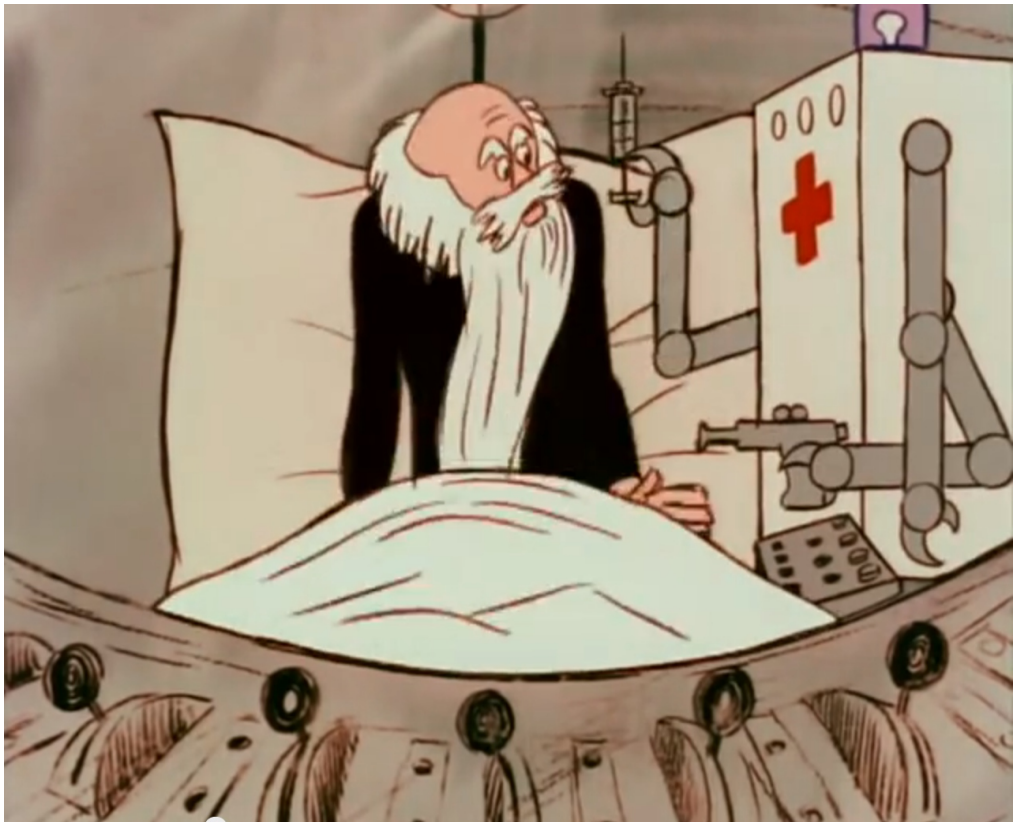
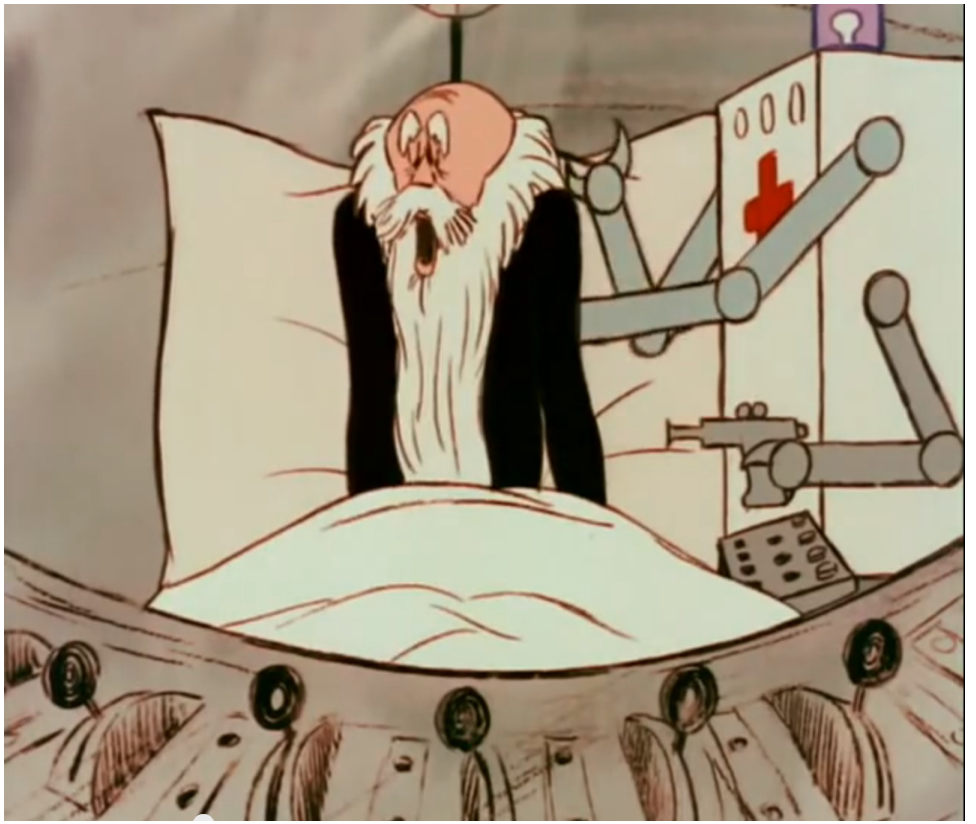
Prediction
(Section 19.1)

Peter Revesz

CSCE 413/813
Computer Science and Engineering
University of Nebraska – Lincoln

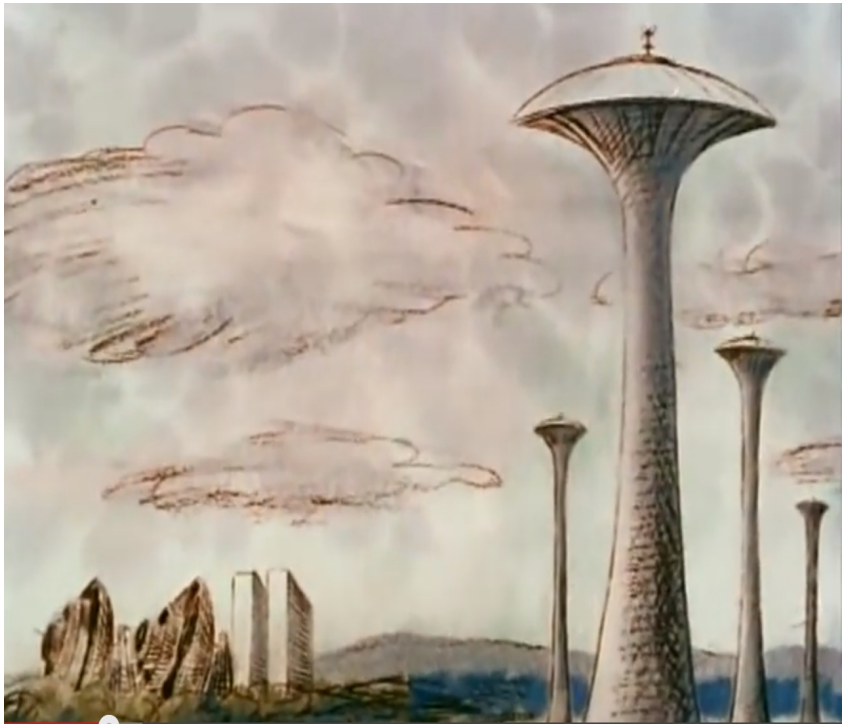
Prediction ?





