.41
Men's 400 freestyle	Paul Biedermann (GER)	3:40.07	3:42.18
Men's 200 backstroke	Aaron Peirsol (USA)	1:51.92	1:53.37
Men's 400 IM	Michael Phelps (USA)	4:03.84	4:04.82
Women's 200 freestyle	Federica Pellegrini (ITA)	1:52.98	1:54.23
Women's 200 butterfly	Liu Zige (CHN)	2:01.81	2:02.83

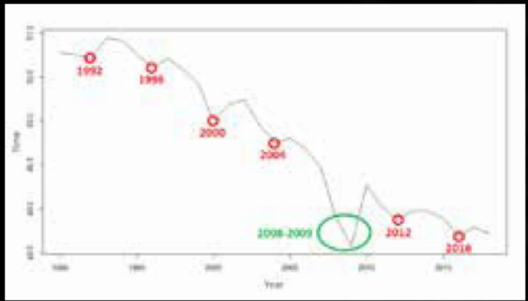
Among the world records set in 2008-2009 that still stand, two of them would still be current world records today, if they had been swum without high-tech suits according to this analysis: Michael Phelps' men's 400 IM and Liu Zige's women's 200 fly.

Note that the estimated effects depend on the stroke, the distance, and the suit. For example, the difference between the actual time set by Paul Biedermann in the 200 free and the adjusted time is 2.41 seconds, smaller than the 0.98 second of difference observed in Michael Phelps' 400 IM, a longer event. There are two reasons for it: Phelps' record was set in 2008, and Biedermann's was set in 2009, so Biedermann used a faster suit. Phelps wore a leg suit, while Biedermann wore a full body suit, so Biedermann took full advantage of his suit.

It is also interesting to note that if Biedermann had swum without a super suit, he would not have broken Ian Thorpe's world record in the men's 400 freestyle. Since this record was set in 2002, it has lasted 19 years, and it would be the longest standing world record of all time in men's events.

swimmers in each year since 1990.

AVERAGE TIME OF THE FASTEST 100 SWIMMERS IN EACH YEAR IN THE MEN'S 100 FREESTYLE, SINCE 1990



The decreasing pattern is evident, as we would expect. But we can observe another interesting aspect.

Every four years, it is possible to notice a dramatic drop in the average time. Which is not coincidence, since it corresponds to the Olympic years. The only exception is the period 2008-2009: The times decrease from 2007 to 2008, and decrease even more from 2008 to 2009, which is unusual, since 2009 was not an Olympic year. Of course, the suits were the cause.

The same pattern is observed in all other events included in the Olympic program. That is why, in this analysis, only these events are

the decreasing trend over the years and the seasonal effect each four years, using data from 1990-2007 and 2010 on, to estimate the times from 2008-2009 period in "normal" conditions, in other words, without super suits.

The statistical model is called ARIMA (Autoregressive Integrated Moving Average), one of the most used models to adjust time series data.

Since the 2009 suits were faster than the 2008 suits, different effects were considered for each of those years.

In the men's events, there were swimmers who preferred to use only the leg suit, and others used the full body suit. A very careful data analysis was conducted to estimate the percentage of swimmers who used each type of suit in each event, using data from the major competitions.
It is important to notice that we are able only to calculate the average effect of the suits. The suits' effects could vary from swimmer to swimmer, and the individual effect is impossible to measure without a designed experiment.

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Esporte

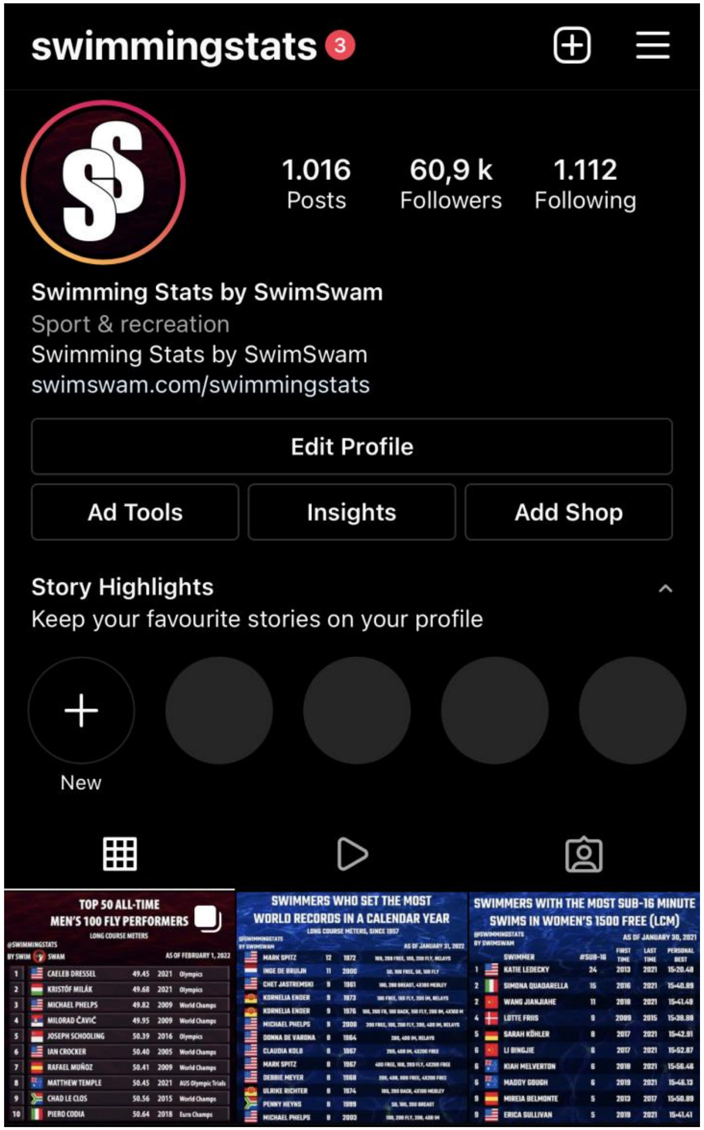
Uma a cada 69 anos: campanha do Fla no Brasileiro é exceção estatística

Daniel Takata, professor da Escola Nacional de Ciências Estatísticas do Rio de Janeiro, estudou os números quase inalcançáveis do rubro-negro

Por **Alexandre Senechal, Luiz Felipe Castro** - Atualizado em 13 nov 2019, 09h54 - Publicado em 13 nov 2019, 09h17

Flamengo, líder com 77 pontos em 32 rodadas Kaio Lakaio/VEJA

São 77 pontos em 32 rodadas. Dez de vantagem para o segundo colocado. A marca que coloca o Flamengo com uma mão na taça a seis jogos do fim do Campeonato Brasileiro é um recorde. Utilizando um modelo matemático para analisar todas as edições do torneio desde 2003 – quando a competição passou a ser disputada por pontos corridos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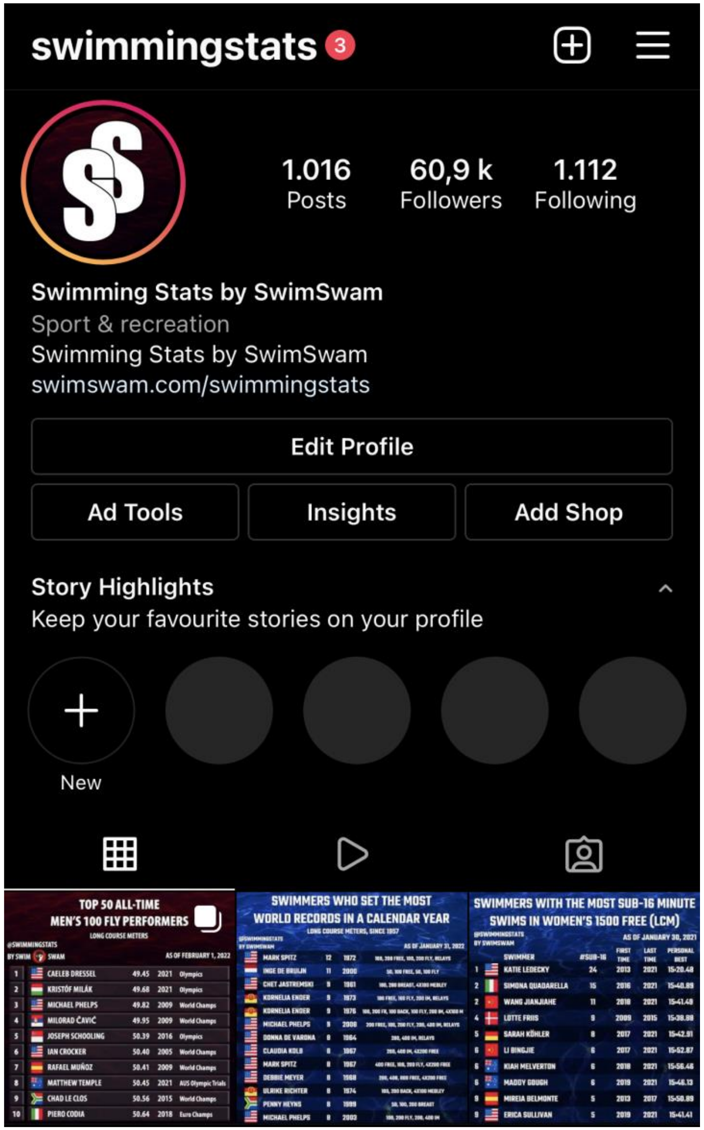
Edit Profile
Ad Tools
Insights
Add Shop
Story Highlights
Keep your favourite stories on your profile
New
TOP 50 ALL-TIME MEN'S 100 FLY PERFORMERS
SWIMMERS WHO SET THE MOST WORLD RECORDS IN A CALENDAR YEAR
SWIMMERS WITH THE MOST SUB-16 MINUTE SWIMS IN WOMEN'S 1500 FREE (LCM)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Ad Tools
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Add Shop
Story Highlights
Keep your favourite stories on your profile
New
TOP 50 ALL-TIME MEN'S 100 FLY PERFORMERS
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SWIMMERS WITH THE MOST SUB-16 MINUTE SWIMS IN WOMEN'S 1500 FREE (LCM)


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SWIMMERS WHO SET THE MOST WORLD RECORDS IN A CALENDAR YEAR
LONG COURSE METERS, SINCE 1957
@SWIMMINGSTATS BY SWIMSWAM
AS OF JANUARY 31, 2022
MARK SPITZ 12 1972 100, 200 FREE, 100, 200 FLY, RELAYS
INGE DE BRUIJN 11 2000 50, 100 FREE, 50, 100 FLY
CHET JASTREMSKI 9 1961 100, 200 BREAST, 4X100 MEDLEY
KORNELIA ENDER 9 1973 100 FREE, 100 FLY, 200 IM, RELAYS
KORNELIA ENDER 9 1976 100, 200 FR, 100 BACK, 100 FLY, 200 IM, 4X100 M
MICHAEL PHELPS 9 2008 200 FREE, 100, 200 FLY, 200, 400 IM, RELAYS
DONNA DE VARONA 8 1964 200, 400 IM, RELAYS
CLAUDIA KOLB 8 1967 200, 400 IM, 4X200 FREE
MARK SPITZ 8 1967 400 FREE, 100, 200 FLY, 4X200 FREE
DEBBIE MEYER 8 1968 200, 400, 800 FREE, 4X200 FREE
ULRIKE RICHTER 8 1974 100, 200 BACK, 4X100 MEDLEY
PENNY HEYNS 8 1999 50, 100, 200 BREAST
MICHAEL PHELPS 8 2003 100, 200 FLY, 200, 400 IM
@swimmingstats
Cool stat.

A importância do conhecimento do contexto no esporte

Ranking football players

Ian McHale, Phil Scarf

First published: 10 June 2005 | https://doi.org/10.1111/j.1740-9713.2005.00091.x

Abstract

The Actim index is the official player rating system of the Barclays Premiership, which was introduced for the 2004–2005 football season. It was devised by Ian McHale and Phil Scarf for the Press Association in partnership with the Premier League and Football Data Co. Here they describe the development of the index and take a look at player performance this season.

The greatest F1 driver of all time?

Juan Manuel Fangio is the greatest Formula One driver of all time, according to research from the Sheffield Methods Institute's Dr Andrew Bell.

