BETTING ON THE FUTURE OF SPORTS

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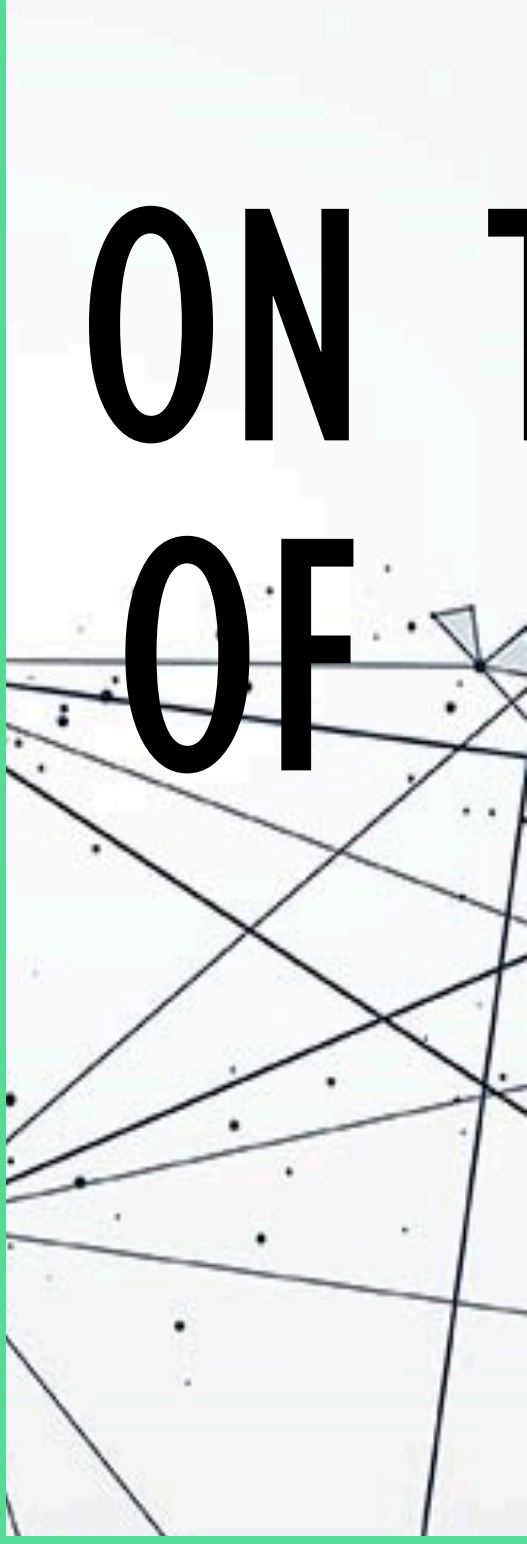

With the new legalization and pending legalization
the power of artificial intelligence to reinvent the be

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of sports betting in several states, how can we harness
etting scene? And what does this mean for you?

