

# Using New Iterative Methods and Fine Grain Data to Rank College Football Teams

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# History of BCS

- Bowl Championship Series
  - Ranking since 1998
  - Undergone reconstruction
- Computer Rankings
  - No longer use scores
  - Common Data
    - Location, Date, Strength of Schedule, Outcome of a Game

# Importance of BCS Rankings

- Determines who plays in the National Championship Bowl
- Breaks conference ties
- Influences selections of many bowl games

# BCS Bowl Game Accuracy

Using the BCS computer rankings, we determined how often the rankings were able to predict the outcome of a bowl game.

- Assuming the higher ranked team should win the game

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	Totals
Correct	5	7	6	7	6	11	8	7	12	8	5	82
Incorrect	5	3	4	3	5	5	6	8	5	9	10	63
Accuracy	50.0	70.0	60.0	70.0	54.5	68.8	57.1	46.7	70.6	47.1	33.3	56.6

- 56.6% is not statistically significant
- $p$ -value = 0.0673

# Preliminary Results

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	Totals
Correct	6	6	6	6	7	12	9	7	11	10	7	87
Incorrect	4	4	4	4	4	4	5	8	6	7	8	58
Accuracy	60.0	60.0	60.0	60.0	63.6	75.0	64.3	46.7	64.7	58.8	46.7	60.0

- Difference of Scores
- $p$ -value < .01
- Indication that scores can help rank teams
  - What about even finer grain data?

# Play-by-Play Method

- Finer grain data comes from play-by-play statistics
- Stats should reflect team success
  - Help predict the outcome of a game
  - Indicate the magnitude of a win or loss

# Getting the Statistics

- Designed a web-crawler to download the web pages that contained play-by-play stats
- Wrote a parser that extracted the data we needed so it could be imported into a database

2 1 New Mexico St. PUNT 12:31 40 PUNT 11:00 48 3 8 1:31

- (1st and 10) NMSU drive start at 12:31.
- (1st and 10) PENALTY NMSU false start 5 yards to the NMSU35.
- (1st and 15) Chase Holbrook pass complete to Chris Williams for 2 yards to the NMSU37 (Jackson, Eric;Leverette, Geor).
- (2nd and 13) Justine Buries rush for 11 yards to the NMSU48 (Williams, Travi;Johnson, Demeri).
- (3rd and 2) Chase Holbrook pass incomplete to Brandon Allen.
- (4th and 2) Jared Kaufman punt 43 yards to the SLU9, Jackson, Eric return 7 yards to the SLU16 (Dan White;Davon House).

3 1 Southeastern La. PUNT 11:00 16 PUNT 09:32 23 3 7 1:28

- (1st and 10) SLU drive start at 11:00.
- (1st and 10) Lucas, Jay rush for 2 yards to the SLU18 (Dante Floyd;Jared Naylor).
- (2nd and 8) Babin, Brian pass incomplete to Lucas, Jay.
- (3rd and 8) Babin, Brian pass complete to Gilbert, Mario for 5 yards to the SLU23 (La'Auli Fonoti).
- (4th and 3) Samples, Cody punt 33 yards to the NMSU44, fair catch by Chris Williams.

4 1 New Mexico St. PUNT 09:32 44 TD 06:15 7 56 3:17

- (1st and 10) NMSU drive start at 09:32.
- (1st and 10) Justine Buries rush for no gain to the NMSU44 (Powell, Marquis).
- (2nd and 10) Chase Holbrook pass complete to Chris Williams for 4 yards to the NMSU48 (Jackson, Eric).
- (3rd and 6) Chase Holbrook pass complete to Derek Dubois for 10 yards to the SLU42, 1ST DOWN NMSU (Richardson, Ant).
- (1st and 10) Justine Buries rush for 4 yards to the SLU38 (Powell, Marquis).
- (2nd and 6) Tonny Glynn rush for 8 yards to the SLU30, 1ST DOWN NMSU (Jackson, Eric;Williams, Travi).
- (1st and 10) Chase Holbrook pass complete to Derek Dubois for 2 yards to the SLU28 (Powell, Marquis).
- (2nd and 8) Chase Holbrook pass complete to Chris Williams for 28 yards to the SLU0, 1ST DOWN NMSU, TOUCHDOWN, clock 06:15.
- (1st and 0) Ryan Jastram kick attempt good.
- (1st and 0) NMSU ball on NMSU30.
- (1st and 0) Ryan Jastram kickoff 57 yards to the SLU13, Ross, Byron return 27 yards to the SLU40



# Play-by-Play Statistics

- Only retrieved full sets of play-by-play data for the past 3 seasons
- Ran over 40 different statistics on data from the 2007-2008 season
- Results seen indicate a percentage of accuracy based on the 32 bowl games played that year