Sci-fi cartoon of robot nurse 1968

Prediction ?



Sci-fi cartoon 1968

Sweden 1973

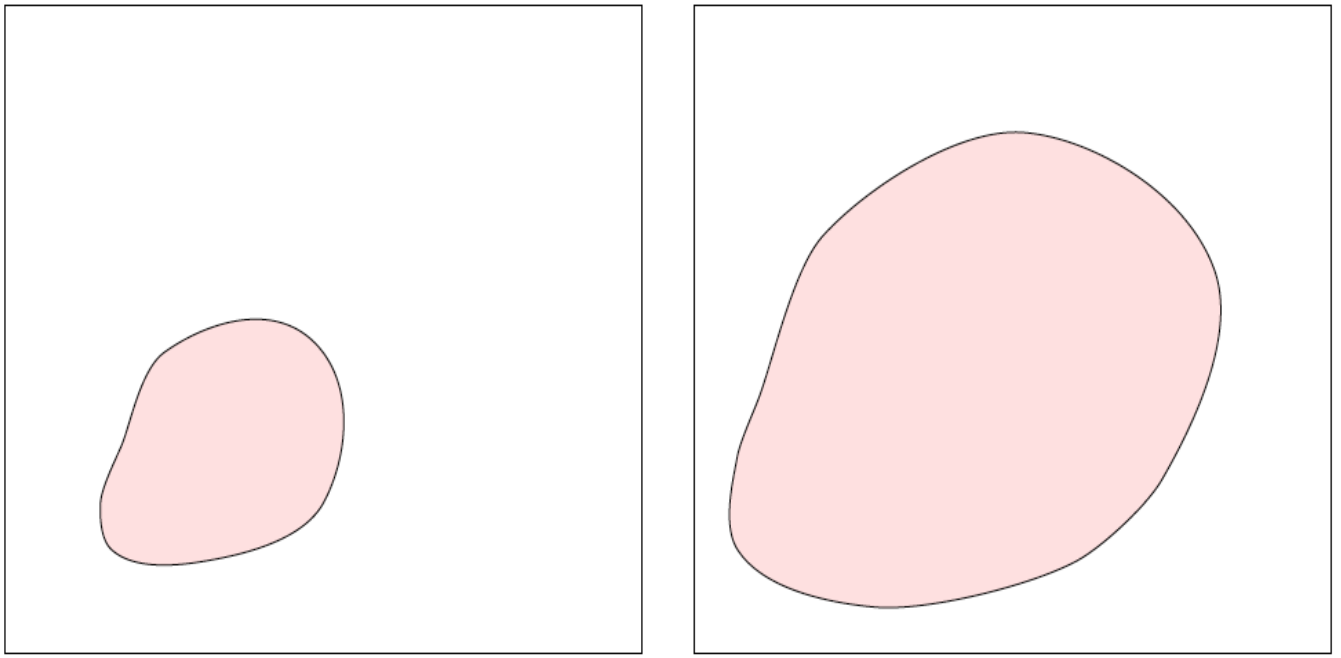
Prediction ?

