Innovation: Evidence from Patents?

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Motivation

- Technological innovation is a key driver of long-term economic growth
- Patents are a common proxy for innovative activity (Kogan et al. (2012)), where patent counts and citations relate to the scale and novelty of innovation
- Research Question: Does government spending spur innovation? (Brogaard, Denes and Duchin (2014))
  $\longrightarrow$ Merge U.S. federal contract-level data with patent data
  $\longrightarrow$ Limited to count and citation data for patents

Data on Innovation

- Focus on patent data from U.S. Patent and Trademark Office, which provides detailed data of patent grants, applications and ownership
- Previous data: National Bureau of Economic Research and Kogan et al. (2010)
- Limitations: Data mainly includes patent counts and citations and ends in 2010, with no publicly-available code to update
- Goal:
  (1.) Extract additional fields from patent data, including government rights
  (2.) Extend dataset to most recent patent data
  (3.) Develop code that will allow for future updates and distribute publicly

Patent 8,849,451

(12) **United States Patent**
Rizzi et al.

(10) **Patent No.: US 8,849,451 B2**
(45) **Date of Patent: Sep. 30, 2014**

(54) **HOPPING ROBOT**

(75) Inventors: **Alfred Anthony Rizzi**, Belmont, MA (US); **Michael Patrick Murphy**, Cambridge, MA (US); **John Joseph Giarratana**, Whitman, MA (US); **Matthew David Malchano**, Somervill, MA (US); **Christian Allen Weagle**, Malden, MA (US); **Chris Aaron Richburg**, Somerville, MA (US)

(73) Assignee: **Boston Dynamics, Inc.**, Waltham, MA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 753 days.

(21) Appl. No.: **13/066,276**

(22) Filed: **Apr. 11, 2011**

(65) **Prior Publication Data**

US 2012/0259460 A1 Oct. 11, 2012

(51) **Int. Cl.**

G06F 19/00	(2011.01)
B62D 57/00	(2006.01)
A63H 17/00	(2006.01)
B62D 57/028	(2006.01)
B60B 15/02	(2006.01)
B60B 15/08	(2006.01)

(52) **U.S. Cl.**

CPC ***B62D 57/028*** (2013.01); *B60B 15/02* (2013.01); *B60B 15/08* (2013.01); *Y10S 901/01* (2013.01)

USPC **700/245**; 901/1; 180/7.1; 446/431

(58) **Field of Classification Search**

USPC ..... 123/46 R, 46 SC, 46 H; 180/7.2–10; 700/245–264; 701/69, 116, 124; 901/1, 901/46, 48, 50; 318/568.1–568.25

See application file for complete search history.

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2007/0267116	A1	11/2007	Rhyne et al.	
2008/0230285	A1 *	9/2008	Bewley et al.	180/8.4
2009/0283185	A1	11/2009	Manesh et al.	
2010/0078111	A1	4/2010	Anderson et al.	
2010/0200131	A1	8/2010	Iwase et al.	

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Lambrecht et al, "A Small, Insect-Inspired Robot that Runs and Jumps", Proceedings of 2005 IEEE International Conference on Robotics and Automation, pp. 1240-1245.*

NASA, "Flight Path and Orientation Control", Mar. 18, 2010, courtesy of Internet Wayback Archive.*

(Continued)

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(57) **ABSTRACT**

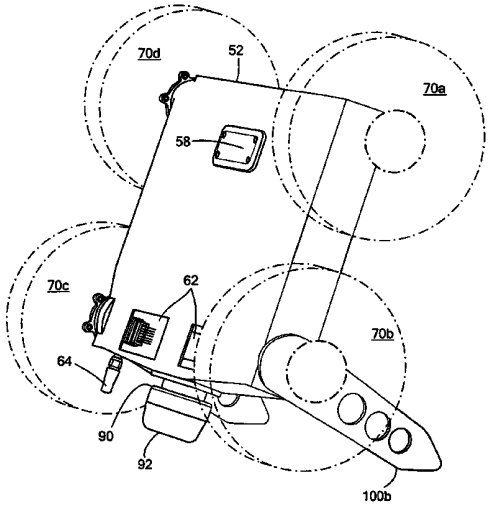
A robot includes a chassis, a motive subsystem configured to maneuver the chassis, a hopping actuator attached to the chassis and configured to launch the robot, and at least one leg pivotable with respect to the chassis to pitch the chassis upward at a selected launch trajectory angle. A control subsystem automatically actuates and controls the motive subsystem when the robot is airborne and uses the rotational momentum of the motive subsystem to control the attitude of the robot chassis in flight.

44 Claims, 9 Drawing Sheets

Patent 8,849,451: Additional Data

GOVERNMENT RIGHTS

This invention was made with U.S. Government support under Contract No. 878424 awarded by Sandia National Laboratories (SNL). The Government has certain rights in the invention.