3rd Down Conversions	65.6	3rd Down Conversions Given Up	65.6
Yards Per Play*	59.4	Yards Given Up Per Play	59.4
Yards Per Play Not Including Punts*	62.5	Yards Given Up Per Play Not Including Punts*	59.4
1st Down Per Set of Downs*	68.8	1st Down Per Set of Downs - 1st Half*	65.6
% of Total Yards Gained on 1st Down	50.0	% of Total Yards Gained on 2nd Down*	40.6
% of Total Yards Gained on 3rd Down*	62.5	% Yards Gained Toward 1st Down	59.4
% Yards Gained Toward 1st Down - Rushing for Short Yards	53.1	% Yards Gained Toward 1st Down - Rushing in 1st Half*	62.5
% Yards Gained Toward 1st Down - Rushing in the 2nd Half*	40.6	% Yards Given Up Toward 1st Down - Rushing in the 1st Half*	62.5
% Yards Gained Toward 1st Down - Variable Point Gap	62.5	Defensive Big Plays*	53.1
Maroon Zone Scores Per Attempt*	50.0	Maroon Zone 1st Downs Per Attempt*	46.9
Red Zone Scores Per Attempt*	53.1	Defensive Big Plays on 3rd Down*	53.1

\*Game Within 14 Points

3rd Down Conversions	65.6	3rd Down Conversions Given Up	65.6
Yards Per Play*	59.4	Yards Given Up Per Play	59.4
Yards Per Play Not Including Punts*	62.5	Yards Given Up Per Play Not Including Punts*	59.4
1st Down Per Set of Downs*	68.8	1st Down Per Set of Downs - 1st Half*	65.6
% of Total Yards Gained on 1st Down	50.0	% of Total Yards Gained on 2nd Down*	40.6
% of Total Yards Gained on 3rd Down*	62.5	% Yards Gained Toward 1st Down	59.4
% Yards Gained Toward 1st Down - Rushing for Short Yards	53.1	% Yards Gained Toward 1st Down - Rushing in 1st Half*	62.5
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% Yards Gained Toward 1st Down - Variable Point Gap	62.5	Defensive Big Plays*	53.1
Maroon Zone Scores Per Attempt*	50.0	Maroon Zone 1st Downs Per Attempt*	46.9
Red Zone Scores Per Attempt*	53.1	Defensive Big Plays on 3rd Down*	53.1

\*Game Within 14 Points

# BCS Comparison

- Percentages indicate the accuracy when predicting games that include at least 1 team ranked by the BCS
- 2007 - 2008 season

<b>Play-by-Play Statistics</b>	<b>%</b>
3rd Down Conversions	64.7
3rd Down Conversions Given Up	64.7
1st Down Per Set of Downs*	70.6
1st Down Per Set of Downs, 1st Half*	58.8
BCS Method	47.1

\*Game within 14 points


# Combination of Statistics

- We had 4 play-by-play statistics that did well in 2007-2008
- Combined 3 statistics and each statistic is given a weight
  - Ran all possible weight combinations on our 3 years of data

# Combination of Statistics

- Looked for combinations that hit a peak percentages when predicting the outcome of bowl games
- Best combinations for 2008-2009

Weights  
for each  
Statistic (%)



1st Down Per Set of Downs*	1st Down Per Set of Downs in 1st Half*	3rd Down Conversions	Overall Accuracy
30	20	50	82.4
20	0	80	82.4
10	10	80	85.3
0	20	80	82.4
0	10	90	76.5
0	0	100	73.5

\*Game within 14 points

# Combination of Statistics

- Looked for combinations that hit a peak percentages when predicting the outcome of bowl games
- Best combinations for 2008-2009

Weights  
for each  
statistic



1st Down Per Set of Downs*	1st Down Per Set of Downs in 1st Half*	3rd Down Conversions	Overall Accuracy
30	20	50	82.4
20	0	80	82.4
10	10	80	85.3
0	20	80	82.4
0	10	90	76.5
0	0	100	73.5

\*Game within 14 points

Combinations	73.3%
BCS	33.3%

- Combinations do well overall, and are significantly better than the BCS Method

# Combination of Statistics

- No combination of statistics worked consistently from year to year
- Look for another method to find appropriate combinations