Dr Andy Bell used statistical analysis to work out who the sport's most accomplished

Formula for success: Multilevel modelling of Formula One Driver and Constructor performance, 1950–2014

Andrew Bell, James Smith, Clive E. Sabel and Kelvyn Jones

From the journal Journal of Quantitative Analysis in Sports
https://doi.org/10.1515/jqas-2015-0050

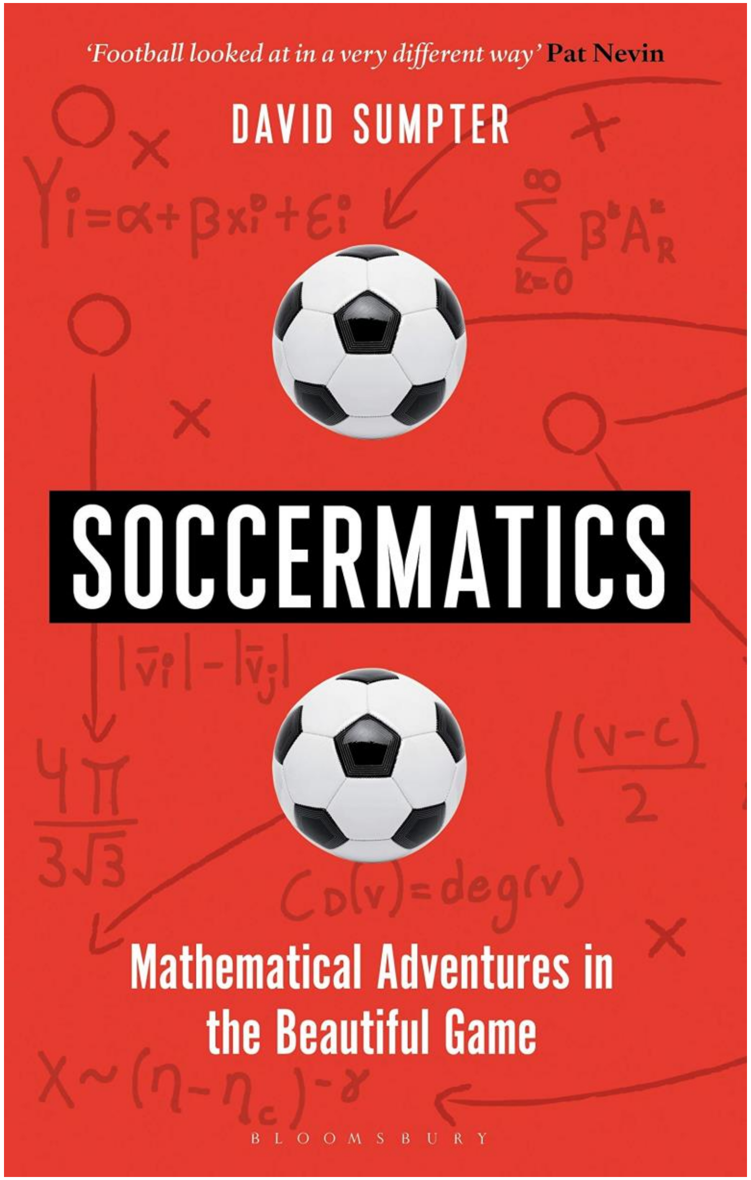
Abstract

This paper uses random-coefficient models and (a) finds rankings of who are the best formula 1 (F1) drivers of all time, conditional on team performance; (b) quantifies how much teams and drivers matter; and (c) quantifies how team and driver effects vary over time and under different racing conditions. The points scored by drivers in a race (standardised across seasons and Normalised) is used as the response variable in a cross-classified multilevel model that partitions variance into team, team-year and driver levels. These effects are then allowed to vary by year, track type and weather conditions using complex variance functions. Juan Manuel Fangio is found to be the greatest

Table A9: Top 50 drivers based on the driver level residuals from model A1d (Michael Schumacher treated as two drivers, pre 2006 and post 2010)

Rank	Driver	Residual	Rank	Driver	Residual
1	Juan Manuel Fangio	0.333	26	Robert Kubica	0.129
2	Alain Prost	0.300	27	Carlos Reutemann	0.128
3	Michael Schumacher (pre-2006)	0.286	28	Tom Pryce	0.128
4	Jim Clark	0.276	29	Stirling Moss	0.123
5	Ayrton Senna	0.265	30	Martin Brundle	0.121
6	Fernando Alonso	0.263	31	Rubens Barrichello	0.119
7	Nelson Piquet	0.238	32	Daniel Ricciardo	0.119
8	Jackie Stewart	0.232	33	Alan Jones	0.119
9	Emerson Fittipaldi	0.217	34	Kimi Raikkonen	0.118
10	Sebastian Vettel	0.213	35	Patrick Depailler	0.118
11	Christian Fittipaldi	0.198	36	Carlos Pace	0.117
12	Lewis Hamilton	0.175	37	Richie Ginther	0.116
13	Graham Hill	0.169	38	Denny Hulme	0.115
14	Dan Gurney	0.166	39	Thierry Boutsen	0.113
15	Jody Scheckter	0.165	40	Mike Hawthorn	0.111
16	Jenson Button	0.160	41	Jean-Pierre Beltoise	0.106
17	Marc Surer	0.158	42	Heinz-Harald Frentzen	0.105
18	Damon Hill	0.157	43	Prince Bira	0.102
19	Louis Rosier	0.143	44	Keke Rosberg	0.100
20	Elio de Angelis	0.141	45	Clay Regazzoni	0.098
21	Ronnie Peterson	0.140	46	Luigi Fagioli	0.097
22	Nino Farina	0.130	47	Jack Brabham	0.093
23	Nick Heidfeld	0.130	48	Jacques Villeneuve	0.093
24	Pedro Rodríguez	0.129	49	Nico Rosberg	0.092
25	John Watson	0.129	50	Phil Hill	0.090

Algumas referências interessantes


'Football looked at in a very different way' Pat Nevin
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SOCCERMATICS
Mathematical Adventures in the Beautiful Game
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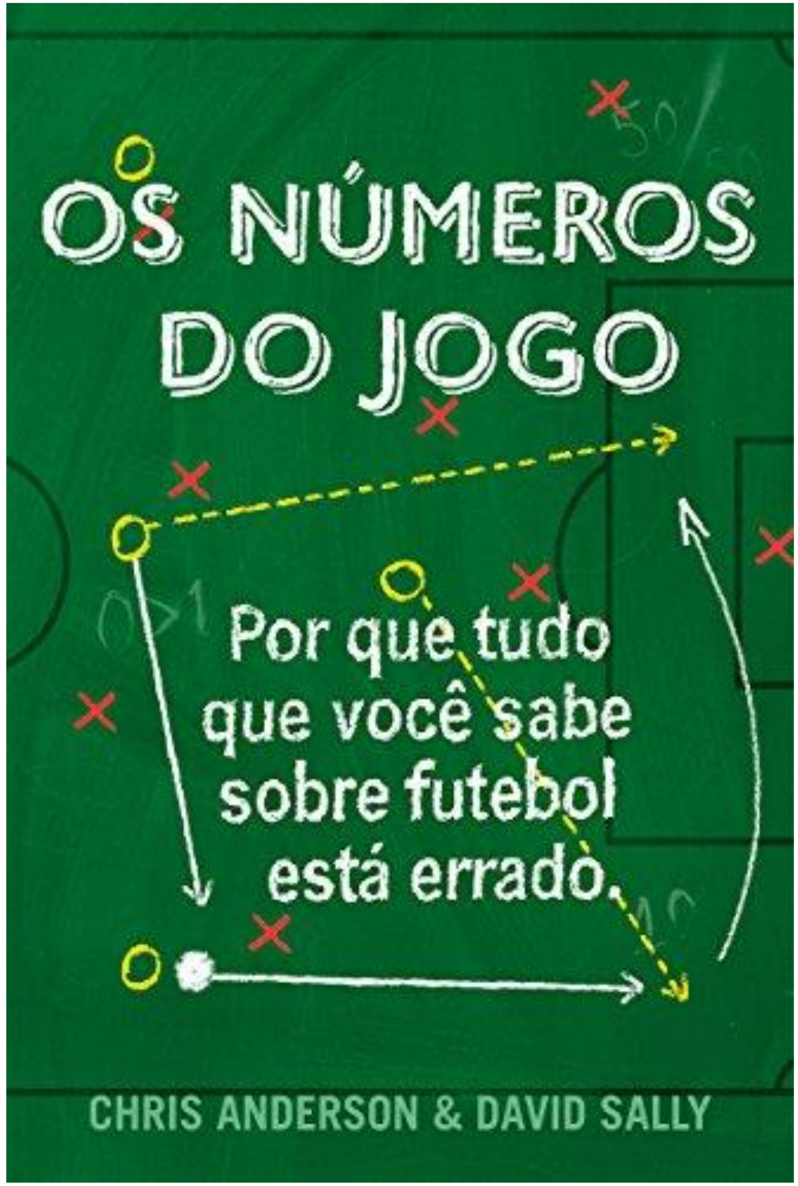
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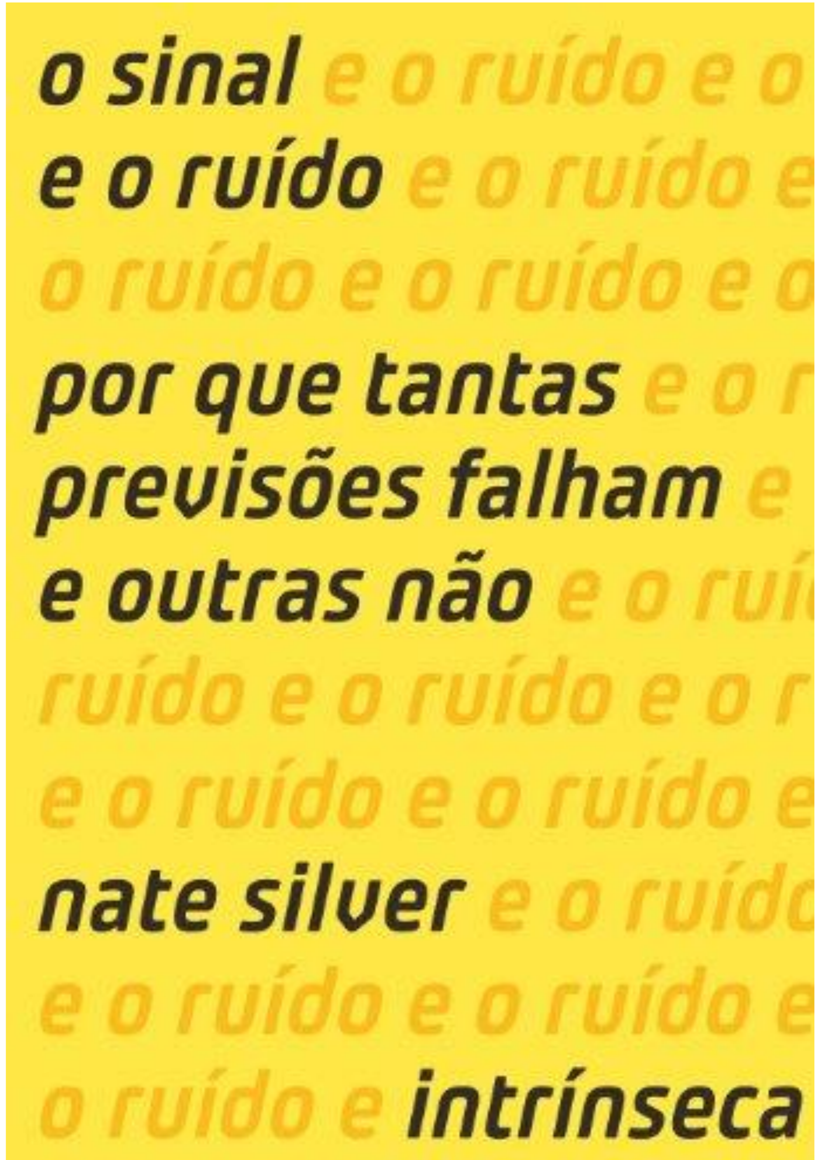
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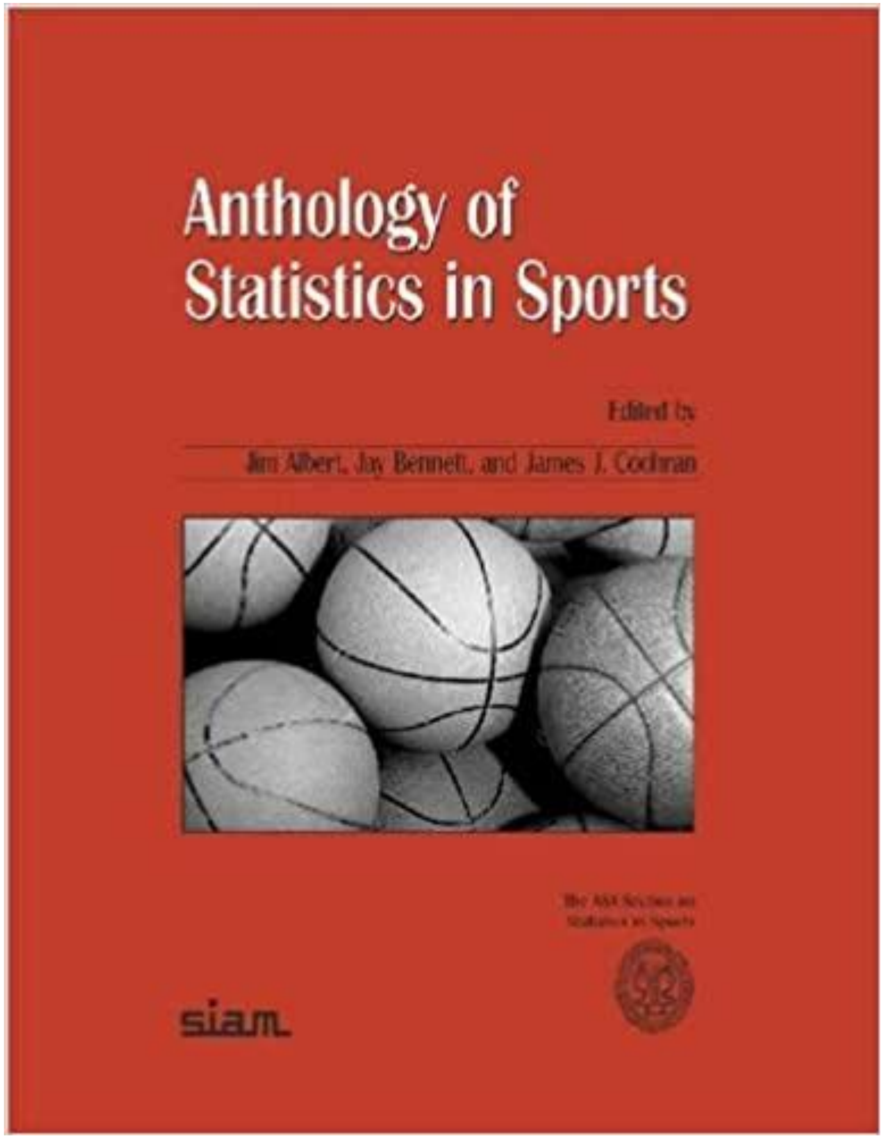
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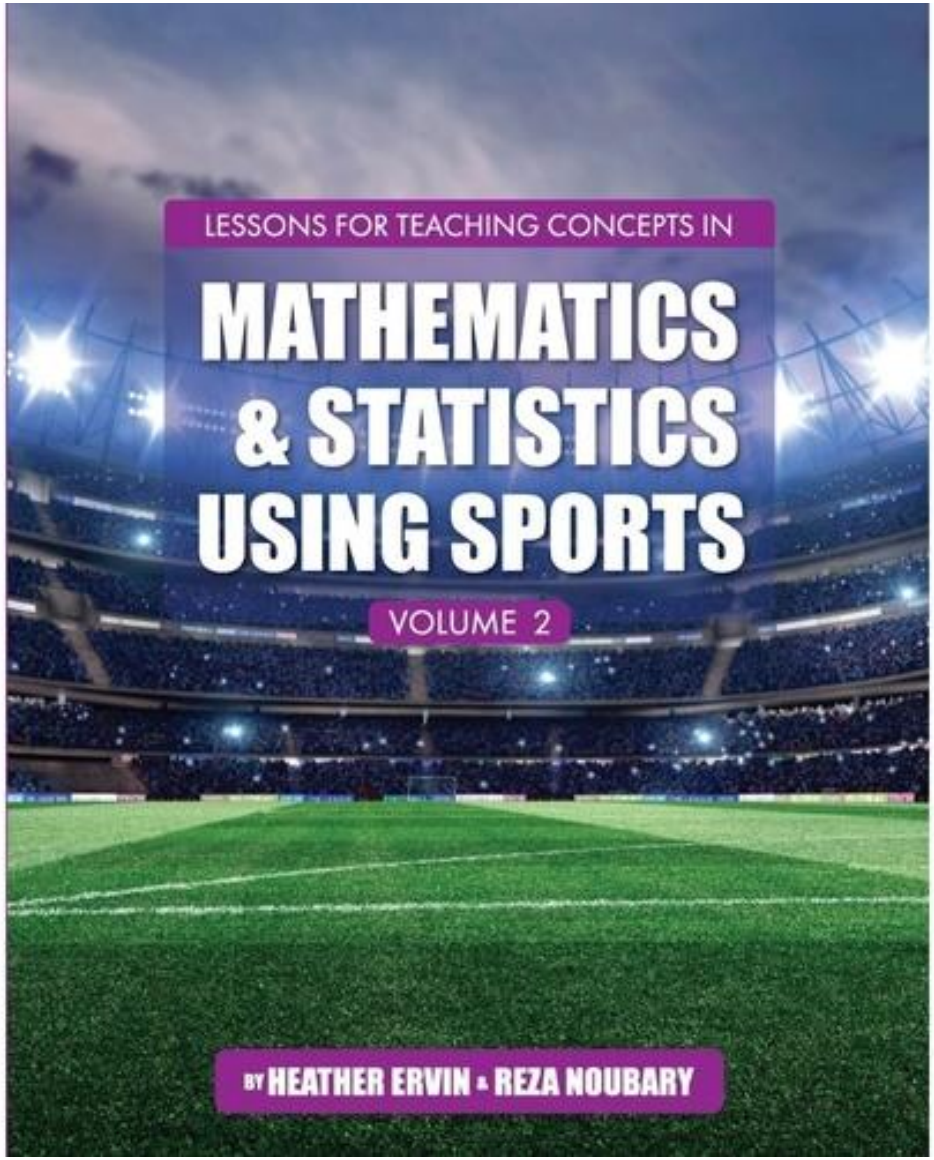
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Journals & Publications