First Step: Extract Data

- Extract selected fields from patent data from 1976 to present
- Discovered that patent data comes in three format: fixed-width format (1976–2001), XML version 1 (2002–2004) and XML version 2 (2005 onwards)
- File counts: fixed-width format (1,356 files), XML version 1 (157 files) and XML version 2 (509 files)
- Wrote Python code to extract fields, depending on data format

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ISD  19810310
NCL  6
ECL  1,4
EXP  Guynn; Herbert B.
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Second Step: Match Names

- Match assignee names in patent data to public U.S. company names
- Allows for patent data to be merged with firm financial and stock price data
- Developed Python code to match names based on cosine similarity

Internation Business Machines Corporation	Intenational Business Machines Corporation	Internationaal Business Machines Corporation	Internantional Business Machines Corporation
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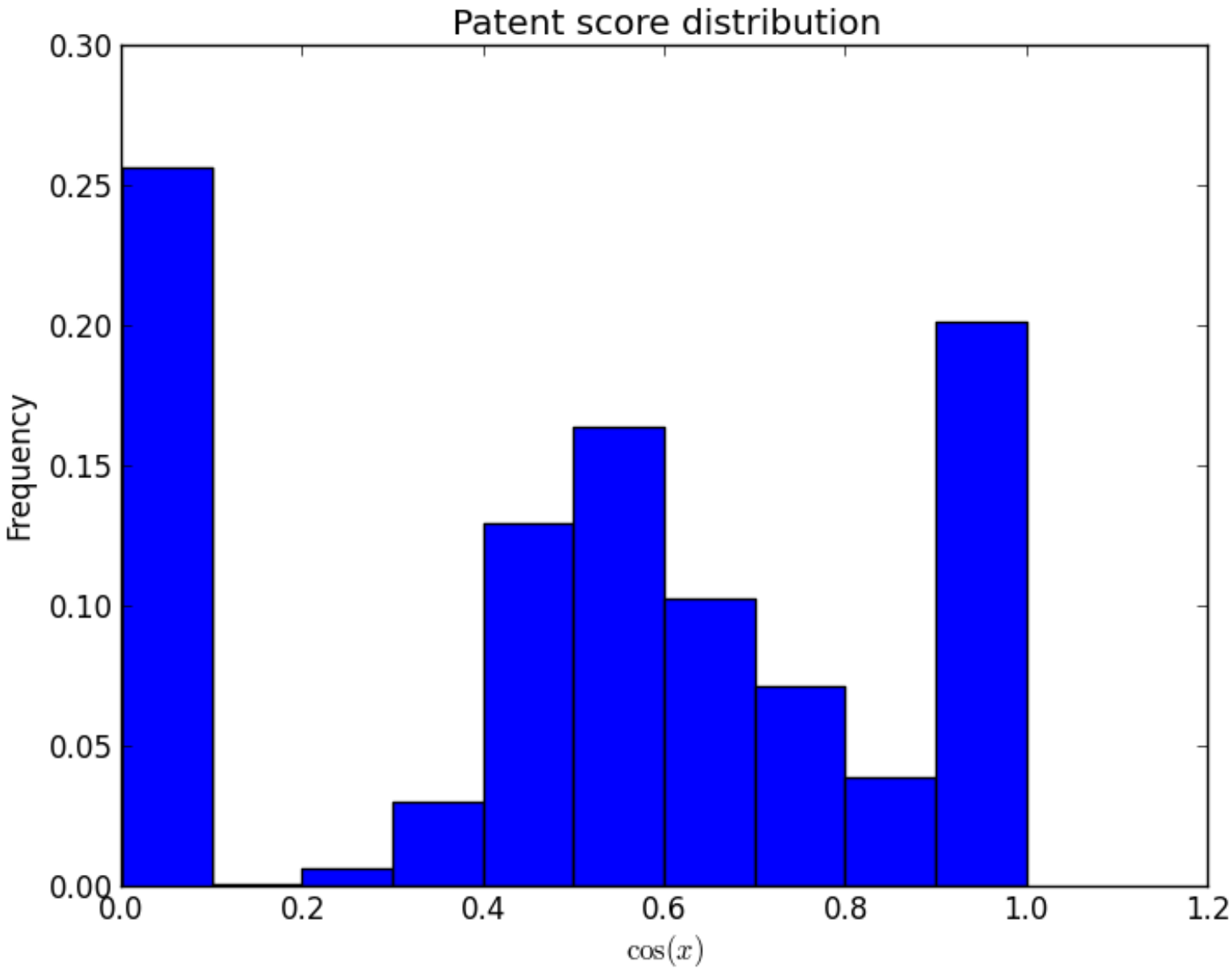
Match Quality Distribution



Next Steps

(1.) Complete matching assignee names to company names, limiting mismatches and missed matches

(2.) Extract patent application and ownership data, leveraging developed codes

(3.) Improve measures of innovation beyond patent counts and citations, using additional fields in patent data

Thank you!

- ...to the eScience Institute Team, especially Andrew Whitaker