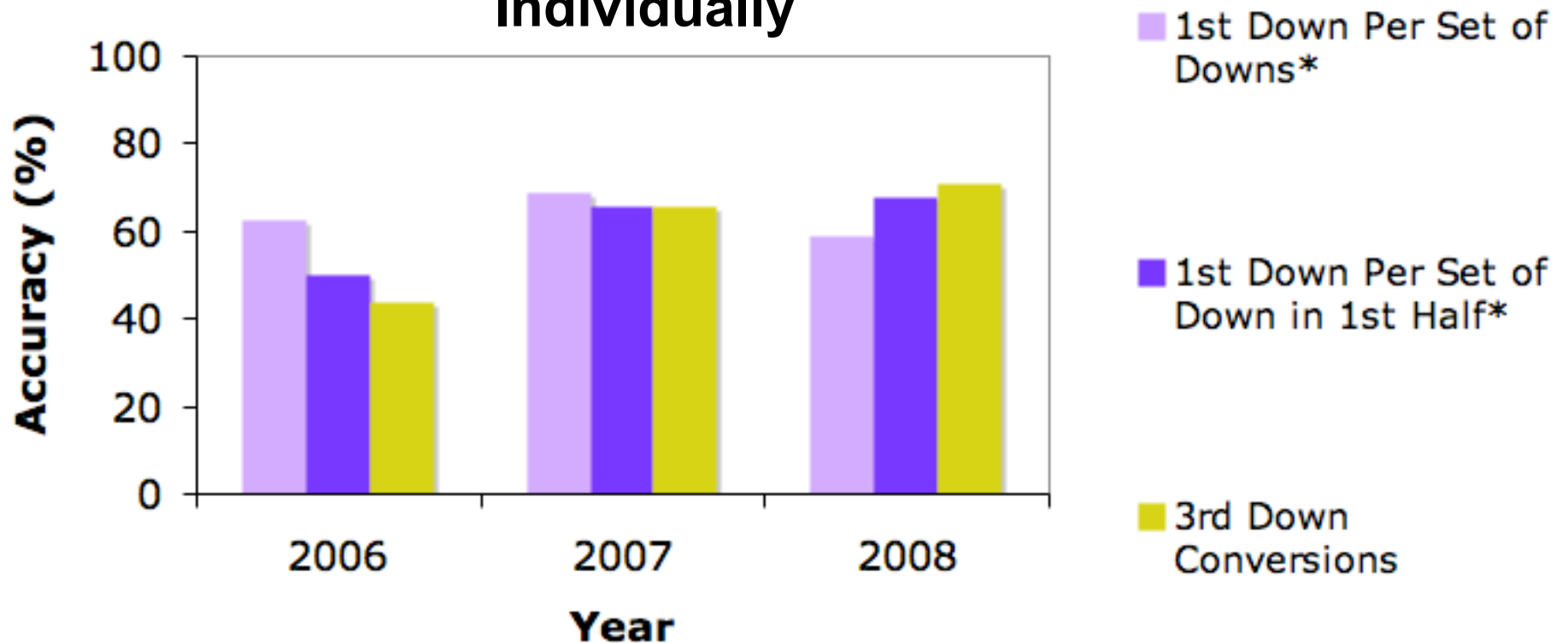


# Week-By-Week Learning

- Ran combinations week-by-week, keeping track of the best weights
- Average those weights and use the averages to calculate the overall ranks