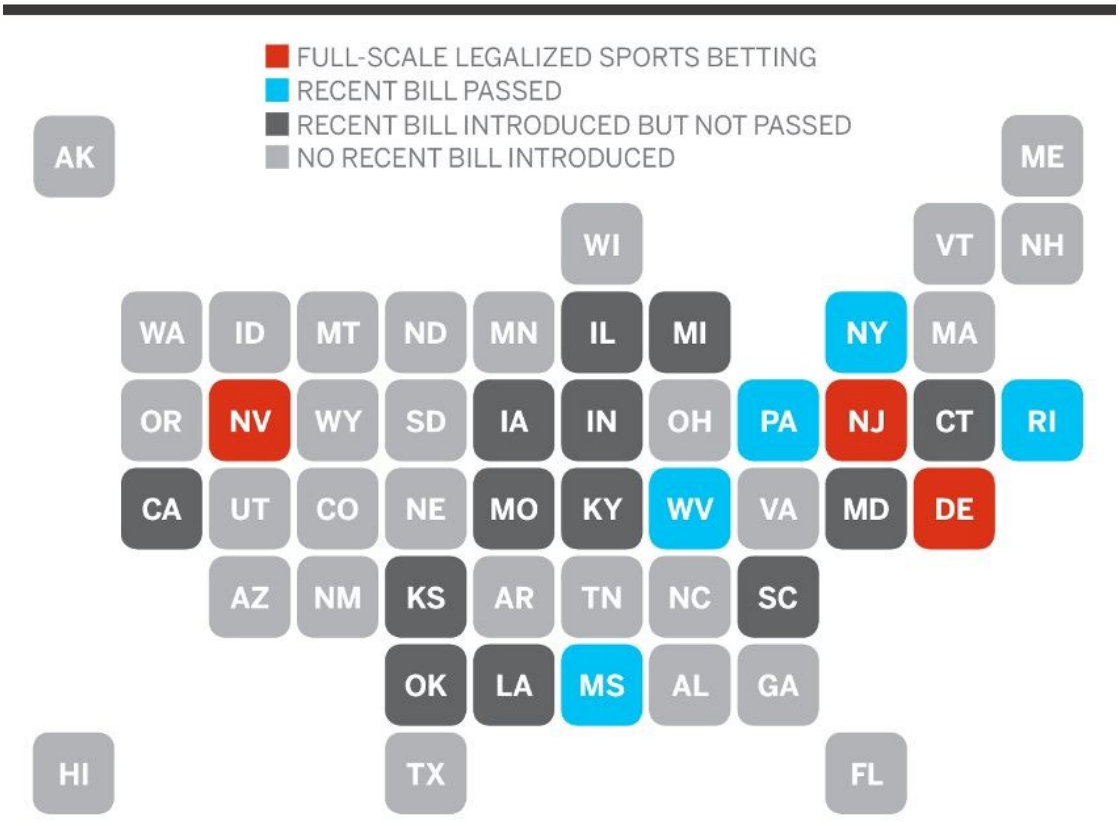
IT'S THE 1970'S IN PITTSBURGH, and the steel industry that built the city is starting to collapse. The city is falling into a recession, and the unemployed and underemployed are desperate. In the midst of this turmoil, Michael Kent plays softball on a company team. They're not doing so well and Kent, a man of mathematics from the Midwest, turns to statistics. When he's not researching and designing nuclear submarines, he's using the company's resources to analyze the statistics of his team. One thing leads to another, and on his quest to improve his team, he delves into college football statistics, and quietly creates the basis for one of the most successful sports betting groups of all time.

In 1979 Kent moved to Vegas to put his statistical models to the test, and with new friends Billy Walters and Dr. Ivan Mindlin, created the Computer Group. They took the betting world by storm, showing the power of (early) computers and turning profits in the several millions every year. The group was shut down by the government for reasons unrelated to their successful analytics, but its legacy still stands – the computer can do way better than any human.

LEGAL OR NOT, sports betting, or placing wagers on the outcomes of sports events, has been around since the early twentieth century. Wagers can be placed on almost every sport at the professional level, and fans love to bet on their teams. And, of course, who doesn't want to win?

Sports experts or analysts will tell you that the best way to beat the odds is to look at game statistics and past games. Since AI and machine learning are both big, emerging fields and perfectly suited to this type of work, the question seems obvious: can a computer program be used to outperform humans? The 1970's sure thought so; a computer can compute data thousands of times more efficiently than humans, cutting down on time and human error. In sports like football and basketball, where there are hundreds of applicable, easily accessible game numbers, startups and programmers have already begun to take betting via computing power a step further, using AI to predict outcomes.

This research is even more timely, considering the broad changes to the legal status of betting. Before this year, the only state where one could legally bet in person on sporting events was Nevada. But the 1992 federal ban on sports betting was struck down by the Supreme Court in May, opening up betting decision-making to the states, and many are already looking to get in on the action. Legal sports betting is already a 3 billion dollar industry in Nevada and with this ruling, this number is likely sharply increase. Beyond the legal scene, Americans make an estimated 150 billion dollars every year from illegally betting on professional and amateur sports. Pro-betting states such as New Jersey and West Virginia are hoping fewer bets will be placed illegally on the black market or through bookies as more people are led into legal betting, cycling more money into state-sponsored venues.