- This is a listing of journals and publications that publish articles related to our field of study.

Journals

- Journal of Quantitative Analysis in Sports
  From the Aims & Scope section:
  The Journal of Quantitative Analysis in Sports (JQAS), an official journal of the American Statistical Association, publishes timely, high-quality peer-reviewed research on the quantitative aspects of professional and amateur sports, including collegiate and Olympic competition. The scope of application reflects the increasing demand for novel methods to analyze and understand data in the growing field of sports analytics. Articles come from a wide variety of sports and diverse perspectives, and address topics such as game outcome models, measurement and evaluation of player performance, tournament structure, analysis of rules and adjudication, within-game strategy, analysis of sporting technologies, and player and team ranking methods. JQAS seeks to publish manuscripts that demonstrate original ways of approaching problems, develop cutting edge methods, and apply innovative thinking to solve difficult challenges in sports contexts. JQAS brings together researchers from various disciplines, including statistics, operations research, machine learning, scientific computing, econometrics, and sports management.

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  From the Aims & Scope section:
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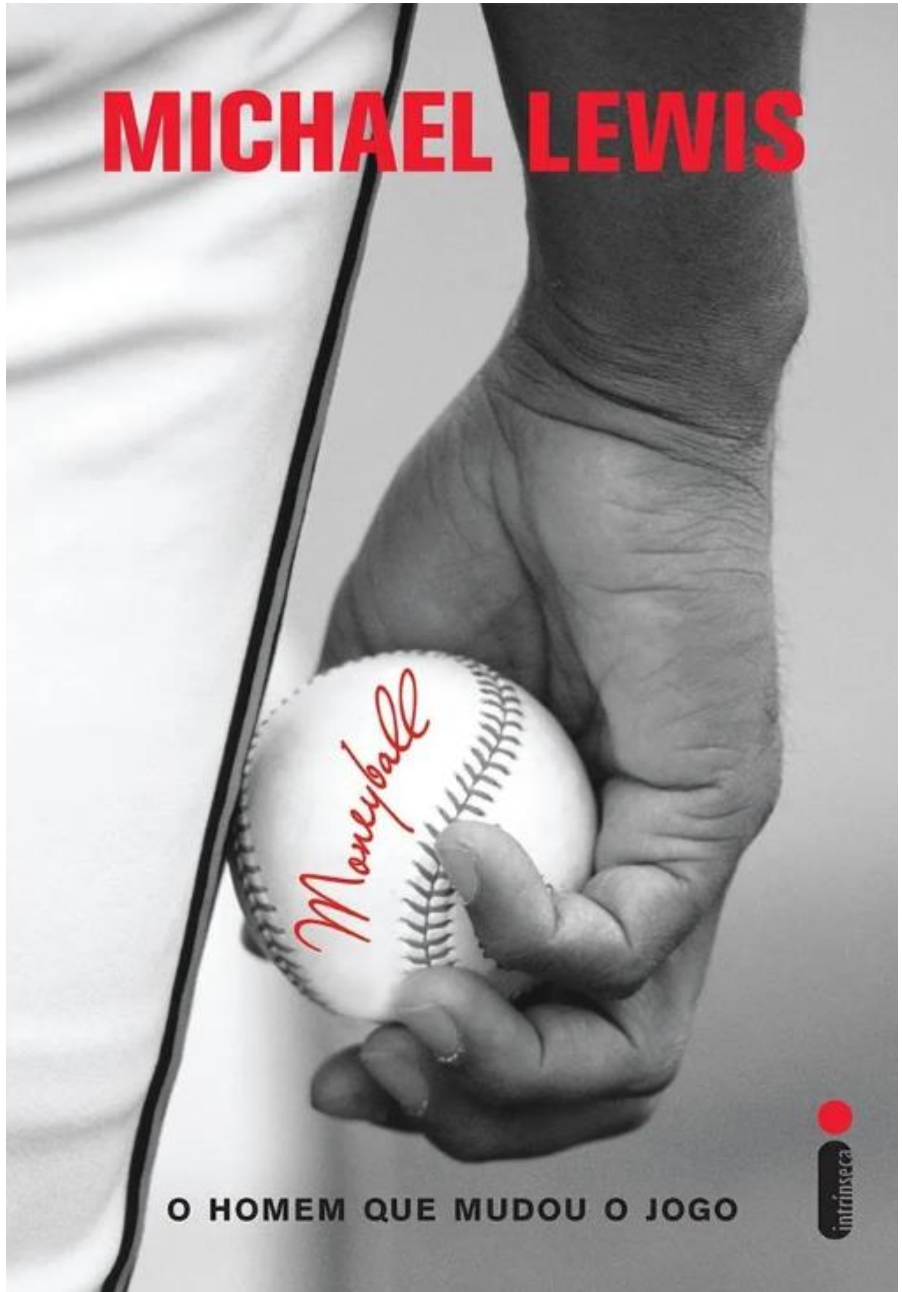
FUTEBOL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Moneyball
O HOMEM QUE MUDOU O JOGO
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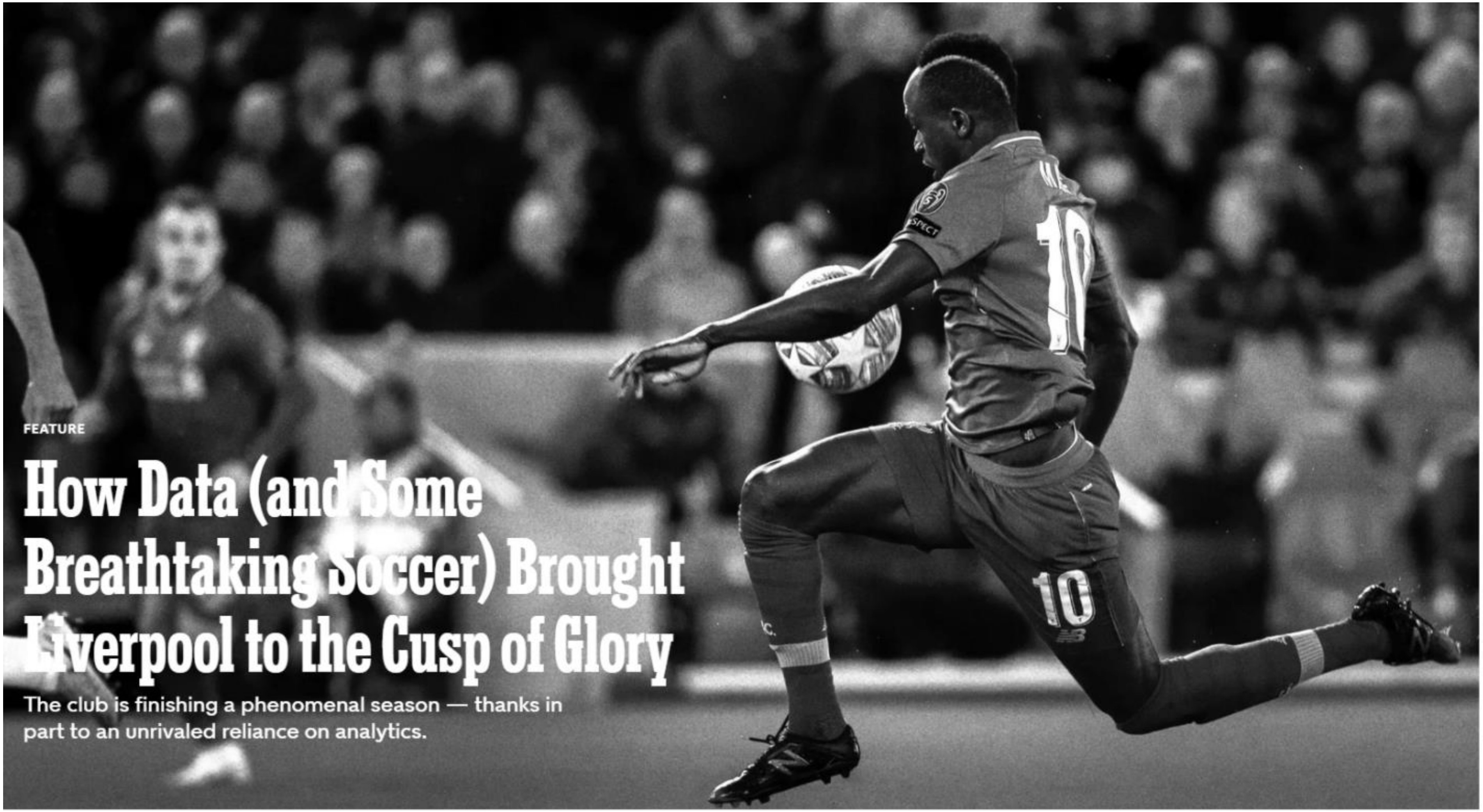
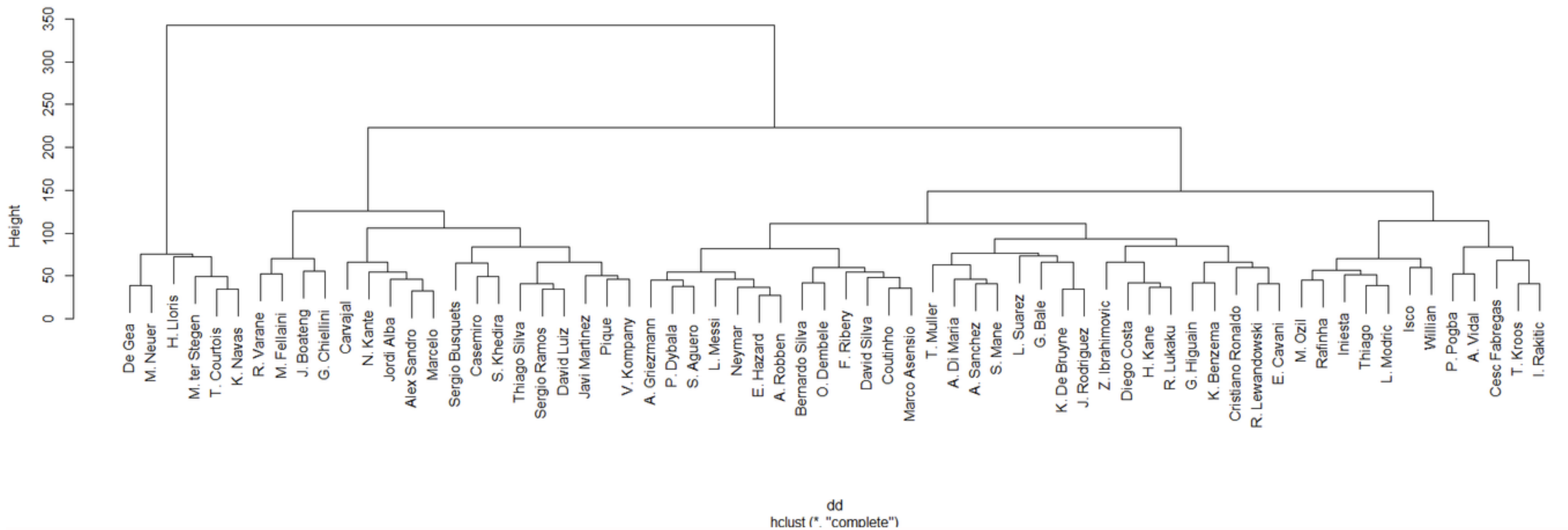