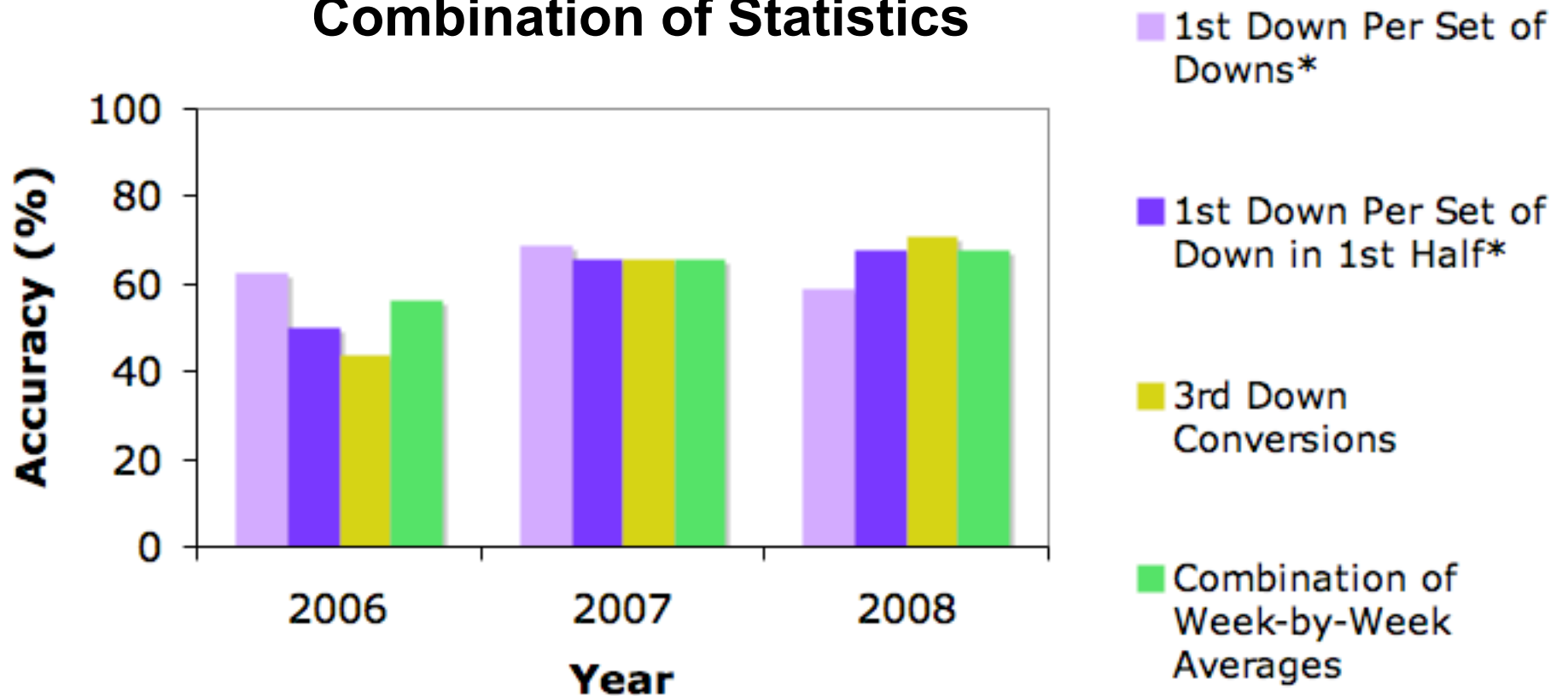
# Week-by-Week Results

## Overall Accuracy of Statistics Individually



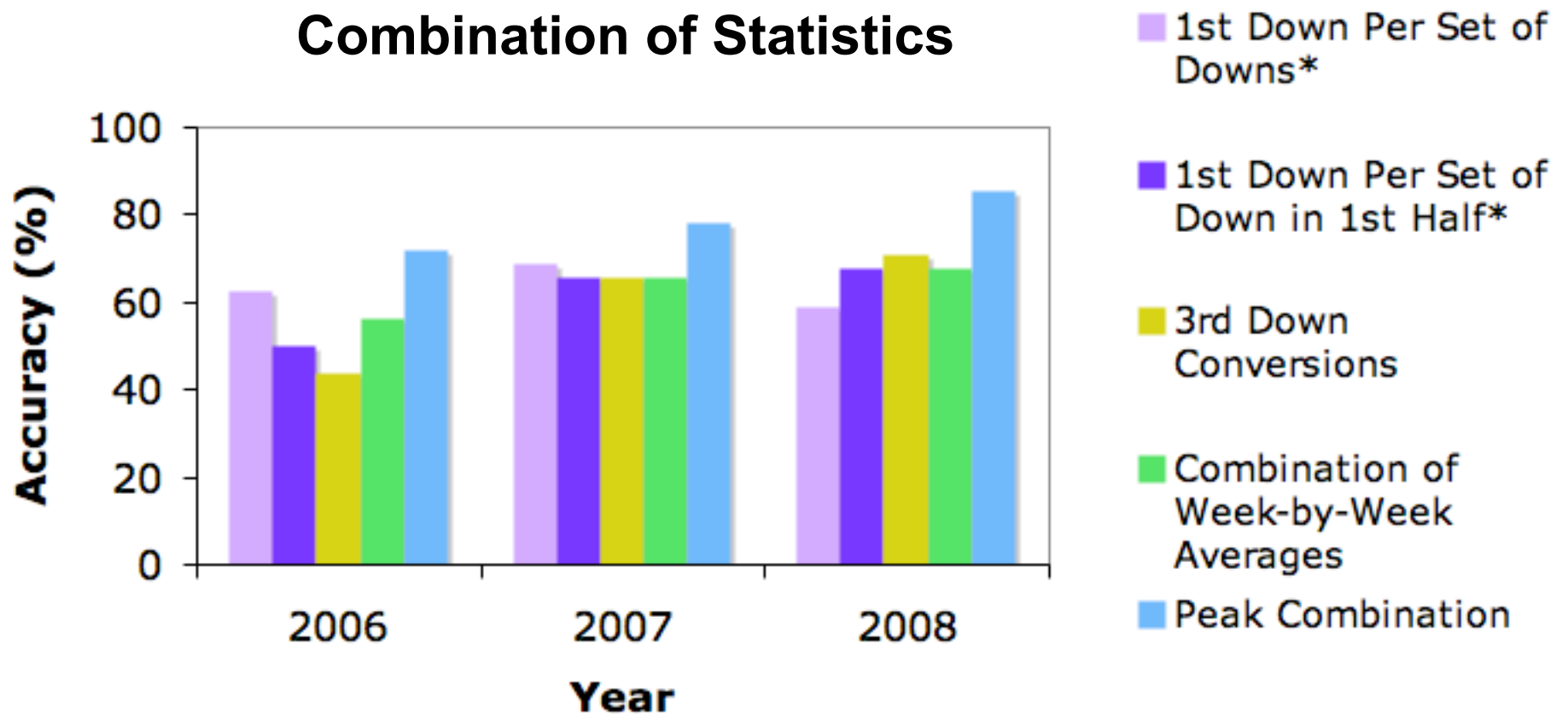
# Week-by-Week Results

## Individual Statistics Compared to Combination of Statistics



# Week-by-Week Results

## Individual Statistics Compared to Combination of Statistics



# Comparison to BCS

- Accuracy is based only on games that include at least one team ranked by the BCS computer rankings

	<b>2006</b>	<b>2007</b>	<b>2008</b>
Combination of Week-by-Week Learning	58.8	64.7	53.3
Peak Combination	70.6	70.6	73.3
BCS Method	70.6	47.1	33.3

# Play-by-Play Conclusions

- Evidence of accuracy when using play-by-play statistics to develop rankings
- Combinations of statistics can be more accurate than a single play-by-play statistic

# Future Work

- Many other play-by-play statistics that can be combined
- Find a more effective method of determining which weights to use for the combinations of play-by-play statistics
- <http://www.math.pacificu.edu/~rowell/football/index.html>

Questions?