Currently, 3 states have legalized sports betting, with five more soon to follow. The number of states permitting betting is likely to increase.

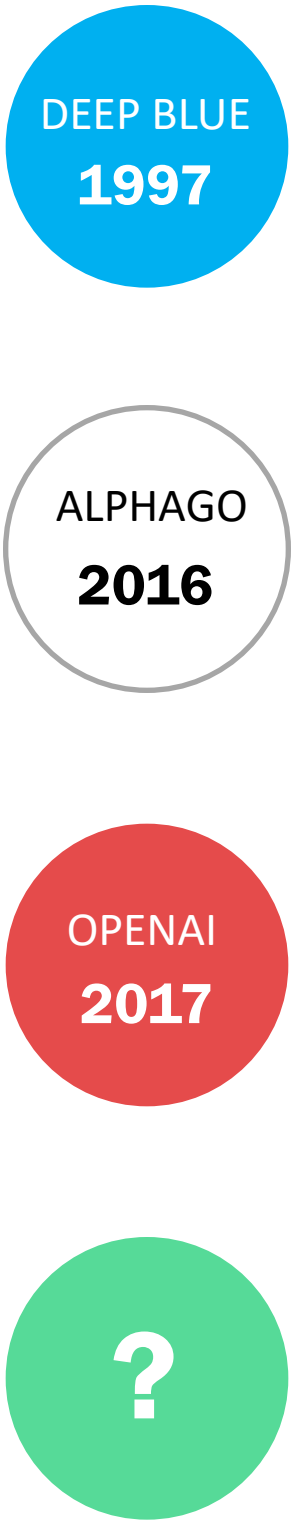
BETTING BASICS

HOW DOES BETTING WORK, for those of us not yet in on this? At the moment, if you want to bet on a sports event like a basketball game or the Kentucky Derby, you can head out to Las Vegas, or sign up online via a sportsbook (which is still only legal in Nevada, Delaware, Montana, and Oregon). When it comes to betting on a race such as cars or horses, there are odds for each competitor that correlate to their chances of winning. For example if the odds for your favorite competitor are 4:1, that means if you bet 100 dollars and win, you get 400 dollars plus the 100 you put in. Of course, losing the wager means losing all of the money you put in.

In other sports where there are only two teams with one loser and one winner, bets are made based on a statistical scheme called a spread. A spread of -180 indicates that you've bet on the favored team and need to wager 180 dollars to win 100 dollars. Think of this like a fee to place the bet - one that you get back along with your winnings, should your team prevail. If you're one for underdogs, a spread of +160 means that a bet of $100 will win you $160 plus the original $100.

This may seem complex at first, but the fundamental principle is the same; you just want to win.

IS AN AI SMARTER?



HOW DOES TECHNOLOGY enter into this conversation? I thought bettors were already seeing success through statistical analysis, says the reader. The Computer Group's models were great for the time, but even they saw massive losses amidst their winnings. AI can do a much better, much more accurately, and already has proven itself superior to mere mathematical formulae.

The news of AI capabilities first truly broke in 1997 with Deep Blue, a chess-playing computer developed by IBM that defeated the world champion at the time, Garry Kasparov. This machine was capable of evaluating 200 million positions per second, the fastest computer at the time. Despite his years and years of practice and experience, Kasparov simply couldn't measure up this sheer computing power.

Then, in 2016 a Google-backed project, AlphaGo was able to defeat the current Go champion. Go is a game that is many times more difficult for a computer to play compared to chess, with about 2 x 10^170 possible board states. Even more recently, in 2017, a startup backed by Elon Musk, created a program called OpenAI that could play the computer game Dota 2. A 5v5 Multiplayer Online Battle Arena (MOBA) game that involves an incredible amount of strategy and mechanical ability, DOTA is home to several professional teams, yet this AI was able to defeat one of said teams. With all of these recent AI's that were able to beat humans at our own games, is it only a matter of time before they take over the sports betting world?