Liverpool's Sadio Mané during the team's Champions League semifinal against Barcelona on May 7.

Joachim Ladefoged for The New York Times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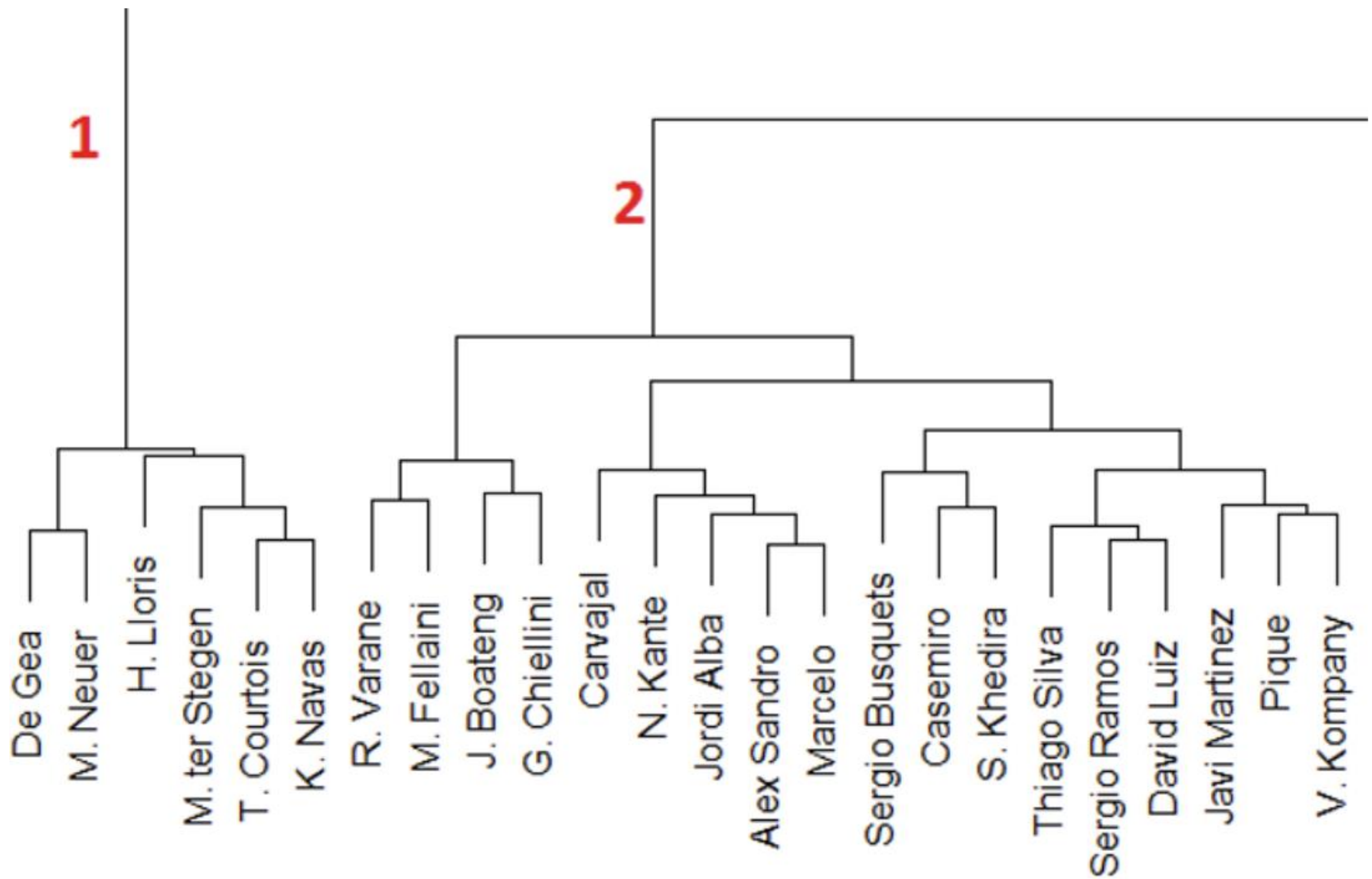
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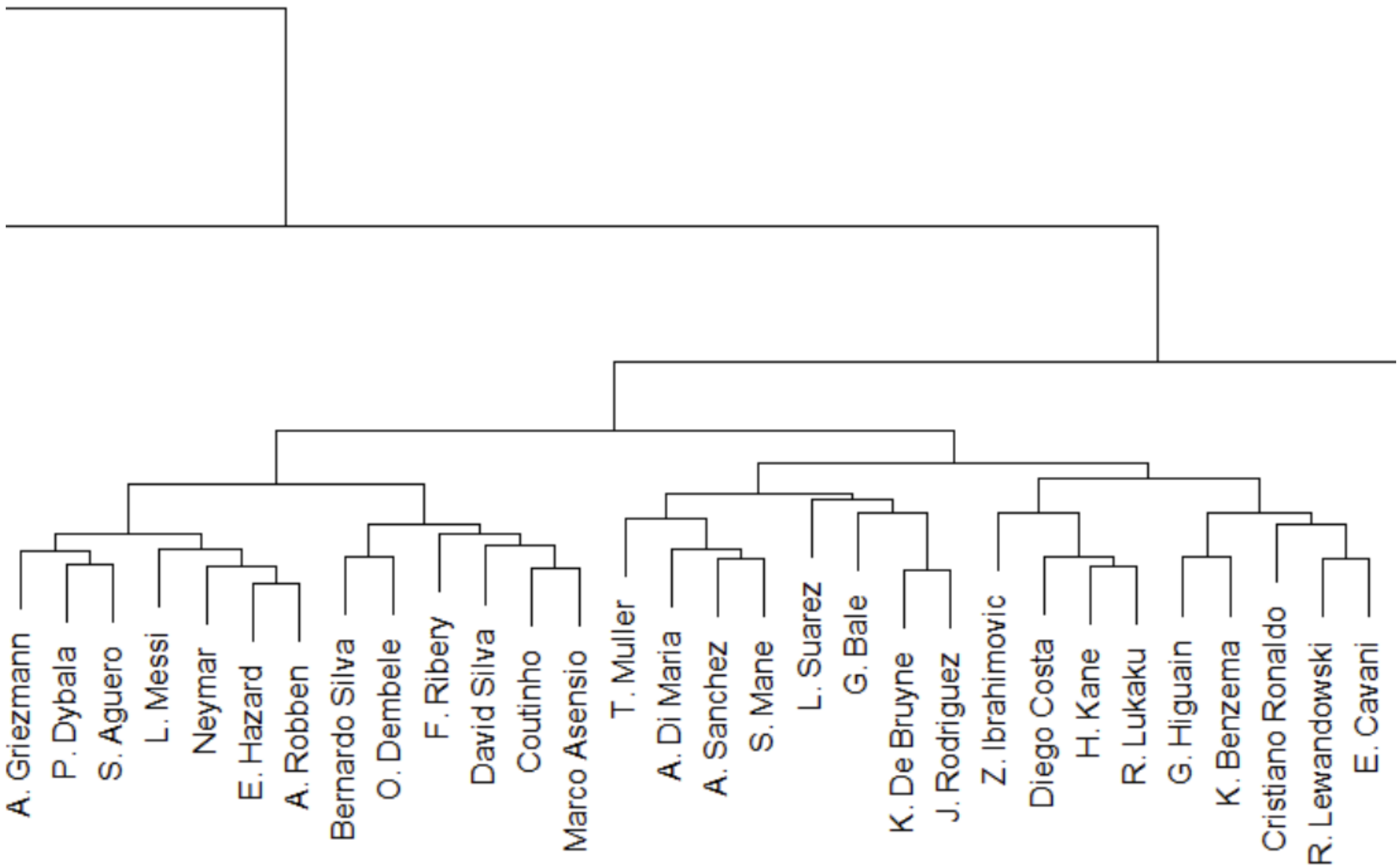
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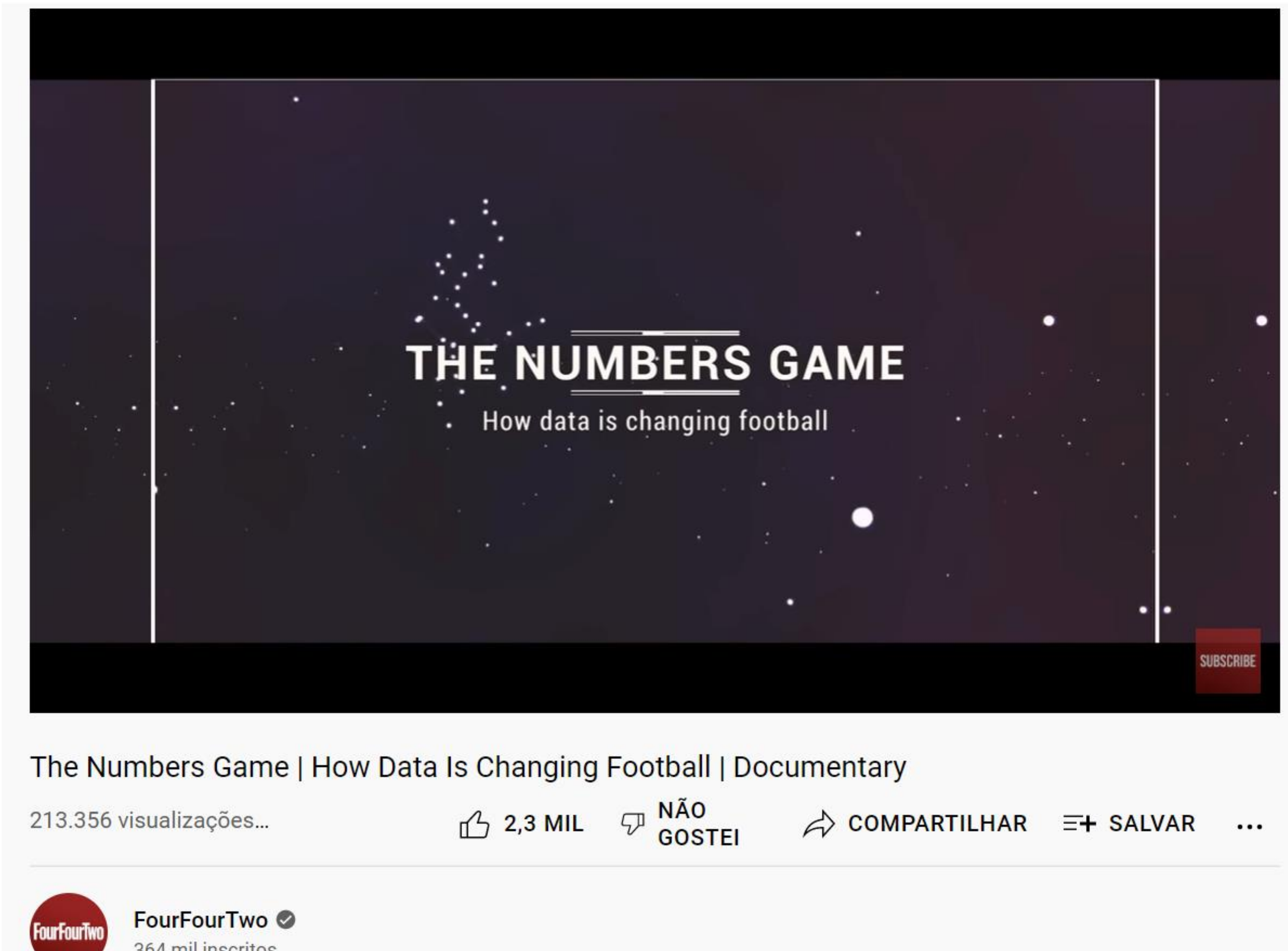