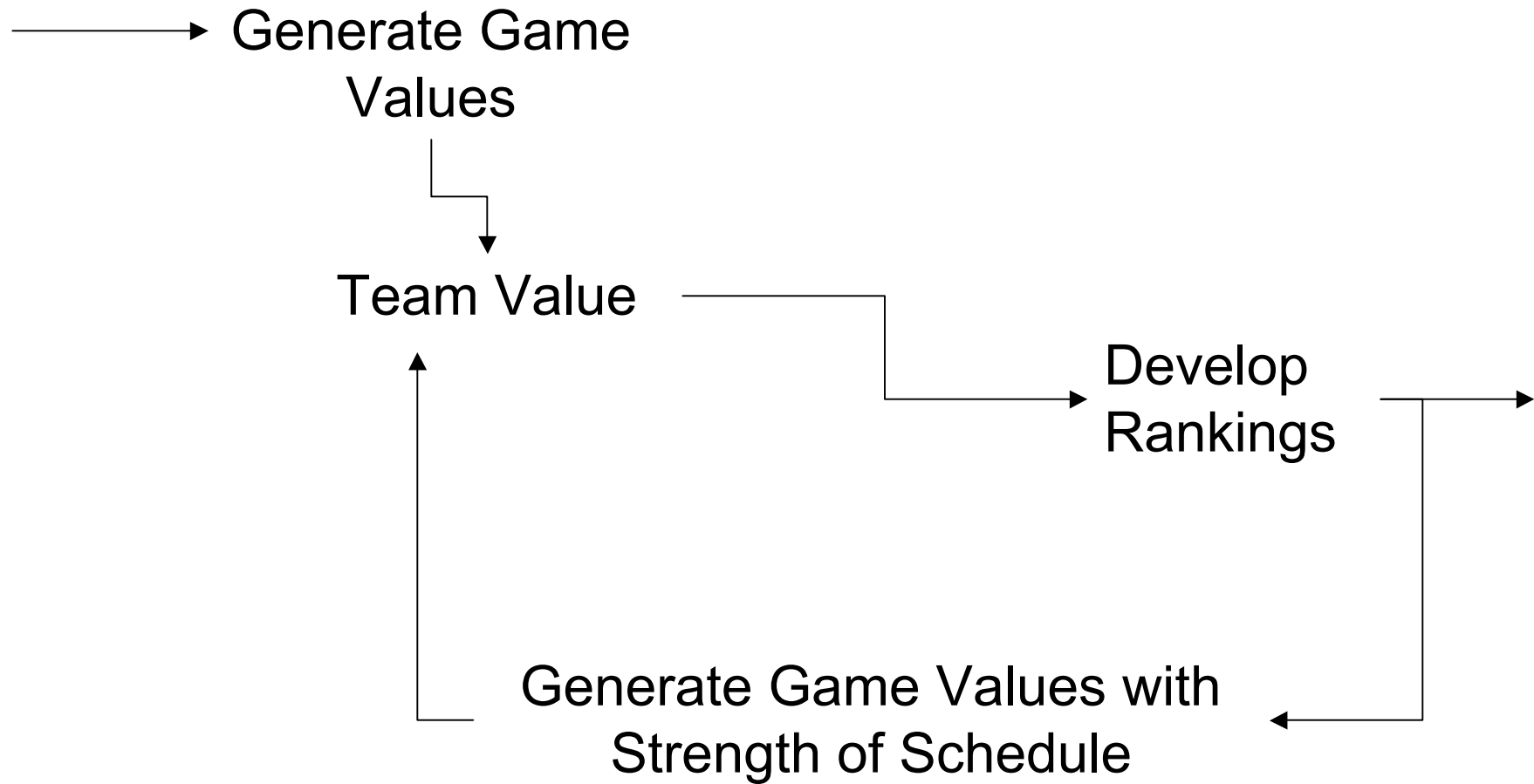


# Statistics to Pursue

	2006	2007	2008
1st Down Per Set of Downs*	62.5	68.8	58.8
1st Down Per Set of Downs, 1st Half*	50.0	65.6	67.6
3rd Down Conversions	43.8	65.6	70.6
3rd Down Conversions Given Up	40.6	65.6	70.6
3rd Down Conversions Given Up*	43.8	62.5	58.8
Percent of Total Yards Gained on 3rd Down*	59.4	62.5	55.9
Percent Yards Gained Toward 1st Down, Rushing, 1st Half*	65.6	62.5	58.8
Percent Yards Gained Toward 1st Down, Variable Point Gap	59.4	62.5	58.8
Percent Yards Given Up Toward 1st Down, Rushing, 1st Half*	53.1	62.5	58.8
Yards Per Play, No Punts*	56.3	62.5	50.0

\*Game within 14 points

# Overview



# Similar Methods

- Started by developing some iterative methods that use statistics similar to the BCS
  - Development of Game Values
    - Difference of scores