IN RECENT YEARS, many researchers and programmers have already tried to use machine learning or AI to predict outcomes in sports. Being able to outperform others in the world of sports betting can result in lots of money. Every year during March, sports fans and even those casually interested in college basketball get excited about March Madness, the NCAA Men's Basketball Tournament. The betting scene is arguably more popular than the tournament itself, and this tournament alone generates an estimated 2.5 billion dollars.

In 2014, researchers at Central Michigan University used a machine learning strategy to place in the top 15th percentile of all submissions, which is very impressive, considering they had no previous basketball knowledge. Their predictions were based off of many years worth of data, which included 347 college basketball teams and 37 distinct variables. They determined that the most important variables were RPI/BPI rank difference (ranks based on win percentage, strength of schedule and other variables), point total difference, steal total difference, block total difference, and field goal percentage. The correlation between these variables and winning were analyzed and modeled with quadratic regression. Their final equations are below.

Variable (x)	**Winning** % (y)
RPI diff	$y = 6e^{-06}x^2 - 0.0032x + 0.4607$
BPI diff	$y = -0.0002x^2 + 0.0198x + 0.512$
Steals diff	$y = 0.015x^2 - 0.0334x + 0.5556$
Points diff	$y = -2e^{-6}x^2 + 0.0018x + 0.5028$
Blocks diff	$y = 0.0077x^2 + 0.0252x + 0.5465$
Field goal pct	$y = -0.0027x^2 + 0.0698x + 0.4904$

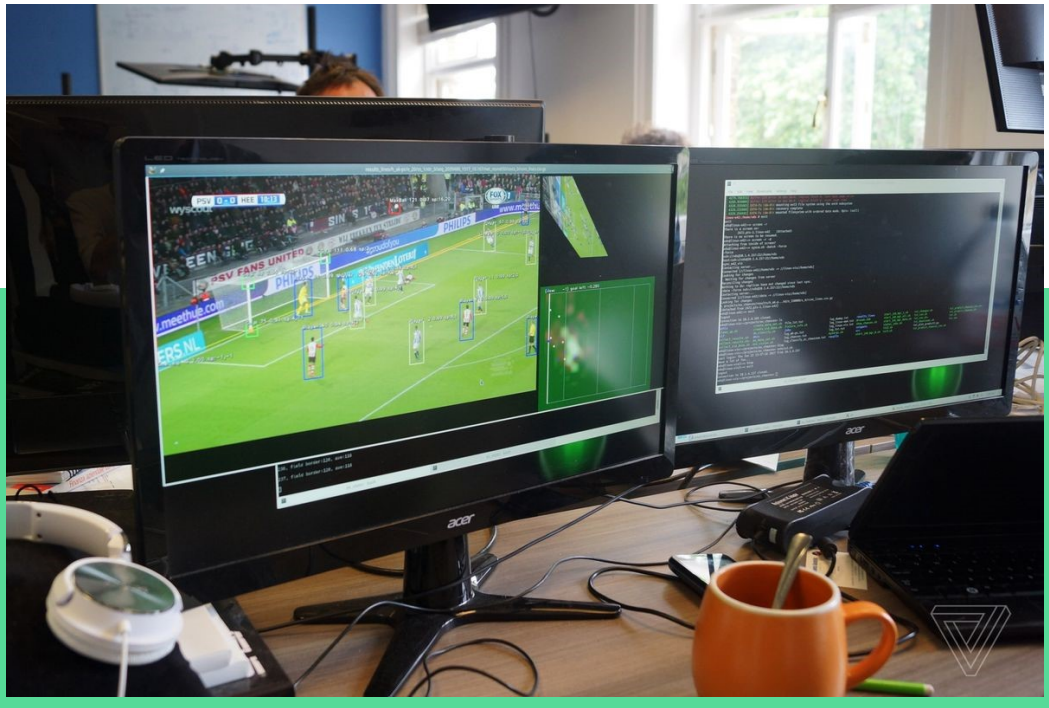
Quadratic regression models with respect to chance of winning

Out of the 63 games in the tournament, this model correctly predicted 42 of them, including 2 of the 5-12 seed upsets. This is even more remarkable considering 2014 had the most upsets in the history of the tournament. Additionally, this was done by a few students at a small university. Their model was not sophisticated and did not use any sort of deep neural network (like the chess and Go AI's). There is only room for improvement in the coming years.