Jellyfish

Mushroom

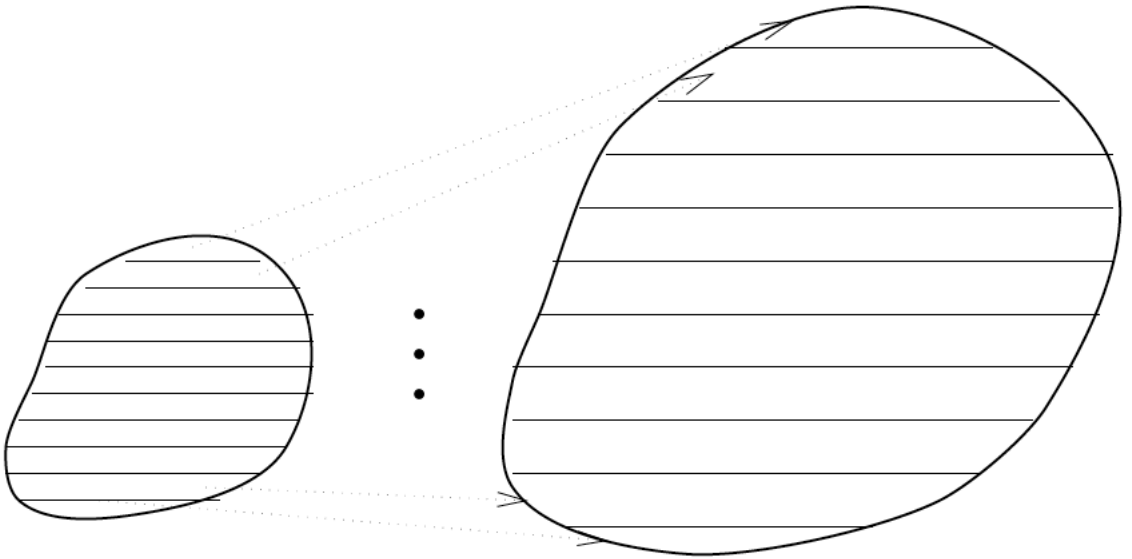
Sweden 1973

Predicting the Spread of Forest Fires



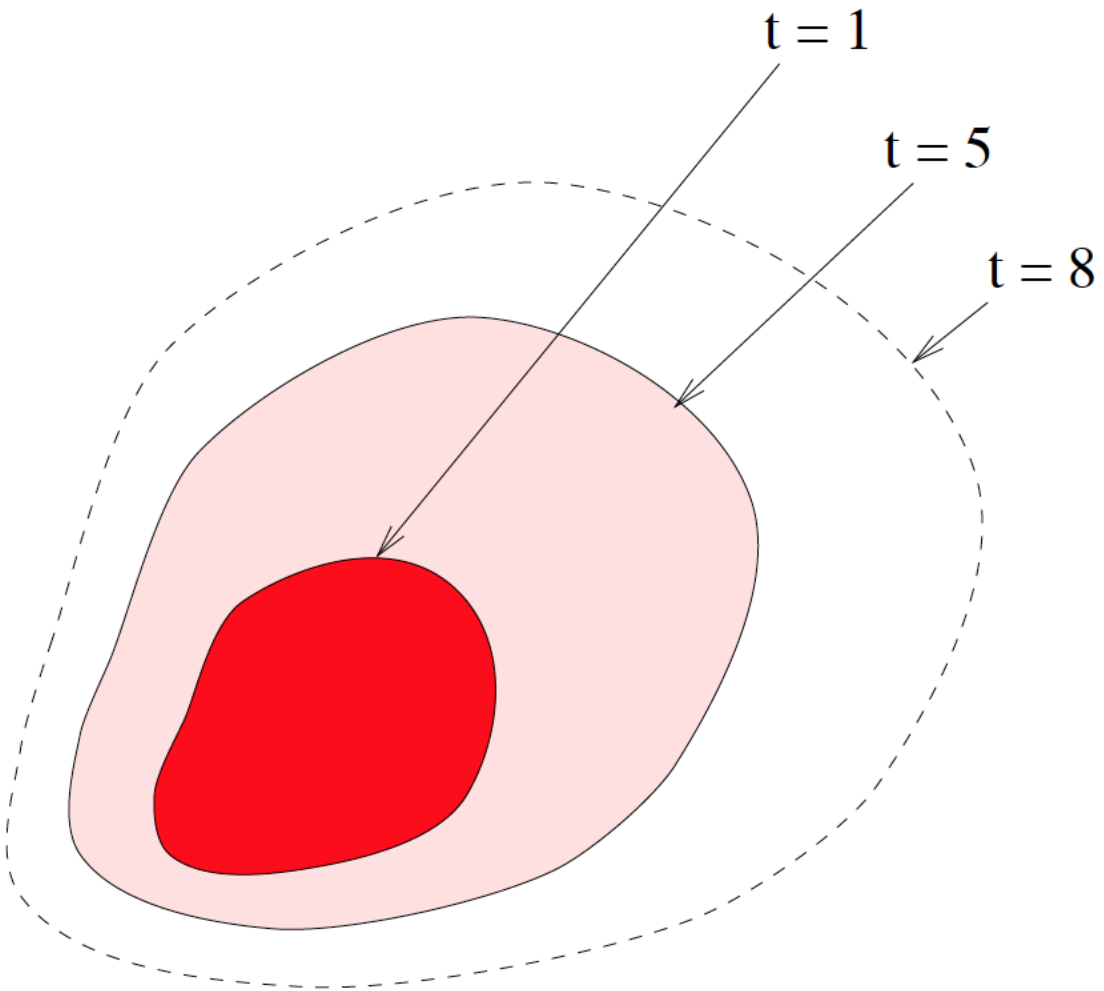
Two aerial snapshots of a fire at times one hour (left side) and five hours (right side from the onset of the fire.

Estimating the Spread by Parametric Rectangles



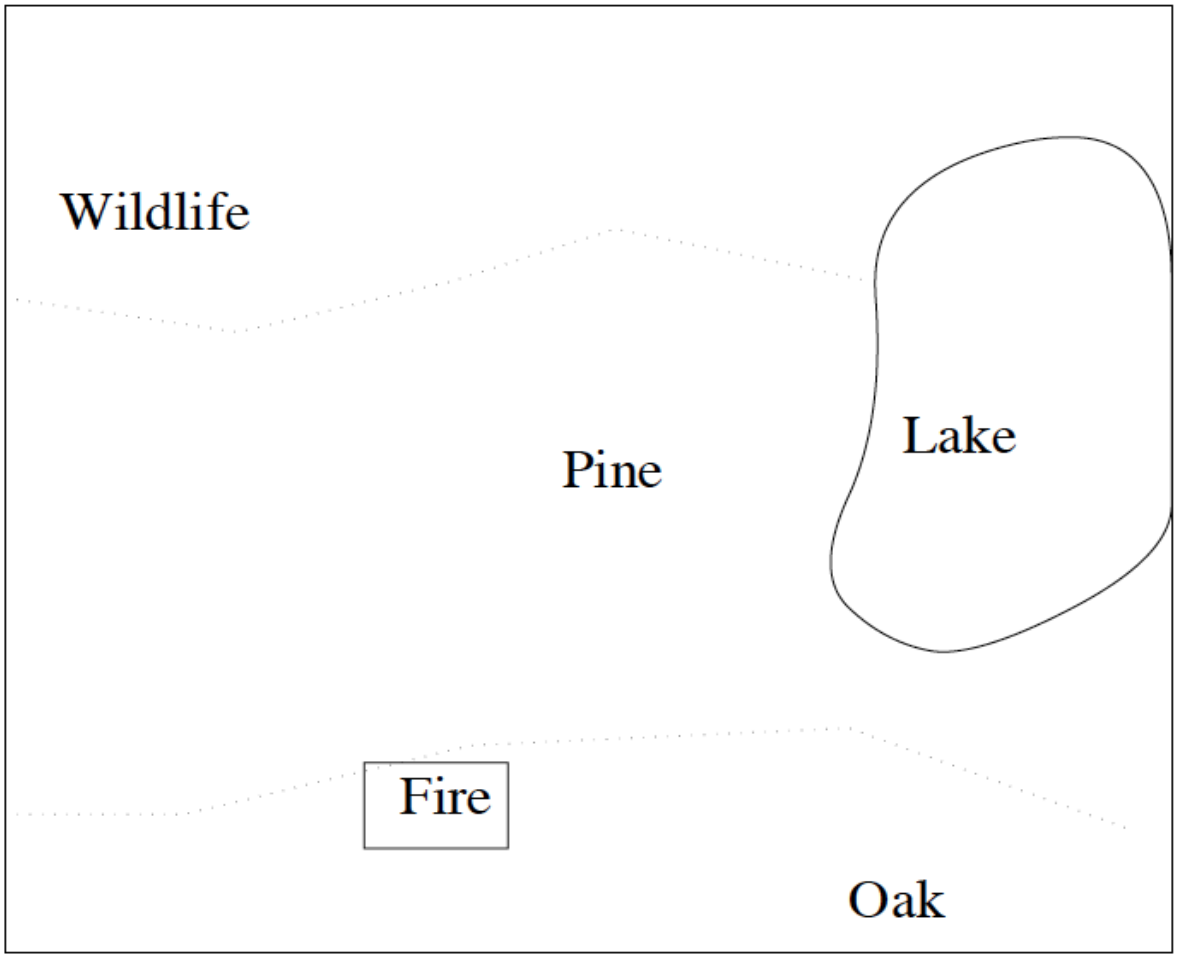
Both snapshots divided into eleven horizontal layers. The i-th layers in both snapshots correspond to each other. Each pair of corresponding layers defines a parametric rectangle.

The Set of Parametric Rectangles Displayed at Various Times

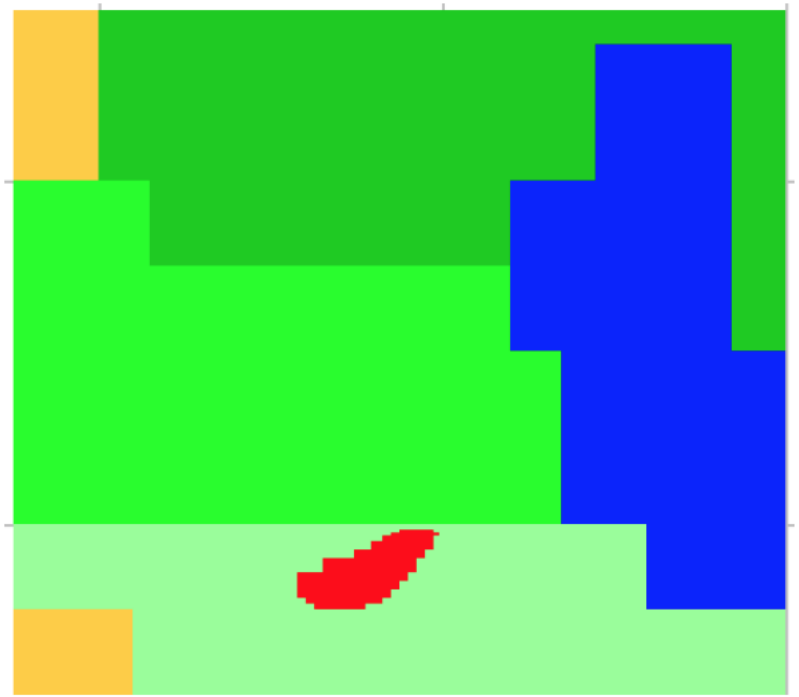


Predicted spread of fire eight hours after the onset of the fire.

