

SOLVING CROSSWORD PUZZLES

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MOTIVATION

- + THOUSANDS OF DAILY SOLVERS
- + SPECIFIC SET OF RULES
- + SEEMINGLY VERY HUMAN TASK

CHALLENGES

- + HUGE STATE SPACE
- + SEMANTIC ANALYSIS IS HARD AND DOMAIN-SPECIFIC
- + ANSWERS ARE MORE THAN JUST ENGLISH WORDS

PROBLEM

DEFINITION

- + FILL IN NYT CROSSWORD
- + MORE REALISTIC: FILL IN SMALLER GRID

APPROACH

- + USE A CSP + SEMANTIC ANALYSIS
- + VARIABLE IS EACH WORD (NOT EACH LETTER)
- + FACTORS: WORD LENGTH (HARD), WORD INTERSECTIONS (HARD), CLUE (SOFT)
- + BACKTRACK SEARCH ALGORITHM

DATA SET

- + PAST NYT DATA (1996-2012)
- + JSON FILES REPRESENTING THE CROSSWORD PUZZLES
- + OVER 400K CLUE/ANSWER

BACKTRACK

- + UNASSIGNED VARIABLE: MCV
- + DOMAIN ORDERING: LOOK FOR PERFECT MATCH, OTHERWISE COMPUTE SCORE BASED ON SEMANTICS AND FREQUENCY
- + LOOKAHEAD: ONLY LOOK AT ONE VARIABLE AHEAD

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ACROSS

- Some interruptions
- "That's that!"
- Contacts ship-to-ship, maybe
- Outbreak caused by the H2N2 virus
- December display
- Three-stringed Eastern instrument
- Lifts
- Common noninvasive med. and
- Sin relative?
- Mathematical field that includes the so-called "butterfly effect"
- "... culpr!"
- Circulation line
- Co. in a 2001 merger with American
- Hamilton, two-term secretary of state under Grant
- One of literature's "three sisters"
- It's big and brassy
- City in Kyrgyzstan
- Off land
- Relatives of texts, for short
- Went from butt to butt?
- Flatness, in brief
- Didn't move, as a product
- Easy-peasy
- Part of a chest

- Chorus starter in a 1972 David Bowie song ... or the theme of this puzzle, phonetically
- Boat who competed on "Dancing With the Stars"
- Maze solver
- Like socks right out of the dryer
- Marks for life

DOWN

- Things that are tossed usually go in them
- "Joke's on you!"
- Gouda alternative
- Fun-size, say
- ...chef
- Slang negative
- Mit. branch
- Interjection of disgust
- Many a sci-fi devolution
- Prominent part of an awdward
- '60s do also called a "natural"
- "Now ... me down to sleep"
- "Obviously!" remarks
- Kind of shooting
- Key of the Nile
- "Would you believe ..."
- Zodiac symbol
- Arizona sights
- "You're boring me"



- One side in a 1967 war
- ... vs. (Japan; Sp.)
- 1942 title role for Rita Hayworth
- Not be squared up, say
- Eastern European capital
- Makeup magnate
- Lauder
- Up
- Pictures, informally
- Some reactions to fireworks
- Airport inits.
- Zodiac symbol
- 54, e.g., in old TV
- Snotion (on), in slang
- Big name in power tools

- Artist Frida with many self-portraits
- Org. concerned with due process
- Young-adult fiction author Darren
- CBS military procedural
- Farm cries
- Lawrence Kudlow's network
- City SSE of New Delhi
- Duds
- Guessers: Abbr.
- It may collect tips ... or be tipped
- Indians' home; Abbr.
- Veiled

RESULTS

- + ABLE TO SOLVE A 4x4 CROSSWORD WITH 100% ACCURACY. PUZZLE WAS CONSTRUCTED USING EXISTING NYT CLUES
- + 15x15 NYT CROSSWORD TAKES A SIGNIFICANT PERIOD OF TIME AND CPU RUNS AT 100%

ANALYSIS

- + LOOKING FORWARD: NEED TO CONSIDER MULTIPLE WORD FILLS, RIGHT NOW THE DOMAIN IS ONLY ENGLISH WORDS
- + IN ORDER TO DECREASE RUN TIME FOR A FULL 15x15 PUZZLE, NEED MORE POWERFUL WAYS TO DECREASE DOMAIN