Drives07.txt

```

"2753","1","188","20","0","49","0","15:00","12:40","1","1","8","29","PUNT","2:20"
"2753","2","103","21","0","0","0","12:40","08:28","1","1","15","79","TD","4:12"
"2753","3","188","20","0","32","1","08:28","03:19","1","1","13","48","FGA","5:09"
"2753","4","103","33","0","18","1","03:19","00:49","1","1","7","49","INT","2:30"
"2753","5","188","35","0","24","0","00:49","14:43","1","2","4","-11","PUNT","1:06"
"2753","6","103","30","0","0","0","14:43","10:03","2","2","13","70","TD","4:40"
"2753","7","188","25","0","27","0","10:01","08:37","2","2","3","2","INT","1:24"
"2753","8","103","32","1","31","1","08:37","07:13","2","2","5","1","FG","1:24"
"2753","9","188","39","1","24","1","07:02","06:53","2","2","1","15","FUMB","0:09"
"2753","10","103","24","0","0","0","06:53","02:03","2","2","14","76","TD","4:50"
"2753","11","188","40","0","34","1","01:59","15:00","2","3","8","26","FG","1:59"
"2753","12","103","20","0","0","0","15:00","12:57","3","3","7","80","TD","2:03"
"2753","13","188","22","0","43","1","12:50","08:25","3","3","11","35","PUNT","4:25"
"2753","14","103","15","0","47","0","08:25","05:42","3","3","7","32","DOWNS","2:43"
"2753","15","188","47","1","33","0","05:42","03:53","3","3","4","-20","PUNT","1:49"
"2753","16","103","45","1","5","1","03:53","14:08","3","4","11","40","FG","4:45"
"2753","17","188","20","0","48","0","14:08","10:07","4","4","12","28","PUNT","4:01"
"2753","18","103","14","0","21","0","10:07","07:42","4","4","4","7","PUNT","2:25"
"2753","19","188","24","0","31","0","07:42","06:13","4","4","4","7","PUNT","1:29"
"2753","20","103","32","0","45","1","06:13","01:48","4","4","9","23","PUNT","4:25"
"2753","21","188","4","0","5","0","01:48","00:00","4","4","4","1","PUNT","1:48"
"2753","22","103","48","0","null","0","00:00","48","4","5","0","0","0","0:00"
"2754","1","6","23","1","6","1","15:00","12:30","1","1","7","17","FG","2:30"
"2754","2","86","29","0","34","0","12:24","10:25","1","1","4","5","PUNT","1:59"
"2754","3","6","19","0","26","0","10:25","08:08","1","1","4","7","PUNT","2:17"
"2754","4","86","37","0","30","1","08:08","03:50","1","1","9","33","INT","4:18"
"2754","5","6","0","0","0","0","03:50","03:50","1","1","2","0","TD","0:00"
"2754","6","86","39","0","0","0","03:44","14:20","1","2","12","61","TD","4:24"
"2754","7","6","20","0","14","1","14:12","10:28","2","2","13","66","FG","3:44"
"2754","8","86","32","0","34","0","10:21","08:37","2","2","4","2","PUNT","1:44"

```

```

11:00 48 3 8 1:31
ards to the NMSU37
s, Travi;Johnson, Demeri).
return 7 yards to the SLU16
09:32 23 3 7 1:28
red Naylor).
the SLU23 (La'Auli Fonoti).
Chris Williams.
06:15 7 56 3:17
Marquis).
ards to the NMSU48
ards to the SLU42, 1ST

```

- (1st and 10) Justine Buries rush for 4 yards to the SLU38 (Powell, Marquis).
- (2nd and 6) Tonny Glynn rush for 8 yards to the SLU30, 1ST DOWN NMSU (Jackson, Eric;Williams, Travi).
- (1st and 10) Chase Holbrook pass complete to Derek Dubois for 2 yards to the SLU28 (Powell, Marquis).
- (2nd and 8) Chase Holbrook pass complete to Chris Williams for 28 yards to the SLU0, 1ST DOWN NMSU, TOUCHDOWN, clock 06:15.
- (1st and 0) Ryan Jastram kick attempt good.
- (1st and 0) NMSU ball on NMSU30.
- (1st and 0) Ryan Jastram kickoff 57 yards to the SLU13, Ross, Byron return 27 yards to the SLU40 (B. Baiamonte;Nick Ply).

Drives07.txt

```

"2753","1","188","20","0","49","0","15:00","12:40","1","1","8","29","PUNT","2:20"
"2753","2","103","21","0","0","0","12:40","08:28","1","1","15","79","TD","4:12"
"2753","3","188","20","0","32","1","08:28","03:19","1","1","13","48","FGA","5:09"
"2753","4","103","33","0","18","1","03:19","00:49","1","1","7","49","INT","2:30"
"2753","5","188","35","0","24","0","00:49","14:43","1","2","4","-11","PUNT","1:06"
"2753","6","103","30","0","0","0","14:43","10:03","2","2","13","70","TD","4:40"
"2753","7","188","25","0","27","0","10:01","08:37","2","2","3","2","INT","1:24"
"2753","8","103","32","1","31","1","08:37","07:13","2","2","5","1","FG","1:24"
"2753","9","188","39","1","24","1","07:02","06:53","2","2","1","15","FUMB","0:09"
"2753","10","103","24","0","0","0","06:53","02:03","2","2","14","76","TD","4:50"
"2753","11","188","40","0","34","1","01:59","15:00","2","3","8","26","FG","1:59"
"2753","12","103","20","0","0","0","15:00","12:57","3","3","7","80","TD","2:03"

```

11:00 48 3 8 1:31

yards to the NMSU37

is, Travi;Johnson, Demeri).

return 7 yards to the SLU16

```

"2753","13","188","22","0","43","1","12:50","08:25"
"2753","14","103","15","0","47","0","08:25","05:42"
"2753","15","188","47","1","33","0","05:42","03:53"
"2753","16","103","45","1","5","1","03:53","14:08"
"2753","17","188","20","0","48","0","14:08","10:07"
"2753","18","103","14","0","21","0","10:07","07:42"
"2753","19","188","24","0","31","0","07:42","06:13"
"2753","20","103","32","0","45","1","06:13","01:48"
"2753","21","188","4","0","5","0","01:48","00:00"
"2753","22","103","48","0","null","0","00:00","48"
"2754","1","6","23","1","6","1","15:00","12:30","1"
"2754","2","86","29","0","34","0","12:24","10:25"
"2754","3","6","19","0","26","0","10:25","08:08"
"2754","4","86","37","0","30","1","08:08","03:50"
"2754","5","6","0","0","0","0","03:50","03:50"
"2754","6","86","39","0","0","0","03:44","14:20"
"2754","7","6","20","0","14","1","14:12","10:28"
"2754","8","86","32","0","34","0","10:21","08:37"