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ESPORTE

Como a estatística ajudou a fazer 3 campeões: Palmeiras, Athletico e Grêmio

O futebol que se discute nas mesas-redondas tem cada vez mais estado longe do que se pratica nos campos, ao menos em termos estatísticos. Se a discussão é sobre "posse de bola" e como "Guardiola tem um time dominante", os clubes trabalham com uma gama enorme de índices específicos. "A gente vai além e pega o ritmo de passes dos jogadores. A gente fez isso muito com o Grêmio, eles eram uma máquina de passes. Passes bons para a frente, não ficar com a bola por muito tempo, jogar com a mesma qualidade na esquerda e na direita. E a gente entrega relatórios, por exemplo: vocês querem um acerto de 78% em passes para frente e nesse jogo foram 60%. Tem que melhorar."

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▶ 01:16 *Ken Pomeroy on College Basketball Data and Fan Engagement*

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SEP. 14, 2021, AT 10:00 AM

Possession Is The Puzzle Of Soccer Analytics. These Models Are Trying To Solve It.

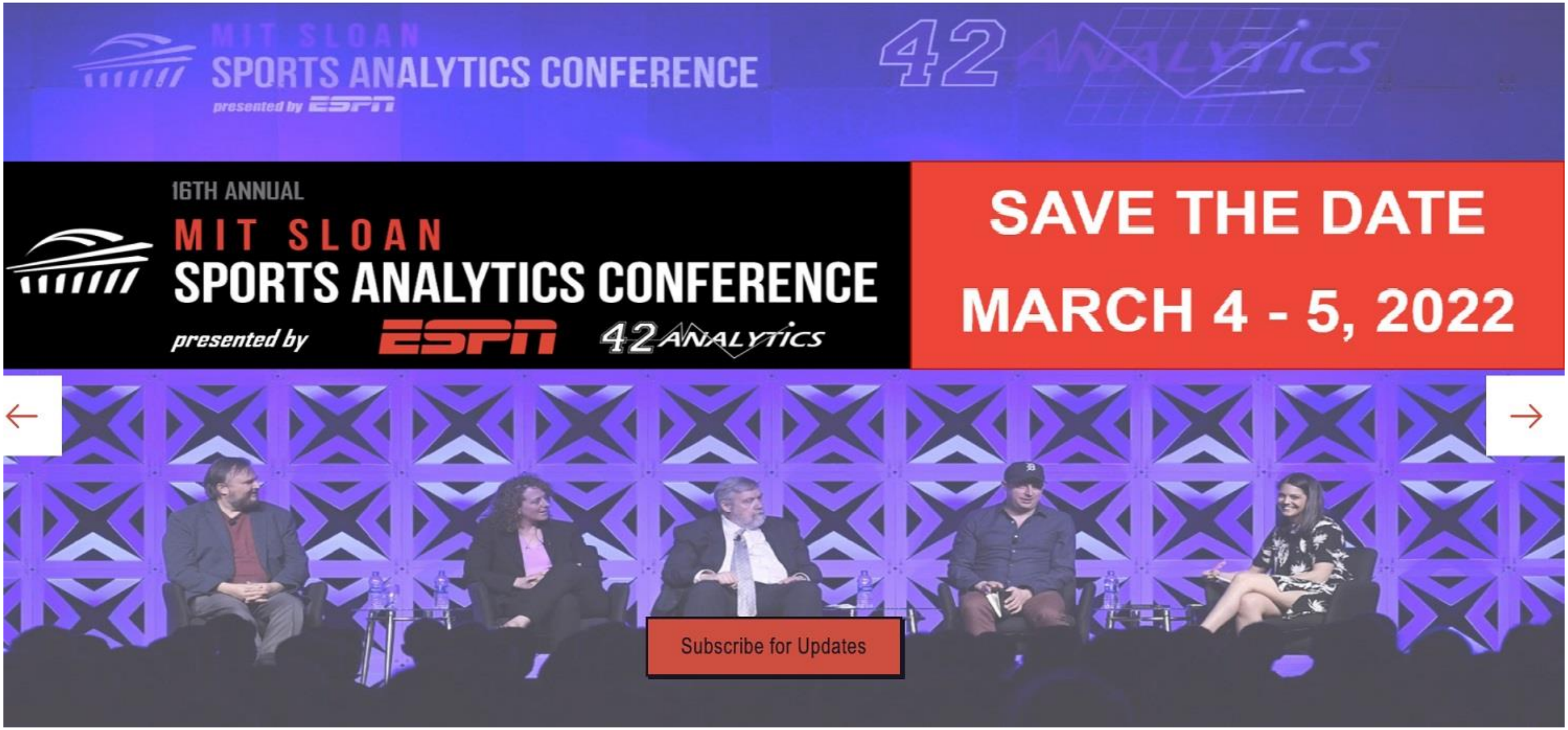
By John Muller

Filed under Soccer

Soccer possession models are gaining steam

Key soccer possession models by publication year, with type of model and possession information

NAME	CREATOR	DEBUT	METHOD	WINDOW	OFF-BALL INFORMATION
Markov Chains	S. Rudd	2011	Markov chain	One possession	Defensive states tagged in event data
Possession-Based Model	N. Mackay	2016	Logistic regression and GAM	One possession	None
Expected Threat (xT)	K. Singh	2019	Markov-like	Next 5 actions (goal for)	None
Valuing Actions by Estimating Probabilities (VAEP)	KU Leuven DTAI	2019	Gradient-boosted trees	Next 10 actions (goal for or against)	Possession history proxies
Expected Possession Value (EPV)	J. Fernández et al.	2019	Multiple models	Next goal (for or against) or end of half	Full tracking data
Possession	Stats	2019	Gradient-	Next 10	Possession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Decomposing the Immeasurable Sport: A deep learning expected possession value framework for soccer

Javier Fernández
F.C. Barcelona
javier.fernandezr@fcbarcelona.cat

Luke Bornn
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Dan Cervone
Los Angeles Dodgers
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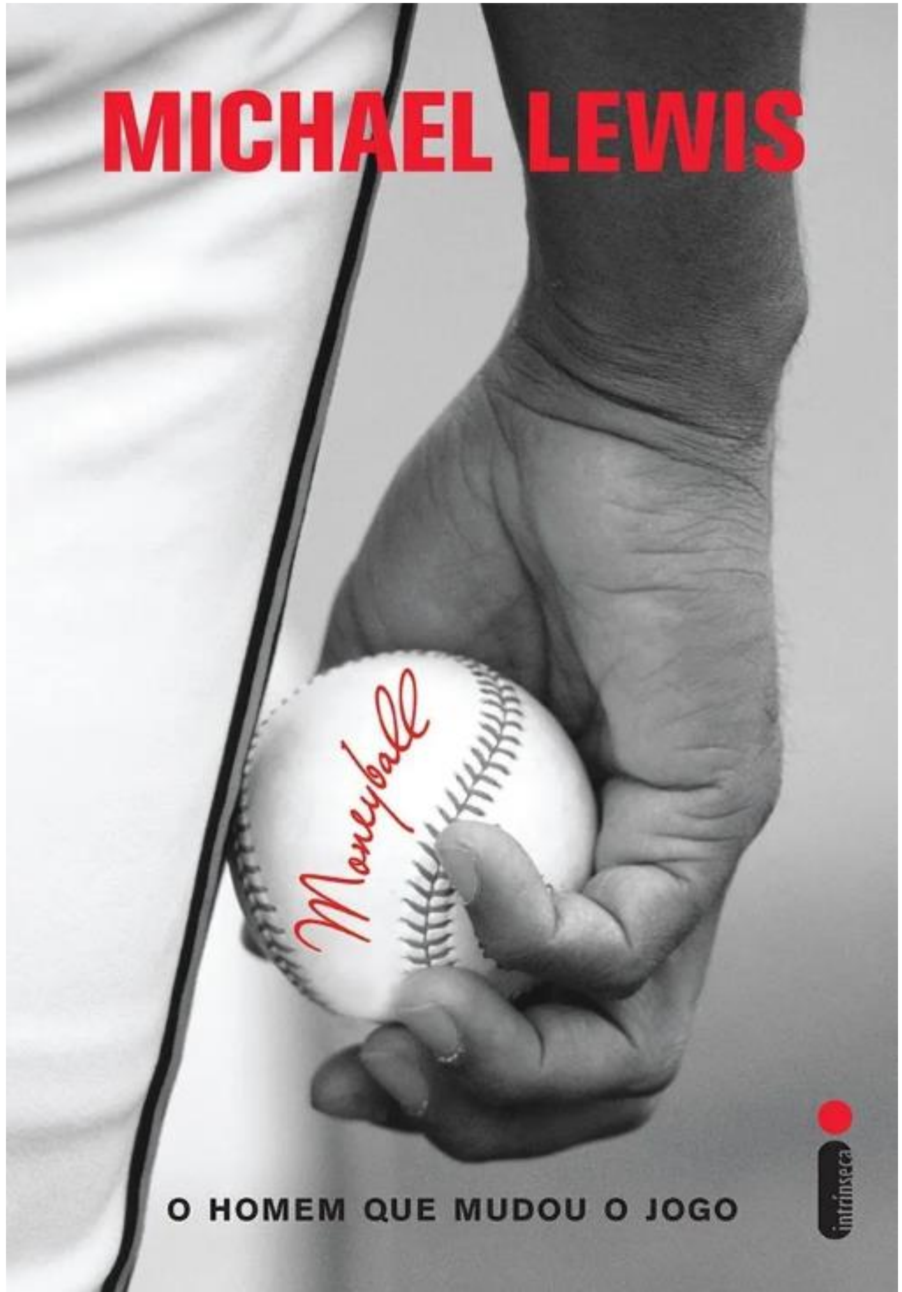
1. Introduction

What is the right way to think about analytics in soccer? Is the sport about measured events such as passes and goals, possession percentages and traveled distance, or even more abstract notions such as mistakes (to quote Cruyff, "Soccer is a game of mistakes, whoever makes the fewer wins")? Analytical work to date has focused primarily on these more isolated aspects of the sport, while coaches tend to focus on the tactical interplay of all 22 players on the pitch. Soccer analytics is lacking from a comprehensive approach that can start to address performance-related questions that are closer to the language of the game. Questions such as: who adds more value? How and where is this value added? Are the teammates creating spaces of value? When and how should a backward pass be taken? How risky is a team attacking strategy? What is a player's decision-making profile?