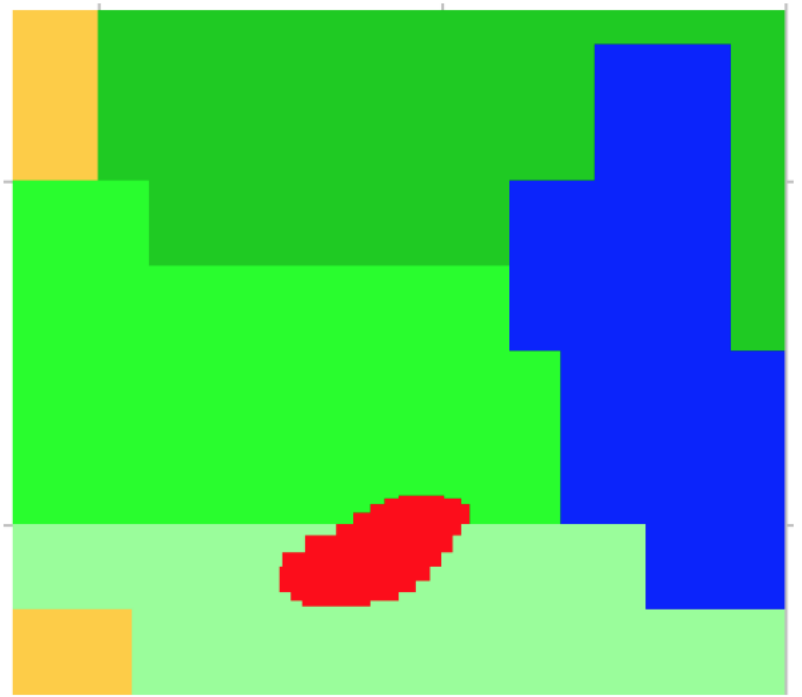
Blocking the Spread of the Fire



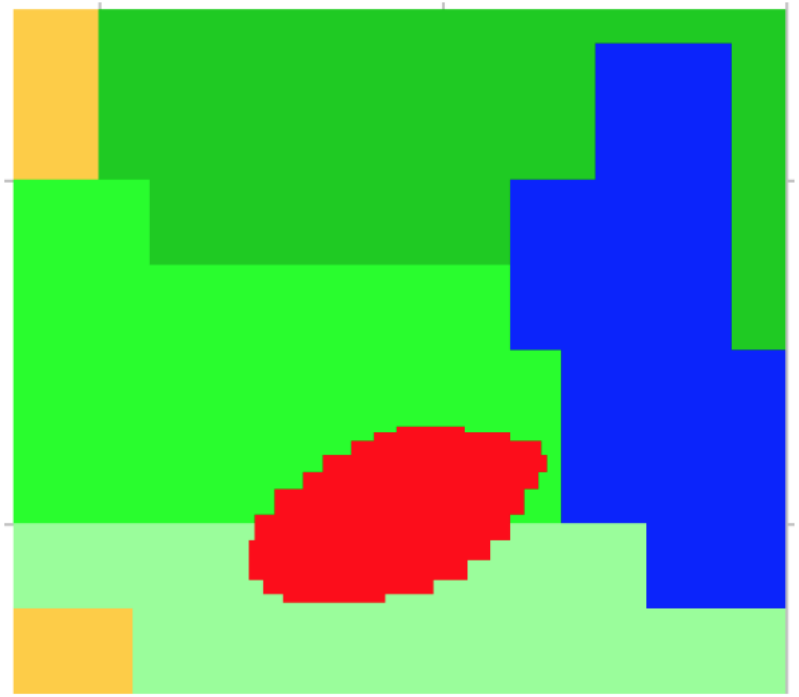
Suppose a fire breaks out in the area shown above.



