

### **Week Starting 1st August.**

I read the GSCF papers quite a few times over the week, trying to make sure I understood them completely, and to see if there were any questions I needed to ask, but I didn't find any that weren't answered somewhere between the two papers. I understand more clearly the local / global division, and the communication between the modules in both the homogenous and heterogeneous cell suppressor cases. I've also been doing some more background reading in image processing.

I read the papers that you sent me last week and they are all quite interesting. The papers mostly look at innate immunity and the danger model. Several algorithms are provided, which focus on quite different issues to previous reading.

One approach given in "Introducing Dendritic Cells as a Novel Immune-Inspired Algorithm for Anomaly Detection" seemed quite relevant to the health-monitoring-at-home problem. The dendritic cell model "exhibits timely and accurate behavioural switches to changes in context". Looking at the sample results, the power of the algorithm used becomes clear. Unlike most AIS algorithms, this one doesn't classify individual antigens as self/non-self, but places system into "danger mode" based on population representation. It relies on in-frequent switched in context, such as that from healthy to unhealthy for example, which greatly reduces the mis-classification rate that may occur when considering individual items. The danger model used identifies changes in behaviour of the system. The paper gives what appear to be full details of how to apply the algorithm, including how to derive various weights for the main signal concentration equation. The signals produced over time are determined by the input data's "attributes".

I thought a lot about how this might be applied, and how frames from a monitoring camera could be reduced to quantitative attributes to be fed as input into the algorithm. I made a list of straight-forward points that may help to indicate the health of a person based on posture and gait.

- Stride Length
- Pace
- Back angle
- Neck angle
- Stride balance
- Orientation

Assuming that there is just a single person in a room at a time, we can use frame difference to generate a difference mask identifying the position of the person (using noise reduction and image dilation to improve detection). Assuming no occlusion from furniture, the mask's aspect will be a rough measure of orientation (standing/lying/sitting). By looking at the width of the lower portion of the mask over time, we could try to establish stride period, and length, and even analyse stride symmetry to establish a measure for stride balance (relative length of opposite steps). We might also consider taking the difference between the center of the stride and the center of mass of the mask (taking pixels to represent a unit weight) as an estimate measure for their posture (a large difference might imply a hunched, angled back). Since a person's behaviour may be determined by where they are in the room, it would be important to include their location as an attribute too.

I think the dendritic cell model may be able to effectively switch from healthy to unhealthy modes given data based on these crude measures. I'm worried though that these types of systems would likely be implemented in single person housed, with typically very small rooms, where there would be very few strides between destinations, making it difficult for stride cycles and lengths to be measured.

I also thought that I was onto a way of applying the GSCF to tracking and motion prediction of multiple objects that may cross each others paths, inspired a little from the CONDENSATION algorithm (Conditional density propagation for visual tracking - M Isard, A Blake), but have been unable to find any solid method.

Depending on what you think about health-monitoring using the dendritic cell model discussed above, I would quite like to try and carry out some tests and maybe implement this next week to see if it yields good results or not. Although I've been thinking about the General Suppression Framework all week, I've still not been able to think of an application, though I will continue to try.

Thanks again for your time,  
Steven