In order to make an impact on key decision-makers within the sport, soccer analytics

BASQUETE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Evolução da pontuação pela posição do arremesso da NBA de 2000 e 2020
The Evolution Of NBA Playoff Scoring
Most Common Shot Locations In The NBA Playoffs, 2000 Vs. 2020
2000
2020
By @KirkGoldsberry
@rioemdados

NBA

Advanced NBA Stats for Dummies: How to Understand the New Hoops Math

EHRAN KHAN

OCTOBER 18, 2013

How data analytics is revolutionizing the NBA

By **Petra**
Alumni

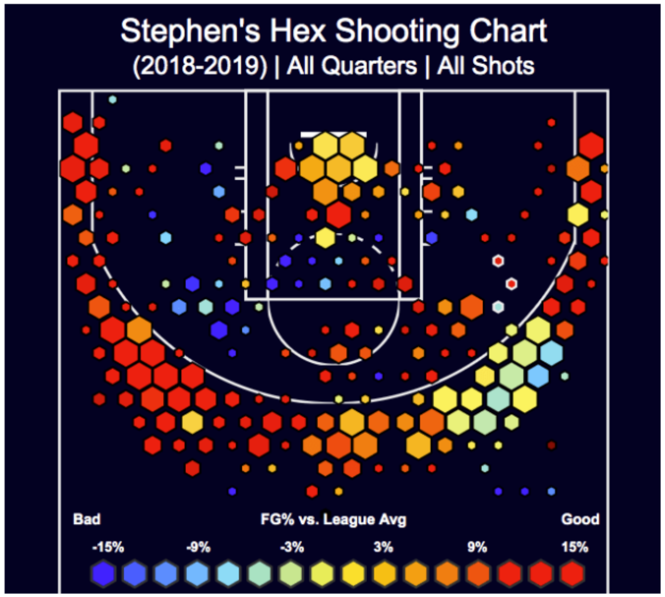
POSTED APR 21, 2020

Next:

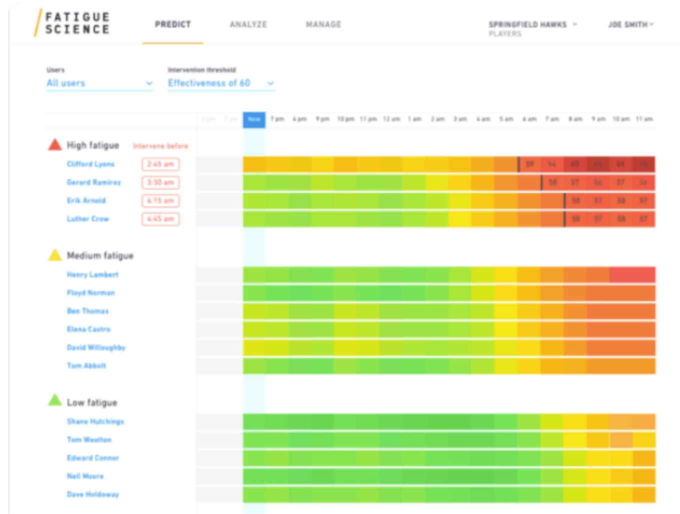
AstraZeneca: AI in Drug Discovery & Development

Professional basketball has looked very different over the past ten years thanks to the use of data analytics. It is almost as if these Analytics models have inputted the conventional NBA and outputted an entirely new game. A game where every team now has at least one data analyst. A game where every move is calculated with the aim to optimize for a winning strategy. A game where DATA is king. So how is data analytics being used in the context of the NBA? Is it really creating value or has it turned the basketball game from fun and eventful to predictable and boring?

1. **Designing winning strategies**: the NBA has installed six cameras in every Basketball court to collect granular data on players' movements. This data is being analyzed by machine learning models to recommend the winning strategy accordingly. Historically, teams were only able to collect basic stats on their players like points scored and assists made, but today, and thanks to the video system installed, teams are now looking at more in-depth data such as the frequency of which players go forward with their right or left foot, or certain 'tells' players make before specific moves. This helped coaches better plan defensive strategies based on their opponents, decide on which players should be matched up against who, and recommend "smarter" offensive moves for their players such as how they should be positioned and how to better optimize for a three-point shot.



2. **Predicting and avoiding player injury**: teams have been collecting sophisticated data points about its players through wearables, sleep monitors, and even saliva samples to asses their fatigue level and predict their performance going forward. The revolutionary application of such data analytics was the "resting" of players even without "obvious" justifications in order to avoid injury. The idea is the more tired a player is, the more prone they are to injury. For example, studies have shown that the likelihood of being injured is less if players rest for 30 days after playing 30 straight games. Hence, NBA teams have been making tough decisions to rest key players to avoid injury (even when the fans don't like it!).

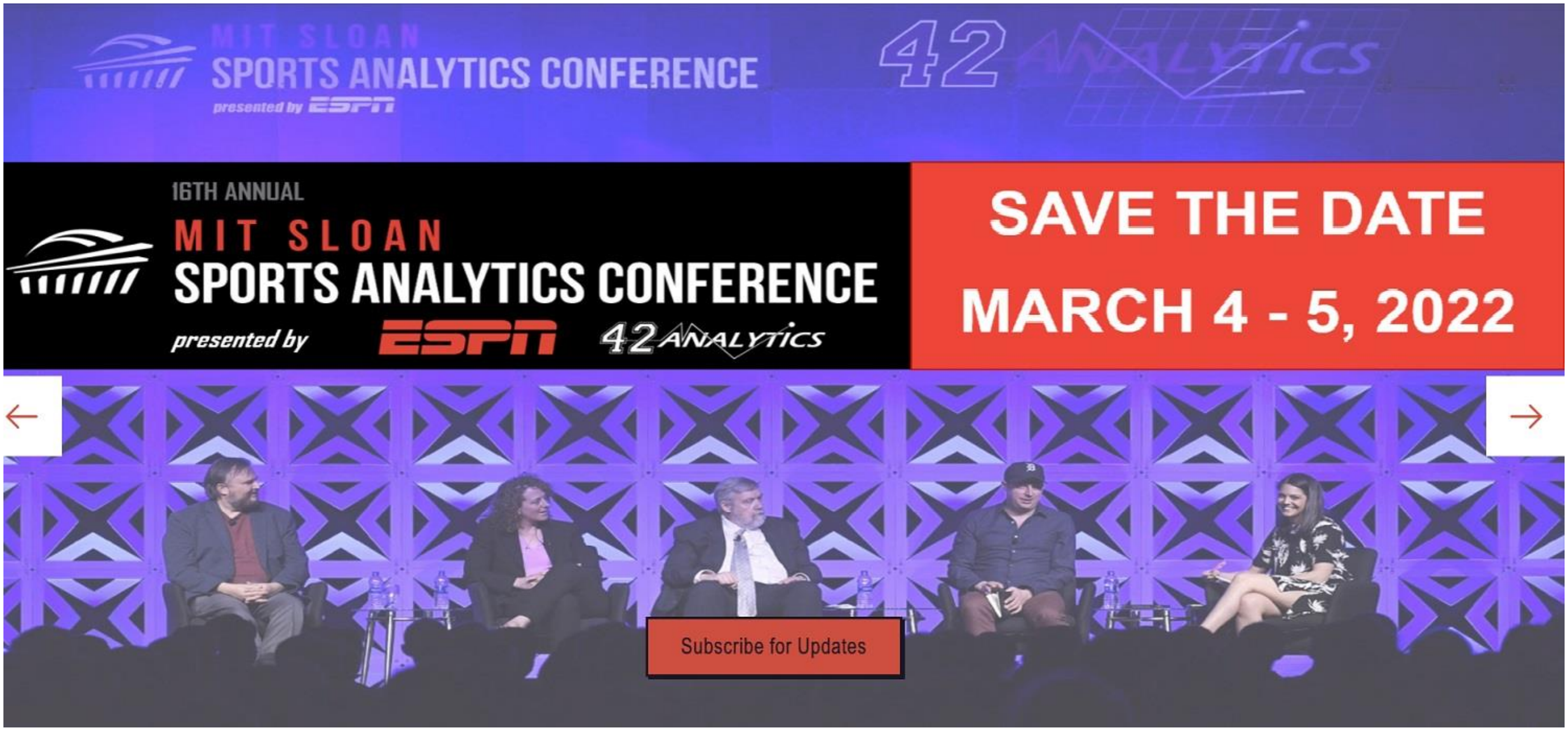


Example of fatigue report

3. **Scouting**: data analytics has become critical for scouting as coaches are now relying on predictive analytics when making draft selections. Drafting is a very important decision in the NBA as teams could be stuck with their expensive selection for years, so it is key that they minimize the risk as much as possible and analytics has been helping with this. Coaches now can easily look up video clips of players to analyze their tracked data (e.g. efficiency with which a certain player drives to the basket with their left hand) and even predict the kind of player they would be (e.g. probability of player becoming an All-Star).

Value capture:

Although there is no direct correlation between use of data analytics and winning, it is clear that teams have already started capturing value from use of data analytics. The biggest game changer to date is the rise of the three-point shot as a result of simple math. Data analytics models showed that three pointers have a 35% chance of going in and hence, could lead to more points than a two-point jump shot taken closer to the basket. As a result, the average 3-point shots taken per team has increased by 50% since 2012.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Using Deep Learning to Understand Patterns of Player Movement in the NBA

Akhil Nistala, John Guttag

Track: Basketball

Abstract

In 2011, SportVU fundamentally changed the way that basketball can be analyzed. STATS SportVU utilized a six-camera system installed in basketball arenas to track the real-time positions of players, at 25 frames per second. In this paper, we demonstrate how we can apply deep learning techniques to this data to produce a queryable database of basketball possessions.

We trained an unsupervised machine learning pipeline that generates a representation, called a ***trajectory embedding***, of how individual players move on offense. The representation is a 32-dimensional vector of floating-point numbers that captures the semantics of a single player's movement, such as locations of the endpoints, screen actions, court coverage, and other spatial features. We generated nearly 3 million trajectory-embeddings from three seasons of data (2013-2014, 2014-2015, 2015-2016).