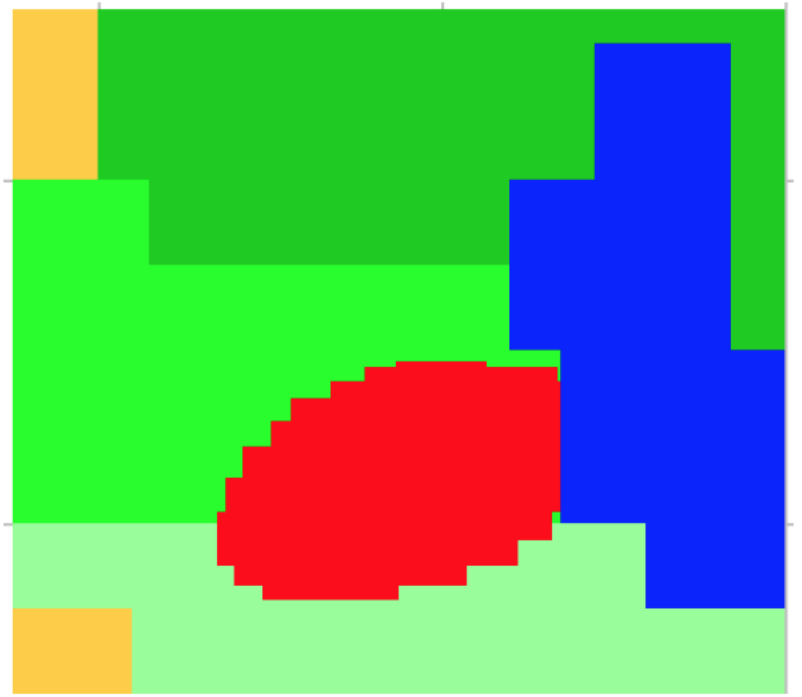
$t = 0$



$t = 2$

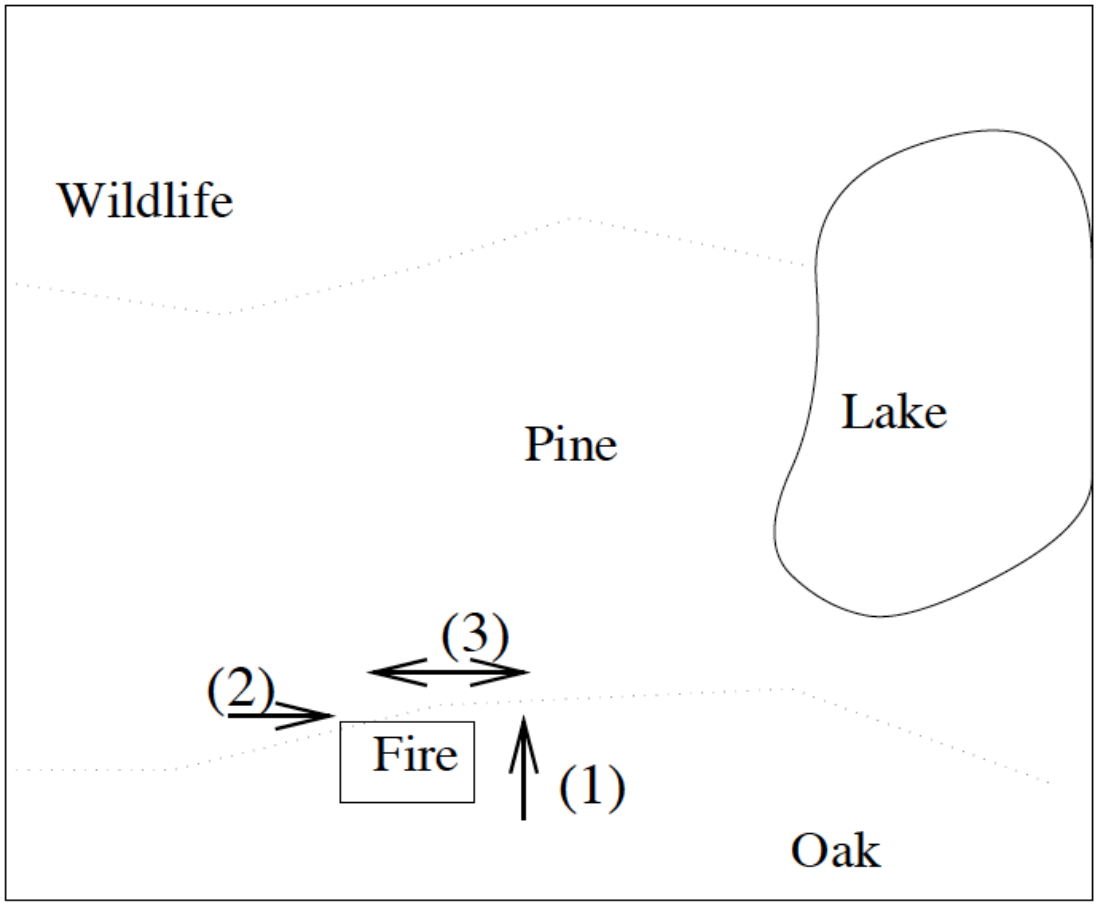


$t = 6$



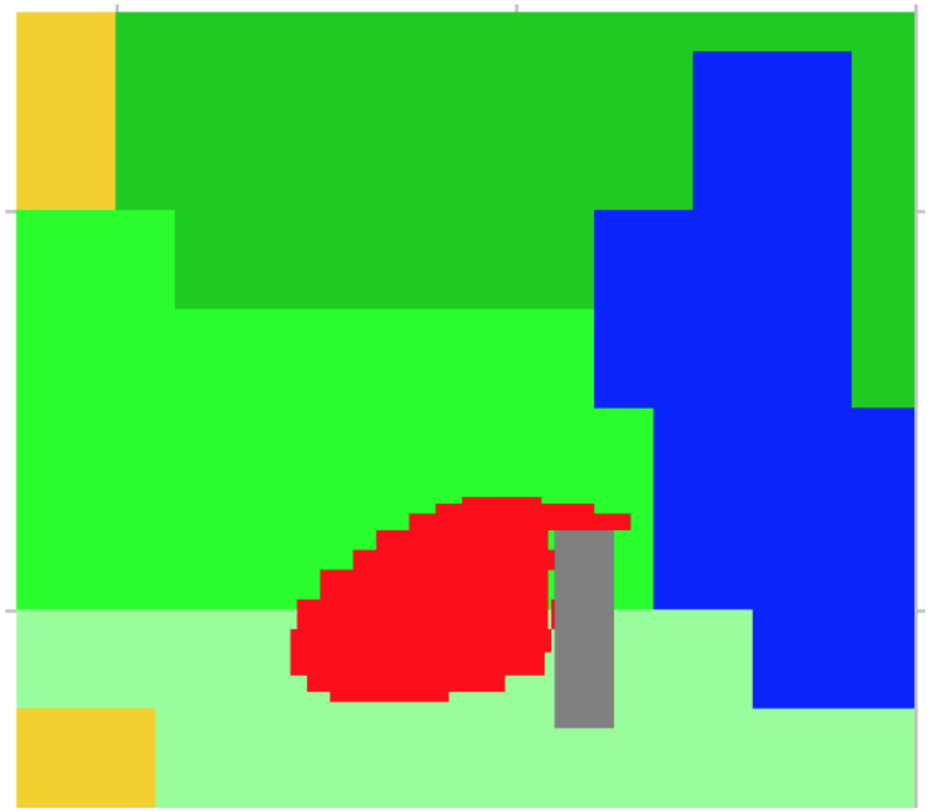
$t = 10$

Decision Support

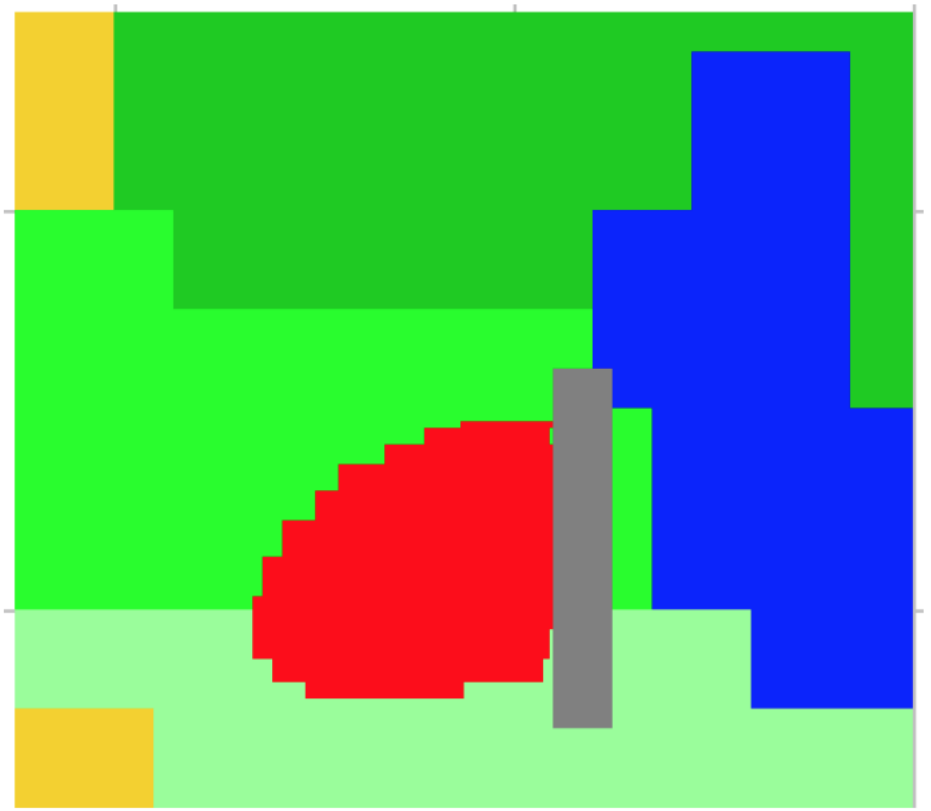


Which is the best strategy for blocking the fire?
1. All fly north. 2. All fly east or 3. Some fly east and some fly west?