```

Players03.txt

```

"1","Robertson","R"
"2","Toler","Burl"
"3","O'Keith","Marcus"
"4","McArthur","Geoff"
"5","Sproles","Darren"
"6","Roberson","Ell"
"7","Terry","James"
"8","Cross","Garrett"
"9","Strang","Vincent"
"10","Makonnen","J"
"11","Manderino","C"
"12","Wilson","Travis"
"13","Echemandu","A"
"14","Alsup","Carlos"
"15","Saba","Ayo"
"16","Washington","Ras"
"17","Dennis","Davin"
"18","Casey","Brian"
"19","Arrington","JJ"
"20","Rodgers","Aaron"
"21","Polite","Antoine"
"22","Hall","Brandon"
"23","Lyman","Chase"
"24","Morris","Danny"
"25","Broussard","Ja"
"26","Staples","Ezekiel"
"27","Rislov","Scott"
"28","Eugene","Bruce"
"29","Tolbert","Henry"
"30","Douglas","Tramon"

```

- (1st and 10) Justine Buries rush for
- (2nd and 6) Tonny Glynn rush for (Eric;Williams, Travi).
- (1st and 10) Chase Holbrook pass to Marquis).
- (2nd and 8) Chase Holbrook pass DOWN NMSU, TOUCHDOWN, c
- (1st and 0) Ryan Jastram kick att
- (1st and 0) NMSU ball on NMSU
- (1st and 0) Ryan Jastram kickoff (B. Baiamonte;Nick Ply).



Database

NCAAPlayByPlay (14)

NCAAPlayByPlay (14)

- CurrentScore
- Drives
- FinalScore
- Games
- MaroonZone
- MaroonZone\_Within14Points
- Players
- Plays
- RunningScore
- Teams
- tmp2007
- tmp2008
- tmp10463
- tmpMetric

SQL query:

```
SELECT G.Date, G.VTeamID, OffenseTeamID, G.GameID, SUM(IF(D.QuarterStart <3, MadeFirstDown, 0))/SUM(IF(P.Down =1
AND D.QuarterStart <3, 1, 0)) AS METRIC, TeamName, F.VScore, F.HScore
FROM `Plays` AS P, Drives AS D, Games AS G, CurrentScore AS C, Teams T, FinalScore AS F
WHERE P.GameID = G.GameID
AND P.DriveID = D.DriveID
AND P.GameID = D.GameID
AND C.GameID = G.GameID
AND C.DriveID = D.DriveID
AND C.PlayNumber = P.PlayNumber
AND OffenseTeamID = T.TeamID
AND F.GameID = G.GameID
AND (
ABS(C.HScore - C.VScore) <= 14
)
AND (
G.Date < '2008-02-01'
AND G.Date >= '2007-03-01'
)
AND OffenseTeamID
GROUP BY G.GameID, OffenseTeamID
ORDER BY G.Date, G.GameID ASC
LIMIT 0, 30
```

[ Edit ] [ Explain SQL ] [ Create PHP Code ] [ Refresh ]

Query results operations

Print view Print view (with full texts)

Show :  row(s) starting from record #    Page number:

in  mode and repeat headers after  cells

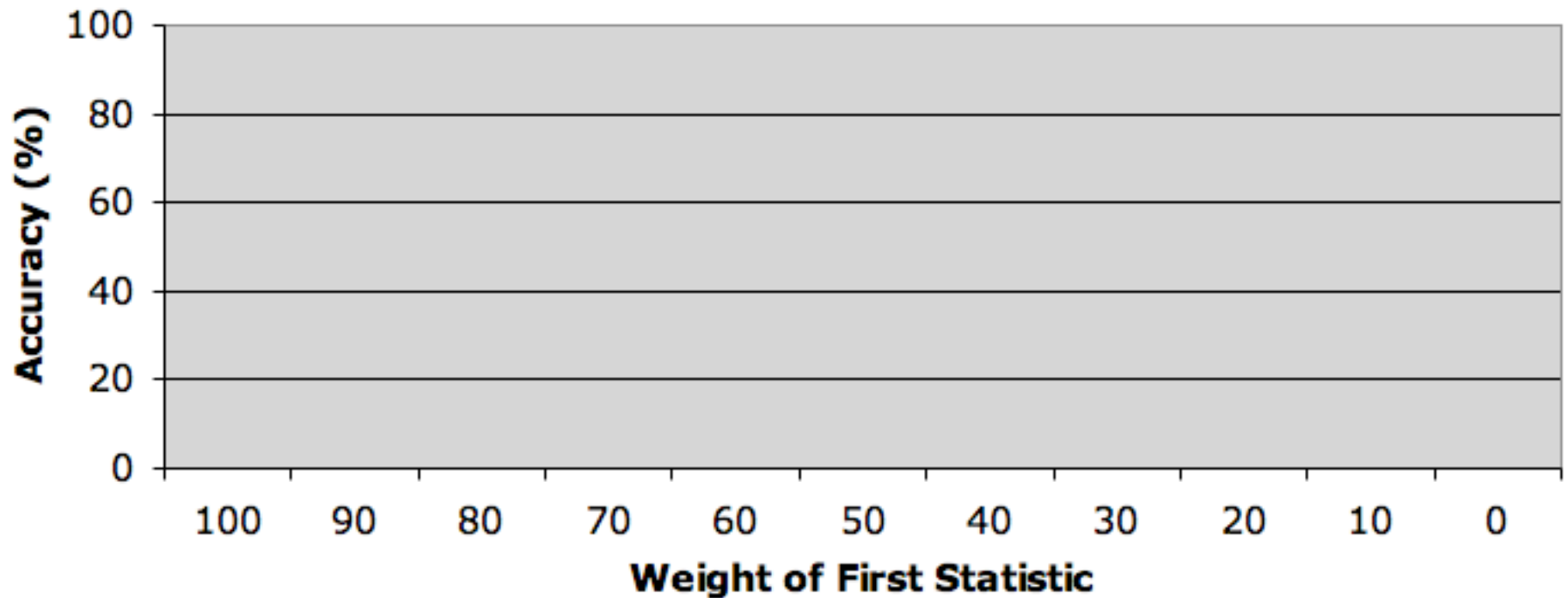
Date	VTeamID	OffenseTeamID	GameID	METRIC	TeamName	VScore	HScore
2007-08-30	28	87	2759	0.5714	Ball State	14	13
2007-08-30	28	28	2759	0.6000	Miami (Ohio)	14	13
2007-08-30	168	168	2760	0.0000	Weber State	7	56
2007-08-30	168	89	2760	0.6250	Boise State	7	56
2007-08-30	53	92	2764	0.4583	Cincinnati	3	53
2007-08-30	53	53	2764	0.4000	Southeast Missouri State	3	53