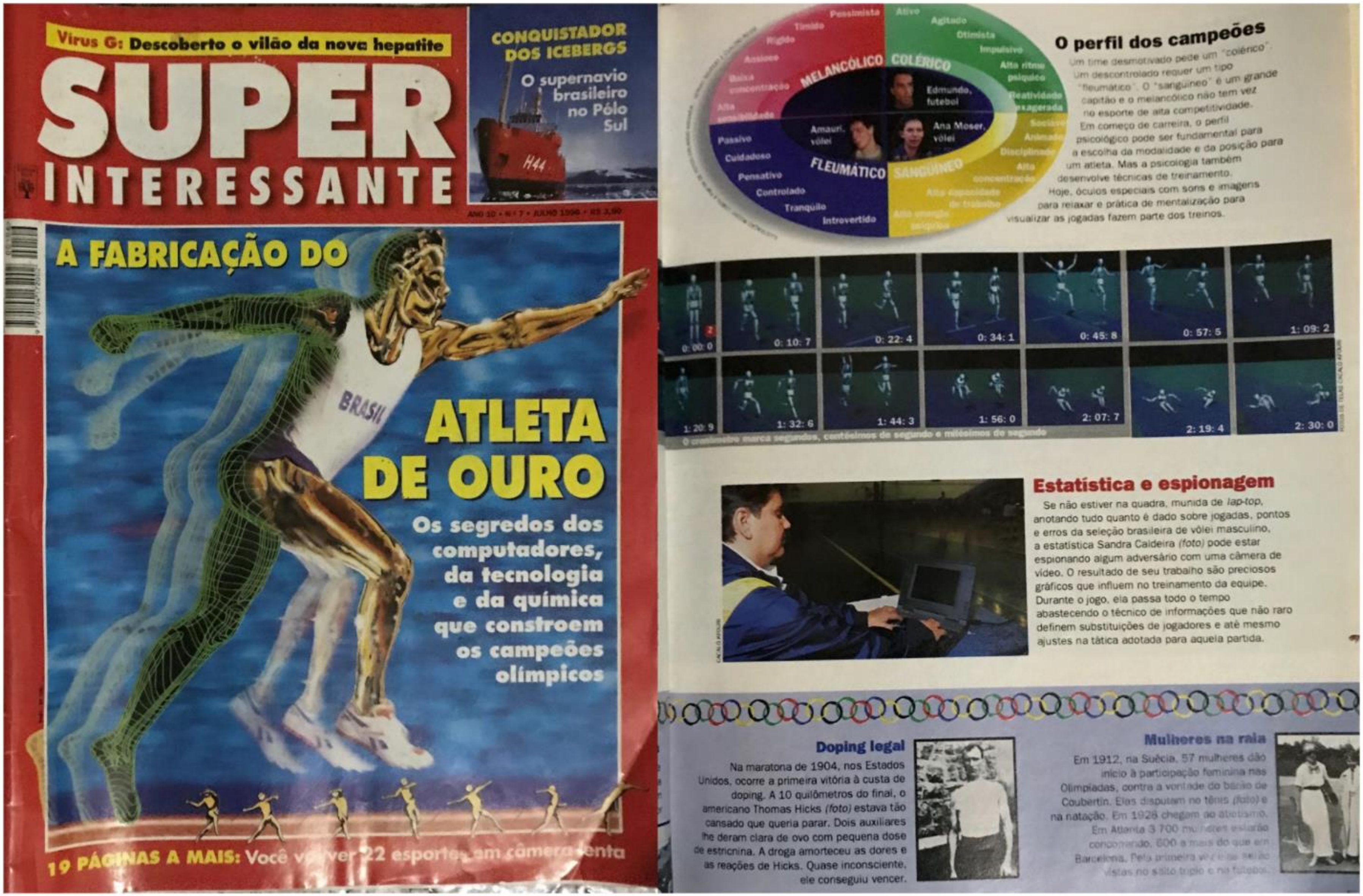
We found that the Euclidean distance between trajectory-embeddings is an excellent indicator of the visual similarity of the movements they encode. For example, two different movements of a post-up in the right block will have nearby embeddings; a post-up in the right block and a screen action above the left wing will have distant embeddings. This result led to the Similar Possessions Finder, a queryable database of basketball possessions.

The Similar Possessions Finder can be used to quickly answer queries such as "How much more frequently did Andre Drummond establish position on the right block than on the left block during the 2015-2016 regular season?" and "Find all possessions from the 2014 playoffs in which Chris Paul ran a screen action in the high post that ended with DeAndre Jordan scoring."

1. Introduction

Our goal was to develop an automated framework to quantitatively examine and compare patterns of individual player movements on offense. This process currently entails a film analyst watching hundreds of hours of game footage, carefully examining each possession and taking notes on

VÔLEI



Vírus G: Descoberto o vilão da nova hepatite

SUPER INTERESSANTE

CONQUISTADOR DOS ICEBERGS

O supernavio brasileiro no Pólo Sul

A FABRICAÇÃO DO ATLETA DE OURO

Os segredos dos computadores, da tecnologia e da química que constroem os campeões olímpicos

19 PÁGINAS A MAIS: Você vai ver 22 esportes em câmera lenta

O perfil dos campeões

Um time desmotivado pede um "colérico". Um descontrolado requer um tipo "fleumático". O "sangüíneo" é um grande capitão e o melancólico não tem vez no esporte de alta competitividade. Em começo de carreira, o perfil psicológico pode ser fundamental para a escolha da modalidade e da posição para um atleta. Mas a psicologia também desenvolve técnicas de treinamento. Hoje, óculos especiais com sons e imagens para relaxar e prática de mentalização para visualizar as jogadas fazem parte dos treinos.

O cronômetro marca segundos, centésimos de segundo e milésimos de segundo

Estatística e espionagem

Se não estiver na quadra, munida de *lap-top*, anotando tudo quanto é dado sobre jogadas, pontos e erros da seleção brasileira de vôlei masculino, a estatística Sandra Caldeira *(foto)* pode estar espionando algum adversário com uma câmera de vídeo. O resultado de seu trabalho são preciosos gráficos que influem no treinamento da equipe. Durante o jogo, ela passa todo o tempo abastecendo o técnico de informações que não raro definem substituições de jogadores e até mesmo ajustes na tática adotada para aquela partida.

Doping legal

Na maratona de 1904, nos Estados Unidos, ocorre a primeira vitória à custa de doping. A 10 quilômetros do final, o americano Thomas Hicks *(foto)* estava tão cansado que queria parar. Dois auxiliares lhe deram clara de ovo com pequena dose de estricnina. A droga amorteceu as dores e as reações de Hicks. Quase inconsciente, ele conseguiu vencer.

Mulheres na raia

Em 1912, na Suécia, 57 mulheres dão início à participação feminina nas Olimpíadas, contra a vontade do barão de Coubertin. Elas disputam no tênis *(foto)* e na natação. Em 1928 chegam ao atletismo. Em Atlanta 3 700 mulheres estarão concorrendo, 600 a mais do que em Barcelona. Pela primeira vez elas serão vistas no salto triplo e no futebol.

Olimpiada 1984 – Los Angeles
Medalha de Prata

10/04/2014 09h00 - Atualizado em 10/04/2014 09h00

Avesso aos números e ex-boleiro, estatístico é arma do Osasco para semi

Com nome de volante, Fábio Simplício tentou ser jogador de futebol, odeia matemática e hoje é quem dá todas as informações para o técnico Luizomar de Moura

Por **Guilherme Costa**
Osasco, São Paulo

Fundamental. Esse advjetivo foi usado pelo treinador Luizomar de Moura e pelas titulares Thaisa e Adenízia quando perguntados sobre o trabalho de Fábio Simplício, estatístico da equipe do Osasco, que está invicto na Superliga feminina e disputa nesta sexta-feira a primeira partida da semifinal, diante do Sesi. A campeã olímpica Adenízia comparou o trabalho de Fábio com o do técnico Luizomar:

-O Fábio é essencial, 50% do jogo é dele e os outros 50% do Luizomar. Minha vida com o Fábio é muito mais fácil, sei de todas as probabilidades. Ele entra em contato com a gente durante a partida, passa as informações de todas as jogadoras adversárias- comenta a meio de rede titular da seleção brasileira e do Osasco.

TUDO SOBRE

Vôlei

BLOG: Vôlei masculino: primeiro ano de Renan no comando é positivo
em 18/09/2017

BLOG: Com três títulos e um vice, seleção feminina de vôlei fecha
em 11/09/2017

Evandro e André são confirmados campeões do Circuito Mundial 2017
em 04/09/2017

BLOG: Alerta: vôlei brasileiro termina sem medalhas nos Mundiais de categorias de base pela primeira vez em
em 28/08/2017

BLOG: Balanço do ano no

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DOI: 10.1177/1747954118808068
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Swimming performance index based on extreme value theory

Daniel T Gomes[1] and Lígia Henriques-Rodrigues[2]

Abstract

The International Swimming Federation has developed a points system that allows comparisons of results between different events. Such system is important for several reasons, since it is used as a criterion to rank swimmers in awards and selection procedures of national teams. The points system is based entirely on the world record of the correspondent event. Since it is based on only one observation, this work aims to suggest a new system, based on the probability distribution of the best performances in each event. Using extreme value theory, such distribution, under certain conditions, converges to a generalized Pareto distribution. The new performance index, based on the peaks over threshold methodology, is obtained based on the exceedance probabilities correspondent to the swimmers' times that exceed a given threshold. We work with 17 officially recognized events in 50 m pool, for each women and men, and considered all-time rankings for all events until 31 December 2016. A study on the adequacy of the proposed generalized Pareto distribution index and a comparison between the performances of Usain Bolt and Michael Phelps are also conducted.

Keywords

Aquatic sport, International Swimming Federation, performance analysis

Introduction

Competitive swimming has a non-subjective ranking system, based on times. When one analyzes the results of a given event, such criterion is free from arbitrariness and is the universal way to choose the "best (fastest) swimmers." However, for some reasons, it might be reasonable to compare performances in different events. For example, the winning time of the 100 m freestyle in a given competition is better than the winning time of the 200 m butterfly?

Obviously, the concept of "better" needs to be defined. Intuitively, a great performance is the one that, in its respective event, corresponds to a discrepant result in comparison to the others.

Such comparison is made by the International Swimming Federation (FINA) through a points system. It is important, since it is used to determine the winners of the World Cup.[1] It is also used by several national federations as the criterion to determine national teams, such as Brazil.[2]

In 2015, the FINA points system was used for the first time to select the best performances of that year. In 2016, Katie Ledecky (United States) and Adam Peaty (Great Britain) were chosen the best performers of the year, by their performances in women's 800 m freestyle and men's 100 m breaststroke, respectively, in Rio de Janeiro Olympic Games.[3]

The FINA points system is based on what is called the *base times*.[4] The base times are defined every year, based on the latest world record that was approved by FINA. The base times are defined with the cut date of 31 December. So, in a given event, let $T_i(t)$ be the time obtained by the swimmer i, in seconds, at the year t, and $B(t-1)$ the base time, which is the world record, in

Reviewer: John Einmahl (Tilburg University, Netherlands),
Ian G. McHale (University of Liverpool, UK),
Jonathan Tawn (Lancaster University, UK).

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[2]Department of Statistics, Institute of Mathematics and Statistics, University of São Paulo, São Paulo, Brazil

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STATISTICAL ANALYSIS: HOW FAST IS ADAM PEATY'S WORLD RECORD?

On Sunday, Adam Peaty became the first man to break 57 seconds in the 100 breaststroke. Could a swimmer be capable of a similar performance in another event? Current photo via "Rafael/Domeyko Photography"

BY SWIMSWAM CONTRIBUTORS

51

July 25th, 2019

Industry, International, Records

Courtesy: Daniel Takata

A couple of days ago, **Adam Peaty** became the first man to break 57 seconds in the 100 breaststroke as he delivered an incredible 56.88.

He is also the only swimmer to ever break 58 and he has the 17 fastest performances of all time.


Adam Peaty MBE
2.022 Tweets
Tweets
Tweets e respostas
Mídia
Curtidas
Adam Peaty MBE @adam_pe... · 43m
I've never thought about how fast it would be in another event, but this is a great analysis 👏🏼
SwimSwam @swimswamn... · 8h
Statistical Analysis: How Fast is Adam Peaty's World Record?
swimswam.com/statistical-an...
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76

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Peaty v Bolt: Which is the greatest world record?

Using statistics to compare world records in athletics and swimming

Professor Takata calculated the likelihood of Peaty's world record being broken by a swimmer as 0.291%.