All fly north



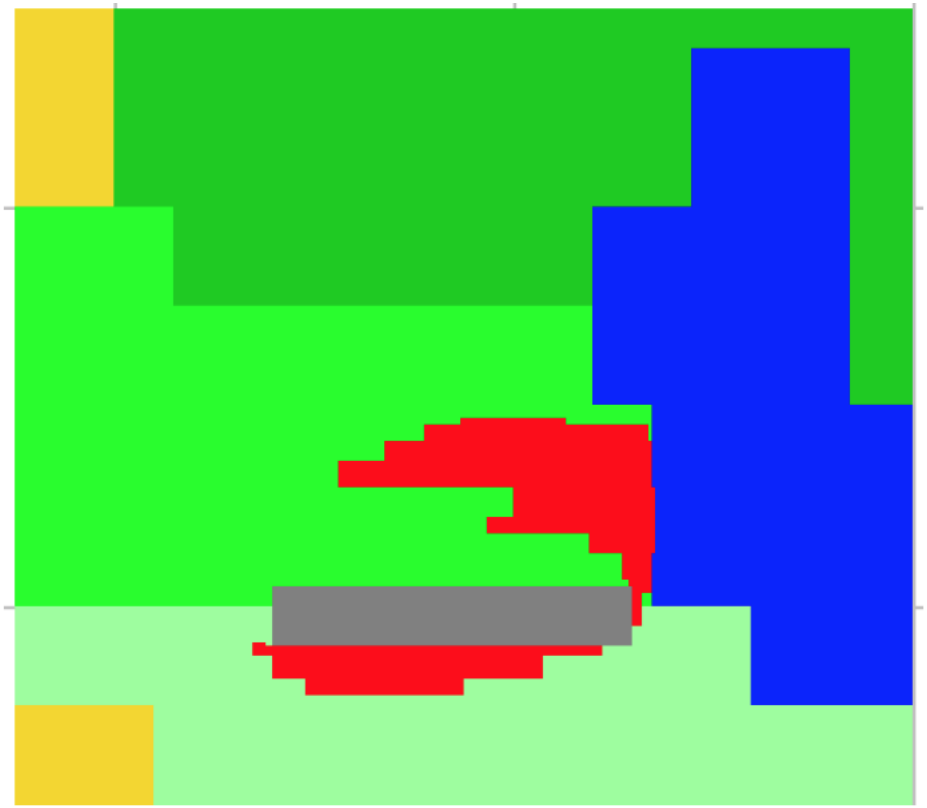
Strategy 1 $t = 6$



$t = 10$

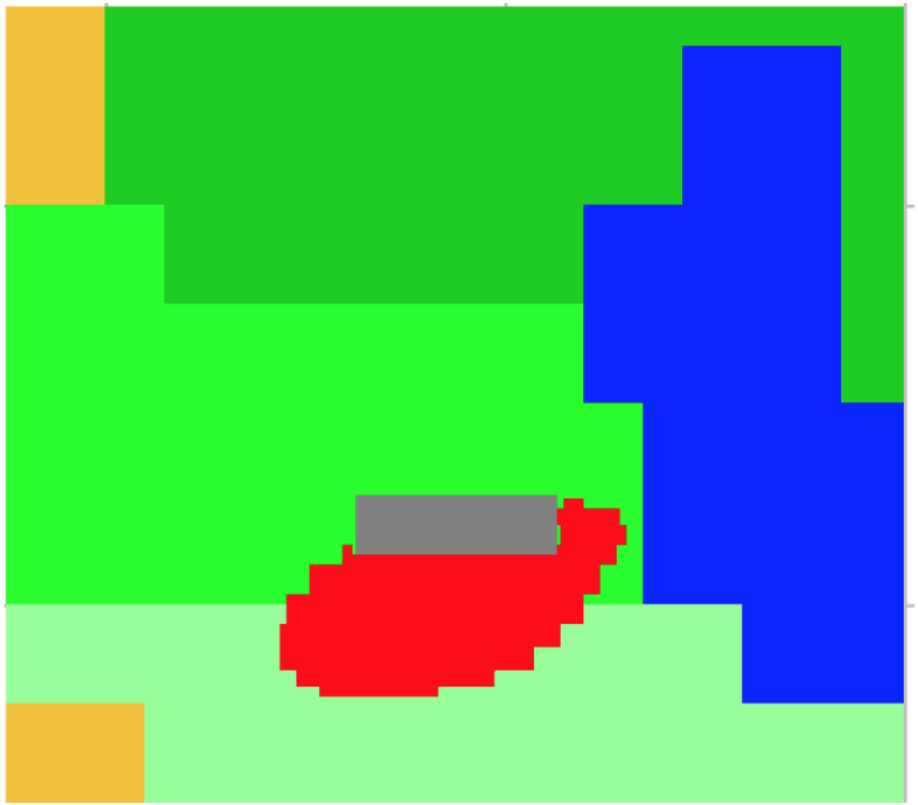
All fly east

Strategy 2 $t = 6$

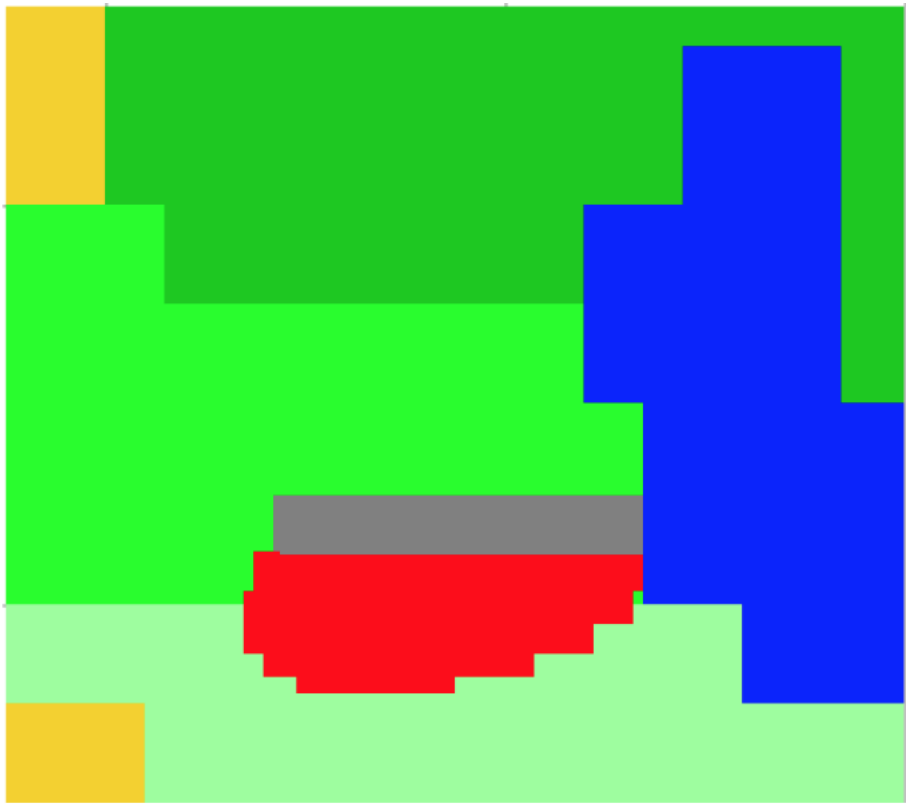


$t = 10$

All fly east at higher latitude.



