6.S899: Branding Statement Assignment

Due on Sunday, September 22, 2019 @ 11:59PM

Assignment: Write a branding statement that explains your academic brand.

A branding statement is a document that explains your brand (what type of research you will do as a professor, how are you suited to work on these problems, etc.). It sets how you will sell yourself to the search committee. The branding statement is not itself a part of your application, but instead a document that will help *you* build the other parts in your application. Your whole application should reinforce the vision that you build out in this exercise. The statement should be no more than ½ page. You can follow the provided worksheet template; example branding statements from current junior faculty are provided in this document as well.

* Fill out this worksheet to write your branding statement and **bring 4 printed copies** to class on Tuesday.
* Submit your branding statement before class on Sunday and read the branding statements from the other people in your online group. These will give you a sense of what these look like for when you give feedback.

In class, we’ll break out into groups of four (organized roughly by research area) and you’ll give feedback on each others’ statements. Afterward, we’ll give everyone a chance to introduce themselves and describe their research in a **one-minute elevator pitch**. Details of how to submit your branding statement and provide feedback for others in your online group will be forthcoming.

After you have received feedback (both during class and online), revise your branding statement. You can use this branding statement to help write your other application materials so that they support a coherent and consistent vision.

Branding statement worksheet

Razvan Marinescu

“I am the machine learning for medicine person.” (what’s a concise phrase for what you do?)

# What is the general problem you are solving?

Should be understandable to anybody in computer science. Aim for one sentence.

Make computers and machines intelligent and use that intelligence to solve medical problems.

# What specific problem does your research address?

Why is this problem important? Should help identify what area your research fits into.

I develop algorithms that analyse and visualise brain imaging data. This is important because the human brian is one of the final frontiers in science, and understanding the human brain will for example solve many brain diseases. Due to the complex nature of medical data which is 3D, limited, noisy and often unlabelled, I am also working on statistical theory in order to create the right set of tools to work with this data.

# What have you achieved in this area?

Aim for one project, whichever is most impressive. Include two if they complement each other. (You can talk about more in a research statement.)

I’ve organised and ran TADPOLE, an international challenge where 33 teams created algorithms to predict the progression of Alzheimer’s disease. This is an important problem, as there are currently no treatments for Alzheimer’s disease that can stop or at least slow down cognitive decline, and we believe these algorithms will be able to select the right subjects for Alzheimer’s clinical trials in order to get treatment. TADPOLE was also unique as it was one of the only challenges in medical imaging to evaluate algorithms prospectively. I evaluated all 92 algorithm submissions, and helped identify the most important types of algorithms and input features that help predict Alzheimer’s disease.

# What is your research vision?

Should answer what you can do in five years. Aim high, as long as you can back up why you would succeed. Try to be memorable.

My immediate aim is to develop new theories for machine learning that will enable computer vision algorithms to work well on the challenging medical imaging datasets. My long-term aim is to place current medical imaging algorithms, which are currently working on supervised and unsupervised tasks, in the more natural reinforcement learning setting. This will enable machines, surgical robots and IoT devices to consider the environment around them and take suitable actions (i.e. acquire new image, deliver treatment, communicate with patient, perform surgery, search the internet for more information). This will create an entire ecosystem where devices (MRI scanner, surgical robot, patient’s mobile phone, etc ... ) gather data, take the right actions, and communicate with doctors and with each other to solve diseases and medical problems as efficient as possible.

Example branding statements

## Stefanie Mueller

I am the fabrication person.

General problem: Ordinary people want to engineer physical objects.

Specific question: How do we develop design tools that let users work and edit in the physical world?

What have you done in this area: I built a system called constructable to allow users to draw on an object to indicate where the laser cutter should work, and a followup system, LaserOrigami, that uses a laser cutter for not only 2D cuts but to bend 3D objects.

Vision: in the future anybody will be able to create anything anytime. This vision requires progress in five areas: speed, material, domain knowledge, sustainability, and intellectual property, which are (briefly):

* Speed: investigate how to build a fabrication device that can modify itself in real time
* Material: rather than using many materials (which can’t be used with every fabrication method), investigate using meta-materials to start with a single material and vary the microstructure.
* Domain Knowledge: novice users can edit 3D shapes, but struggle to understand forces on a fabricated object.
* Sustainability: iterating on physical designs creates physical waste; can we recycle instead?
* Intellectual property: personal fabrication has the potential to infringe on design copyrights; can we prevent this with technical mechanisms?

## Mike Carbin

I am the approximate computing person.

General problem: How can we make programs faster and more reliable?

Specific question: I explore building programming systems that alter what a program does to get better performance and reliability, and in particular how to do this while understanding program’s *quantitative reliability*: How close is the program to the original? What is the probability that the behavior of the new program is acceptable?

What have you done in this area: I wrote Rely, a system for programming unreliable hardware and proving that programs achieve a particular probability of getting correct results. I also wrote a system for writing and verifying *relaxed programs*, programs annotated with transformations that the system can make.

Vision: for approximate computing, optimization is a more complex process of navigating performance and reliability tradeoffs; how can we automate exploring this tradeoff space?

For improving reliability of programs that compose poorly understood components, how can we compose these components with automatic resilience mechanisms, while helping programmers understand how their program’s behavior is influenced by the components they use and the resilience mechanisms? Relaxed programs are a helpful framework to understand this space.

## Fredrik Kjolstad

I am the sparse computing compiler person.

General problem: How can we make it easy to implement fast and portable solutions to sparse computing problems.

Specific questions: I work on domain-specific compilers and new programming model constructs to make it easier to program sparse computing applications such as data analytics, robotics, computational biology, optimization and simulation. How can programmers easily express sparse computation? How can we separate descriptions of computations from descriptions of data structures and machine resources? How can we automatically compile those descriptions into fast and portable code that compute on data in irregular data structures?

What have you done in this area: I developed the taco compiler that compiles any tensor algebra expression into fast code that computes on user-specified data structures. I also developed the Simit programming model that lets the programmer express sparse systems and compute on them using (blocked) linear algebra.

Vision: I think there’s an opportunity for developing a shared compiler infrastructure that can be used across sparse computing applications developed with different mathematical abstractions, such as relations, tensors and graphs. This will require deep understanding for these abstractions, how they relate to data structures, and what information is needed from the programming model to bridge across them.

Guy Bresler

I am the computational complexity of high-dimensional statistics person.

General problem: How can we understand the fundamental limits of statistical inference under computational constraints?

Specific questions: High-dimensional statistics concerns estimation problems where there is a signal with some combinatorial structure, plus some noise, and the goal is to estimate the signal. What are the relationships, if any, between the plethora of modern inference problems?  How does the signal structure determine feasibility, both computational and statistical?

What have you done in this area: I have shown that many of the central statistical inference problems studied in the last decade can be related to one another. This is a first step in developing a coherent computational complexity theory for statistical inference problems. I have also devised algorithms for learning various classes of graphical models, in the process identifying model features that lead to efficient algorithms.

Vision: Currently, each statistical inference problem is studied individually, from scratch: the collection of modern algorithmic approaches are analyzed, information-theoretic lower bounds are proved, and computational limits are proposed typically supported only by heuristics. Instead, the dream is to simplify the landscape by showing that subsets of the zoo of problems are equivalent, thereby also transferring all our understanding from well-studied problems to other as-of-yet poorly understood problems.