WHERE DO WE STAND NOW?

THERE ARE SEVERAL STARTUPS dedicated to applying AI and computing power to sports betting, and have already seen success of varying levels. UK sports betting company Stratagem uses neural networks to analyze the data and patterns of soccer matches. They continuously train this network with fresh data as it comes in, honing the programs ability to accurately predict outcomes. The program watches live video and highlights both the ball and the players; this information is translated into a map. Based on actual positions when goals are scored, the AI can pick player arrangements where it thinks goals can be scored. Then, as the game progresses, it can make guesses as to the final winner and score. This is a similar method to how some professional bettors make predictions, but at the moment Stratagem's program is correct about half of the time. Those aren't great odds however they will surely continue to improve.

Unanimous AI is another startup on the sports betting scene, and they've got a whole blog dedicated to their successes so far. For example, their AI predicted the outcome of the most recent Super Bowl – perfectly. This startup uses the power of collective intelligence, aggregating the predictions of huge numbers of individual, local "bettors" in a system called Swarm AI. Individuals around the globe can sign up to participate in Swarm and are then connected via the Internet, and as the individuals collaborate to make judgments and predictions, the AI can generate its own prediction. Unanimous AI describes this algorithm as "combining the knowledge, wisdom, insights, and intuition of diverse groups into a single eminent intelligence." And it has worked very well, predicting not only the Super Bowl results, but every English Premier League soccer game over the course of five weeks in a row. Alas, it saw less success in guessing the final matchups of the most recent FIFA World Cup (nobody predicted Germany would lose in the group stage); we can see even this model has



Stratagem's program identifies players and the ball, then analyzes their positions when goals are scored.

HOW CAN I GET INVOLVED?

IF YOU LIVE IN THE U.S., your options are still limited (as betting is currently only legal in 4 states). But due to the recent Supreme Court ruling, Connecticut, Mississippi, and a dozen other states have already begun to implement sports betting by passing similar legislation. The promising news is that an estimated 14 states will allow sports betting by 2020 and 37 states by 2025. This new ruling will not only open the door for new players to get into the scene, but since sports betting is taxed, it will also generate revenue for the state.

For the most part, people that regularly participate in this type of betting are loyal sports fans that enjoy gambling. It can be hard for a newcomer to match up against their years in the betting scene, and until now it was best to take the advice of humans who attempt to predict the outcomes of games. For those that are looking to get serious into the betting scene, there is substantial evidence that AI and machine learning programs can be very useful, and much more accurate. Unfortunately, those who do not have any background in computer science or statistics have no way of using these assets at home.

As AI proves its mettle against experienced bettors, it becomes an increasingly viable option for new bettors. Most people have very little experience with computing, so turning to startups like Stratagem, Unanimous AI, AIbet, or Sportsflare would be the way to go. Anybody that consistently bets with some sort of AI service has a good chance of ending up positive. Currently, there are very few services like these but in the future, where there are more gamblers, more startups, and more consistency, it could be even easier to make money.

WHERE DO WE GO FROM HERE?

EVERY SPORT IS CONSTANTLY EVOLVING - the rules and strategies in sports that have been around for decades are still changing. For example, in the NBA, "small ball" is taking over and fewer big men have a substantial role in the game. With this in mind, it is very difficult for an AI to stay consistent and predict outcomes. Furthermore, there are variables that an AI can't take into account like team dynamics and coaching changes. Some players buckle under pressure in big games while others thrive. AI's are not perfect but in the betting world, they have the potential to consistently come out positive which is a feat most sports analysts can not achieve.

As we look towards the future, we'll definitely be seeing more research, more startups, further and faster developments. If AI is so accurate, won't everyone start using it as game-result predictors? If so, can anyone lose a bet anymore? These are all questions that will have to be answered as the technology and its usage develops, but for now it's only a matter of time before using AI becomes the norm. ■ ■ ■