Strategy 3 $t = 6$



$t = 10$

Decision Support

Damage = Weighted sum of various types of burned areas.

$$Damage = \alpha_W B_W + \alpha_P B_P + \alpha_O B_O$$

Strategy	Burned area at $t = 10$			Estimated total damage
	Wildlife	Pine	Oak	
1	0	11203.32	6048.95	28455.59
2	0	6902.92	3292.87	17098.76
3	0	4916.63	6875.0	16708.26

Strategy 3 is the best because it leaves the smallest total damage.

Voting Prediction

(Extra Material)

Predicting election results is difficult. In the USA 2004 election Florida was widely predicted to be majority Democrat but actually was majority Republican. More recently:

How did pollsters get Trump, Clinton election so wrong?

Nathan Bomey, USA TODAY 8:54 a.m. EST November 9, 2016

(Photo: Michael Chow, The Arizona Republic via USA TODAY Network)

Pollsters flubbed the 2016 presidential election in seismic fashion.

Donald Trump's victory dealt a devastating blow to the credibility of the nation's leading pollsters, calling into question their mathematical models, assumptions and survey methods.

Several months of polls pegged Hillary Clinton as the leader in the polarizing race and as the leader in many key battleground states.

But Trump's surge crushed the conventional wisdom among pollsters. Early Wednesday, he was far outpacing projections across the board.

The results suggest pollsters may have wildly underestimated the number of hidden Trump voters — people who stampeded to the ballot box on Election Day but never showed up on the radar of surveyors.

There was one notable exception among pollsters.

mike murphy
@murphymike

Follow

I've believed in data for 30 years in politics and data died tonight. I could not have been more wrong about this election.

10:49 PM - 8 Nov 2016

The US elections of 2016

The Los Angeles Times/University of Southern California tracking poll consistently pegged Trump as the leader throughout the final months of the campaign — and to much derision from political pundits.

Arie Kapteyn, director of the University of Southern California's (USC) Dornsife Center for Economic and Social Research, which jointly runs the poll, said some voters were apparently sheepish about admitting to a human pollster that they were backing Trump. But the L.A. Times/USC poll was based on an internet survey of a recruited group of voters.

"There's some suggestion that Clinton supporters are more likely to say they're a Clinton supporter than Trump supporters are to say they're a Trump supporter," Kapteyn said late Tuesday in an interview.

Frank Luntz 
@FrankLuntz

Follow

All of tonight's exit polls were wrong, and I was wrong for citing them. #ElectionNight

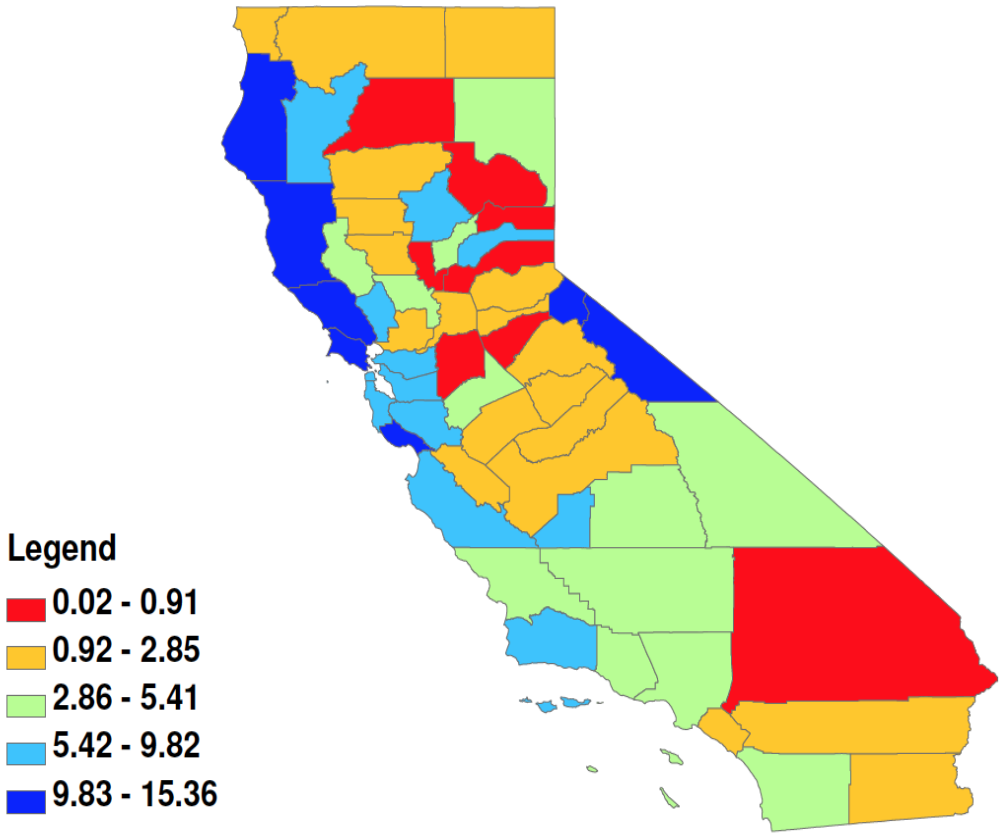
11:30 PM - 8 Nov 2016 · Manhattan, NY, United States

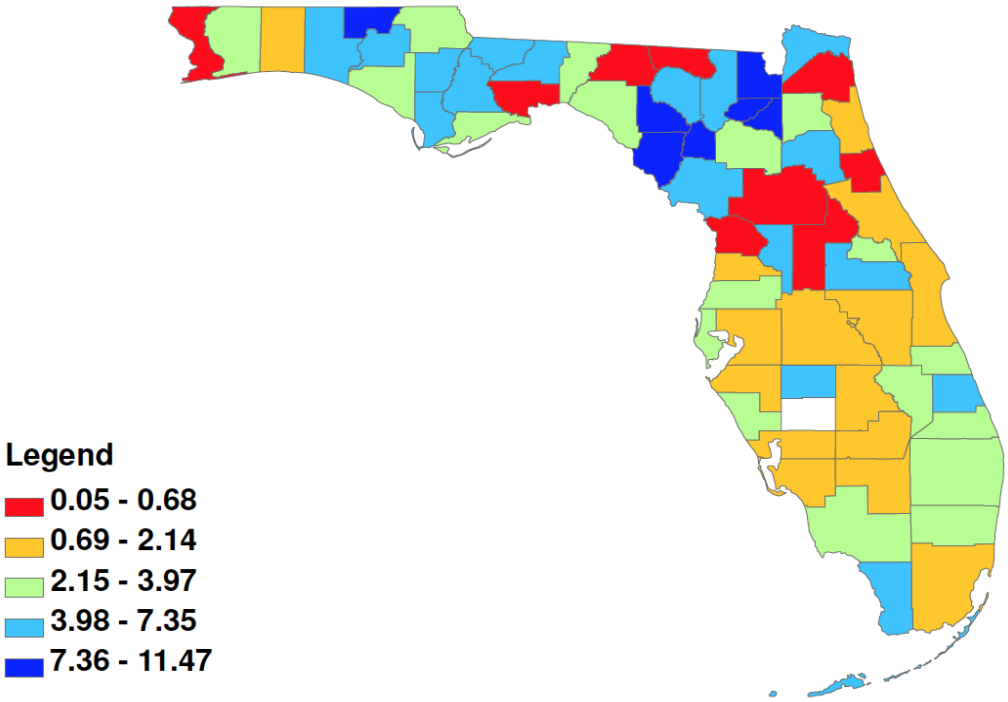
1,033 2,276

Voting Prediction

from Jun Gao's Ph.D. Thesis at UNL (2006)