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Modeling the Training-Performance Relationship Using a Mixed Model in Elite Swimmers

MARTA AVALOS[1], PHILIPPE HELLARD[2], and JEAN-CLAUDE CHATARD[3]

[1]*HEUDIASYC Laboratory, UMR CNRS 6599, Compiègne University of Technology, FRANCE;* [2]*Research Department, French Swimming Federation, FRANCE; and* [3]*Laboratory of Physiology, GIP Exercise, Faculty of Medicine, Saint-Etienne University, FRANCE*

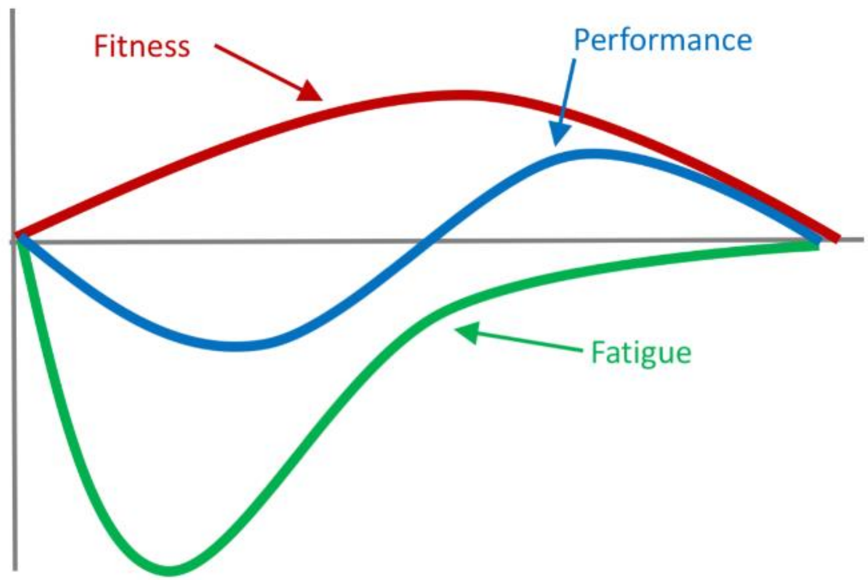
ABSTRACT

AVALOS, M., P. HELLARD, and J.-C. CHATARD. Modeling the Training-Performance Relationship Using a Mixed Model in Elite Swimmers. *Med. Sci. Sports Exerc.*, Vol. 35, No. 5, pp. 838–846, 2003. **Purpose:** The aim of this study was to model the relationship between training and performance in 13 competitive swimmers, over three seasons, and to identify individual and group responses to training. **Methods:** A linear mixed model was used as an alternative to the Banister model. Training effect on performance was studied over three training periods: short-term, the average of training load accomplished during the 2 wk preceding each performance of the studied period; mid-term, the average of training load accomplished during weeks 3, 4, and 5 before each performance; and long-term, weeks 6, 7, and 8. **Results:** Cluster analysis identified four groups of subjects according to their reactions to training. The first group corresponded to the subjects who responded well to the long-term training period, the second group to the long- and mid-term periods, the third to the short- and mid-term periods, and the fourth to the combined periods. In the model, the intersubject differences and the evolution over the three seasons were statistically significant for the identified groups of swimmers. Influence of short-term training was negative on performance in the four groups, whereas mid- and long-term training had, on the average, a positive effect in three groups out of four. Between seasons 1 and 3, the effect of mid-term training declined, whereas the effect of long-term training increased. The fit between real and modeled performances was significant for all swimmers ($0.15 \le r^2 \le 0.65$; $P \le 0.01$). **Conclusion:** The mixed model described a significant relationship between training and performance both for individuals and for groups of swimmers. This relationship was different over the 3 yr. Personalized training schedules could be prescribed on the basis of the model results. **Key Words:** COACHING, EXERCISE, INTENSITY, MATHEMATICAL MODEL

The training-performance relationship is particularly important for elite sports coaches who search for reproducible phenomena useful for organizing the athlete's training program. Many authors have studied the relative influence of training (7,22,23,27) and found that reactions to training depend on volume, intensity, and frequency of the training sessions (7,16,23). Others have reported divergent results (4,9), perhaps related to the fact that delayed effects and interindividual differences were not taken into account.

For individual swimmers, mathematical models have been developed to describe the dynamic aspect of training and the consequences of succession of training loads over (5,6) are based on two antagonistic functions, both calculated from the training impulse. Studies on cellular adaptability reactions to exercise (3) have demonstrated that the negative function can be assimilated to a fatiguing impulse. The positive function can be compared with a fitness impulse resulting from the organism's adaptation to training. Expressed as an exponential, the functions account for the decreasing impact of the training effect. When iterative training sessions are considered, the time course of performance is described by:

$$p_t = p_0 + k_a \sum_{s=0}^{t-1} e^{-(t-s)/\tau_a} w_s - k_f \sum_{s=0}^{t-1} e^{-(t-s)/\tau_f} w_s \qquad (1)$$



Fitness
Performance
Fatigue

Alan Couzens, M.Sc. (Sports Science)

"Devoted to the science of Maximal Athletic Development"

Why Neural Networks are better than the old Banister/TSS model at predicting athletic performance.

Alan Couzens, M.Sc.(Sports Science)

July 26, 2018

I received a lot of follow up qu's/discussion from this tweet on how I'm seeing Neural Networks consistently out-perform the Banister model (the model behind Training Peaks' Performance Management Chart) as a performance predictor for the vast majority of athletes....

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DeepQB: Deep Learning with Player Tracking to Quantify Quarterback Decision-Making & Performance

Brian Burke, ESPN Analytics, brian.j.burke@espn.com

DeepQB is a proposed application of deep neural networks to player tracking data from over two full seasons of American professional football. This novel approach demonstrates the ability to successfully understand complex aspects of the passing game, most notably quarterback decision-making. It can assess and compare individual quarterback pass target selection based on a snapshot presented to the passer by the receivers and defenders. Assessments of quarterback decision-making are made by comparing actual target selection to that predicted by our model. The model performs well, correctly identifying the targeted receiver in 60% of cross-validated cases. When passers target the predicted receiver, passes are completed 74% of the time, compared to 55% when the QB targets any other receiver. This performance is surprisingly strong, given that the offense often conceals its intent by design, while defenses try not to allow any single receiver to be open. Further, quarterback passing skills separate and apart from his receivers and defense are isolated and assessed by comparing metrics of actual play success to the metrics of success predicted by the situation presented to the passer. This approach represents a new way for teams, media, and fans to understand and quantitatively assess quarterback decision-making, an aspect of the sport which has previously been opaque and inaccessible.

1. Introduction

Perhaps the most enigmatic and yet most important player attribute in all of American football is the decision-making abilities of quarterbacks. Although mental abilities are important for every position, quarterback is unique in that psycho-cognitive abilities rival physical abilities in regards to successful performance. Measurable and physical attributes are easily observed through the scouting process, but a professional quarterback's ability to process and exploit highly dynamic information during the course of a play is not well understood. Previously only relatively crude aggregate statistical methods - that cannot fully separate the quarterback's individual impact from those of his teammates, play design, and opponents - have existed to quantify this skill.

Early efforts to exploit football tracking data only scratched the surface of what is possible with such rich information. Typical applications of tracking data merely involved measuring the

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You Cannot Do That Ben Stokes: Dynamically Predicting Shot Type in Cricket Using a Personalized Deep Neural Network

Will Gürpınar-Morgan, Daniel Dinsdale, Joe Gallagher,
Aditya Cherukumudi & Patrick Lucey

Track: Other Sports
Paper ID: 1548748

1. Introduction

The ability to predict what shot a batsman will attempt given the type of ball and match situation is both one of the most challenging and strategically important tasks in cricket.

The goal of each batsman is to score as many runs as possible without being dismissed. Batsmen can be dismissed in several ways, including being caught by fielders or having their wickets knocked over. While simple in principle, the type of shots and style of a batsman is greatly influenced by the format of the game. In short forms of the game such as T20 and One Day Internationals (the focus of this paper), batsmen are typically more aggressive since their team have a limited number of balls from which to score their runs (120 and 300 balls respectively).

Getting the right batsman vs bowler match-up is of paramount importance. For example, for the fielding team, the choice of bowler against the opposition star batsman could be the key difference between winning or losing. Therefore, the ability to have a predefined playbook (as in the NFL) which would allow a team to predict how best to set their fielders given the context of the game, the batsman they are bowling to and bowlers at their disposal would give them a significant strategic advantage.

In this paper, we present a personalized deep neural network approach which can predict the probabilities of where a specific batsman will hit a specific bowler and bowl type, in a specific game-scenario.

As a motivating example let us consider the 2019 Cricket World Cup Final between England and New Zealand, with England needing 9 runs from 3 balls to win. The ball was an attempted "yorker"

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Baseball Predictions and Strategies Using Explainable AI

Joshua Silver (Singlearity, joshua.silver@singlearity.com)
Tate Huffman (Harvard University, thuffman@college.harvard.edu)

1. Abstract

Over the last decade, Major League Baseball has dramatically increased the amount of data it captures and makes available to the public. Meanwhile, there is a growing technology trend that applies AI to analyze massive amounts of data to build complex models that find relationships and meaning in the data. By marrying these two concepts together, we built a neural-network-based AI model called Singlearity-PA (pronounced single-arity-P-A) to solve one of the most fundamental questions in baseball: *How can we predict the outcome of a batter vs. pitcher plate appearance (PA)?*

We show how our model learned even the most subtle rules and strategies of the game, and is able to answer our batter vs. pitcher question with accurate and precise predictions. We demonstrate how to apply techniques to interpret and visualize Singlearity-PA's predictions to make the model's rationale understandable, and sharable for humans.

Finally, we provide open-source tools that allow for the readers' own experimentation and analyses.

2. Introduction and Motivation

Recently, new technologies and databases have rapidly increased the amount of available data in baseball. We now have many new statistics at our disposal. For instance, a single pitch at the major league level contains measurements for approximately 90 different parameters, with such varied data points as pitch information (including velocity, spin rates, and ball movement), batted-ball information (including exit velocity and launch angle) and fielder-position information. Baseball domain experts wishing to improve their abilities to forecast outcomes have pored over this data, looking to answer questions such as "How does a pitched ball spin rate affect pitcher performance

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Baseball Predictions and Strategies Using Explainable AI

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Tate Huffman (Harvard University, thuffman@college.harvard.edu)

1. Abstract

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Making Offensive Play Predictable - Using a Graph Convolutional Network to Understand Defensive Performance in Soccer

Michael Stöckl, Thomas Seidl, Daniel Marley & Paul Power | Stats Perform

1. Introduction

1.1 Measuring defensive quality in soccer

The art of good defending is to prevent something from happening before it has even happened. Virgil Van Dijk is considered one of the best defenders in world soccer as he has the ability to prevent a pass being made to an open attacker to shoot by forcing the ball carrier to pass somewhere else less dangerous. However, while we know this is great defending, in today's stats, Van Dijk would not receive any acknowledgement. A defender's contribution is simply measured by the number of tackles or interceptions they make. But what if we were able to measure actions that have been prevented before they were made?

The aim of a defense and a defender is to make offensive play predictable. For example, Jürgen Klopp's Liverpool, press the opposition with the aim of forcing them to give the ball away in specific areas of the pitch by limiting the number of passing options available in dangerous areas. If the art of good defending is to make play predictable, then it should be measurable. Given enough data, we should be able to predict where a player will pass the ball, the likelihood of that pass being completed and whether this pass will result in a scoring opportunity. It therefore stands that we should be able to measure if a defender forces an attacker to change their mind or to prevent an attacker from even becoming an option.

Figure 1 shows a situation from a match between Liverpool vs Bayern Munich in the 2018/19 UEFA Champions League that leads to Mané (red 10) scoring. Our model identifies that Milner (red 7) is the primary target for Van Dijk (red 4) in the first instance. However, due to the combination of Gnabry (blue 22) closing down Milner, Lewandowski (blue 9) closing down Van Dijk and Mané making an *active run*, behind the defence, Mané becomes both the most likely receiver and a high threat for scoring. This demonstrates our ability to model how players decision making is influenced and how a situation can move from low threat to high threat by the off-ball actions of attackers and defenders. [LINK TO VIDEO].

A utilização da estatística e da ciência de dados no esporte tem sido cada vez mais crescente, principalmente em termos da busca por melhoria de performance.

A utilização da estatística e da ciência de dados no esporte tem sido cada vez mais crescente, principalmente em termos da busca por melhoria de performance.

Desafio: buscar as melhores ferramentas e, principalmente, manipular bases de dados enormes para extração de padrões e informações.

A utilização da estatística e da ciência de dados no esporte tem sido cada vez mais crescente, principalmente em termos da busca por melhoria de performance.

Desafio: buscar as melhores ferramentas e, principalmente, manipular bases de dados enormes para extração de padrões e informações.

É um caminho sem volta: aqueles que continuarem abrindo mão da ciência em favor de opiniões e achismos estarão condenados ao ostracismo.

“In God we trust. All the others must bring data.”
William Edwards Deming

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Obrigado!