# Combinations of Two

- Began combining two statistics together
- Each of the statistics will be given a weight
  - Weight of Stat 1 \* Game Value using Statistic 1
  - (100 - Weight of Stat 1) \* Game Value using Statistic 2
- Add the two parts together to get a final game value

# Combination Outcome

**1st Down Per Set of Downs in 1st Half\*  
combined with  
3rd Down Conversions**

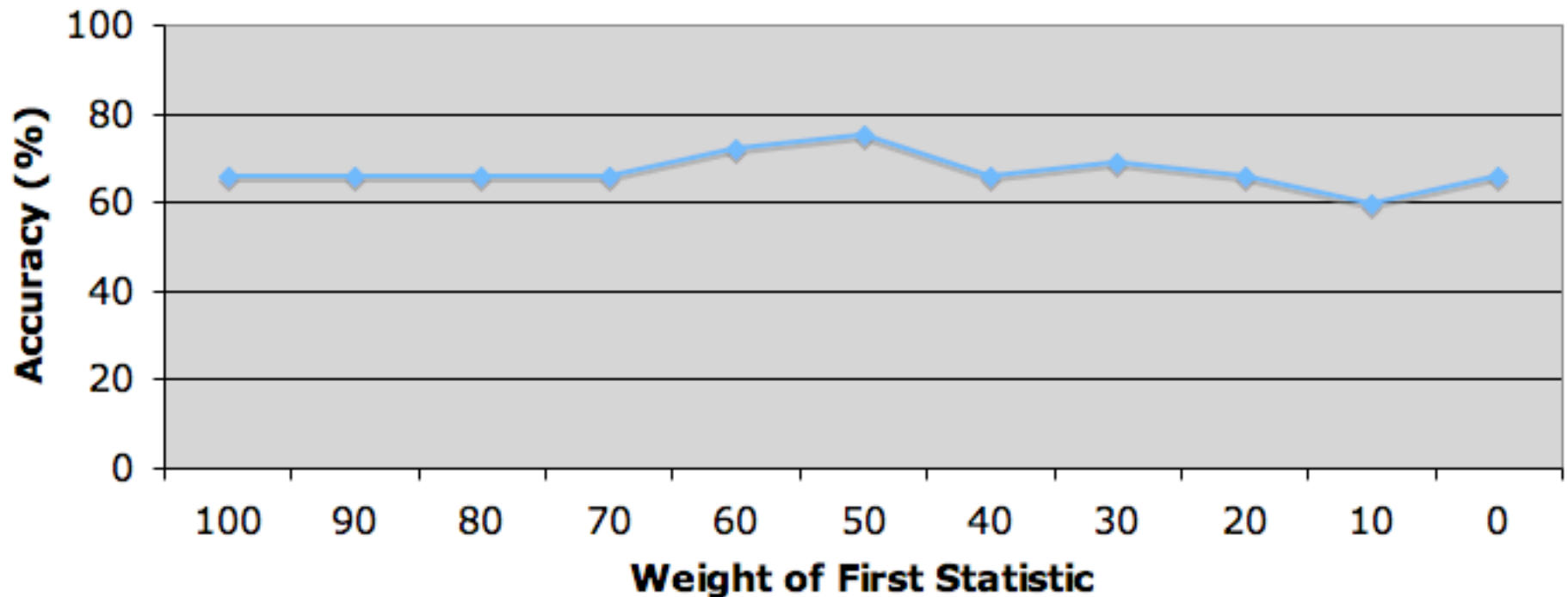


\* Close Game Statistic



# Combination Outcome

**1st Down Per Set of Downs in 1st Half\*  
combined with  
3rd Down Conversions**



- Combining statistics can create greater accuracy

\* Close Game Statistic