https://www.linkedin.com/pub/jun-gao/84/37a/405





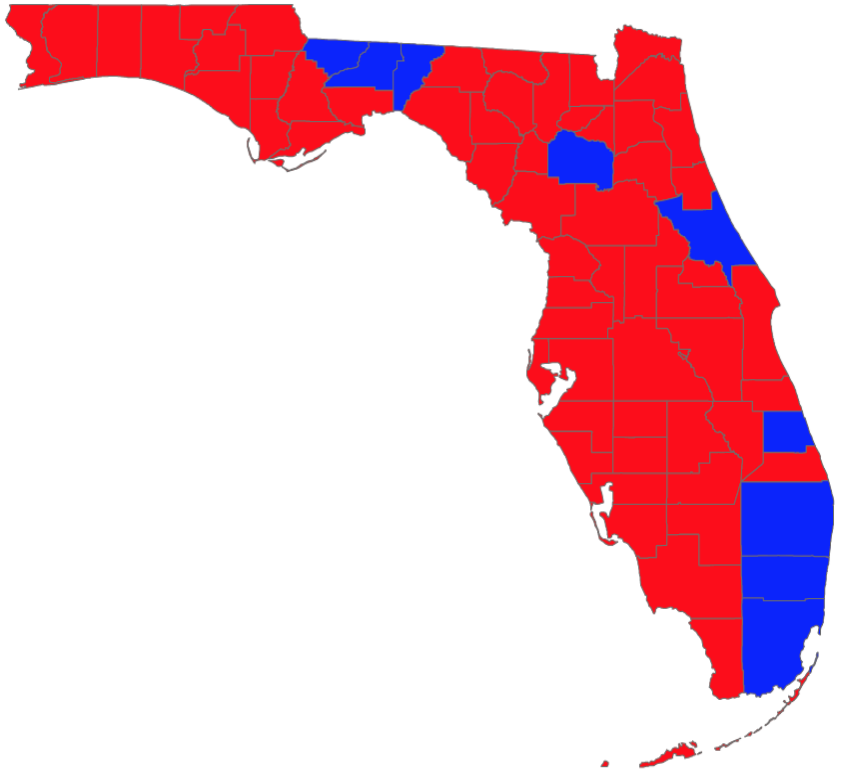
Prediction accuracy for California and Florida

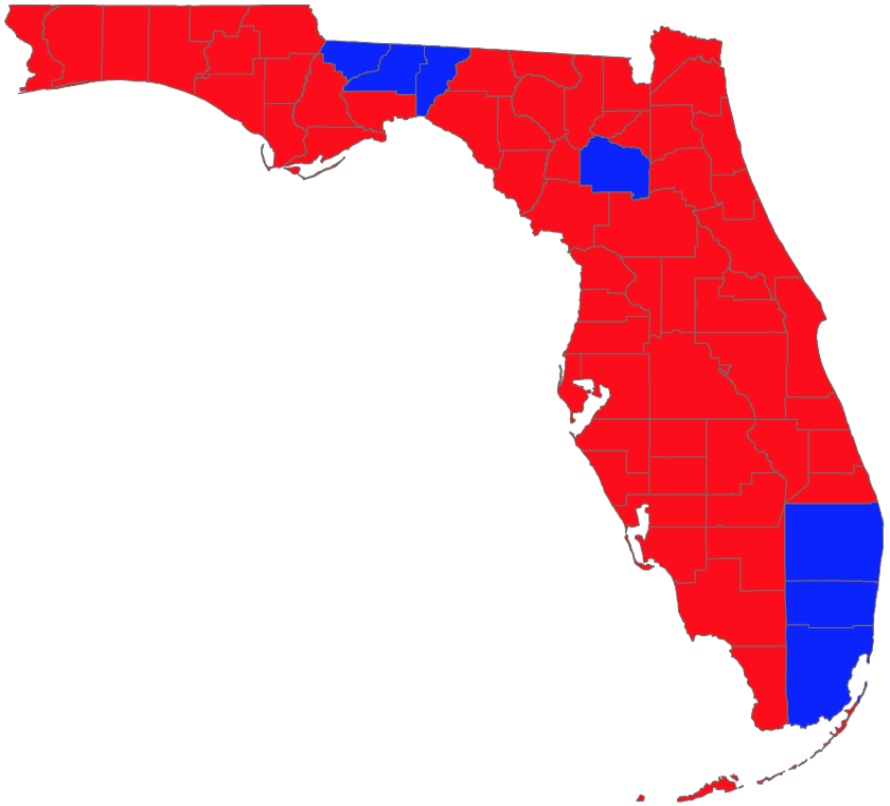
Prediction

Jun Gao's Ph.D. Thesis at UNL (2006):

Chapter 8

USA Presidential Election Prediction





Actual and interpolated results for Florida in 2004.
(Only two out of 67 counties are different.)

Method	California 2004			Florida 2004			Ohio 2004		
	TE	MAE	RMSE	TE	MAE	RMSE	TE	MAE	RMSE
Using IDWU									
IDWU	8.65	11.60	9.67	4.88	7.98	9.05	8.75	11.31	7.60
ASTS ($\theta = 7\%$)	3.49	4.51	6.26	1.09	2.40	5.18	3.57	4.37	3.57
ASTS ($\theta = 8\%$)	3.55	4.77	6.38	1.10	2.40	4.72	3.89	4.66	3.88
ASTS ($\theta = 9\%$)	3.49	4.51	6.26	1.10	2.39	4.61	3.27	4.05	3.14
Using IDWC									
IDWC	8.02	11.33	9.33	3.51	6.62	8.64	8.83	11.27	7.45
ASTS ($\theta = 7\%$)	3.58	4.63	6.83	1.10	2.39	4.84	3.45	5.06	4.88
ASTS ($\theta = 8\%$)	3.54	4.54	6.32	1.11	2.39	4.69	3.78	4.56	3.71
ASTS ($\theta = 9\%$)	3.50	4.51	6.03	1.11	2.39	4.59	3.25	4.03	3.10
LT	5.46	6.66	7.25	2.68	3.81	5.12	4.10	5.09	3.74
EDT	3.46	4.48	6.01	1.10	2.39	4.59	3.18	3.99	3.10

Exponential decay temporal interpolation (EDT) method (p. 40) is the best predictor of election results.