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Combining various monitoring technologies in order to maximize decision making capability

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Combining Various Monitoring Technologies in Order to Maximize Decision Making Capability

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Abstract:

Dairy producers of today have to make a wide range of technology choices available to them. These decisions include activity monitors or wearable technologies (i.e. estrus monitoring, locomotion, laying time, rumination, etc.), robotic milkers, automatic feeder, and herd management software. The focus of this poster is to propose a framework for evaluating the profit maximizing set of technologies. Some of these technologies only perform one function and some technologies monitor multiple activities. This type of analysis to our knowledge has not been performed.

Potential cow signals that can be monitored to make informed health decisions



Background:

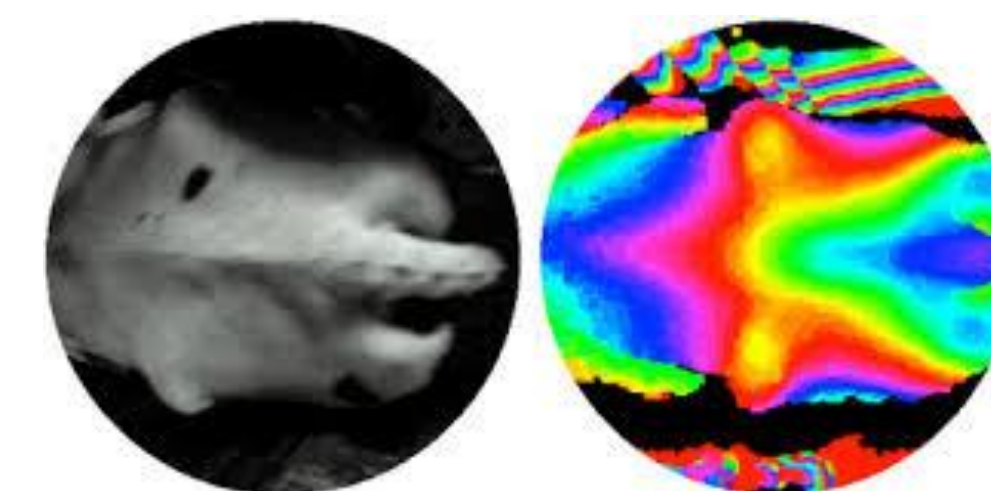
- The trend of having larger and fewer dairies is continuing today. Profit margins on typical dairy farms are reduced because of reduced involvement by the government in regulating agricultural commodity prices. Therefore, any positive changes in on-farm production and efficiency can have an important impact on profitability.
- Precision dairy farming has the specific goal of switching the focus to preventative health & medicine as well as optimize the performance of every animal individually. For example, nutrition efficiency is one area that technologies can provide more information than in the past.
- Early detection of disease is one key advantage of precision dairy. This is also expected to increase animal welfare, another pressure on the industry.
- Informed health management will drive future strategy, and technology is actively being used in animal health research today.
- A motivating factor in the adoption of precision dairy technologies is perceived efficiency gain.
- Evidence suggests gains in milk yield, reduced labor, improved reproductive and increased profitability are possible.
- Perceived intangible benefits to the farmer include decreased stress, fatigue, and increased family time.

Potential Wearable Technologies:

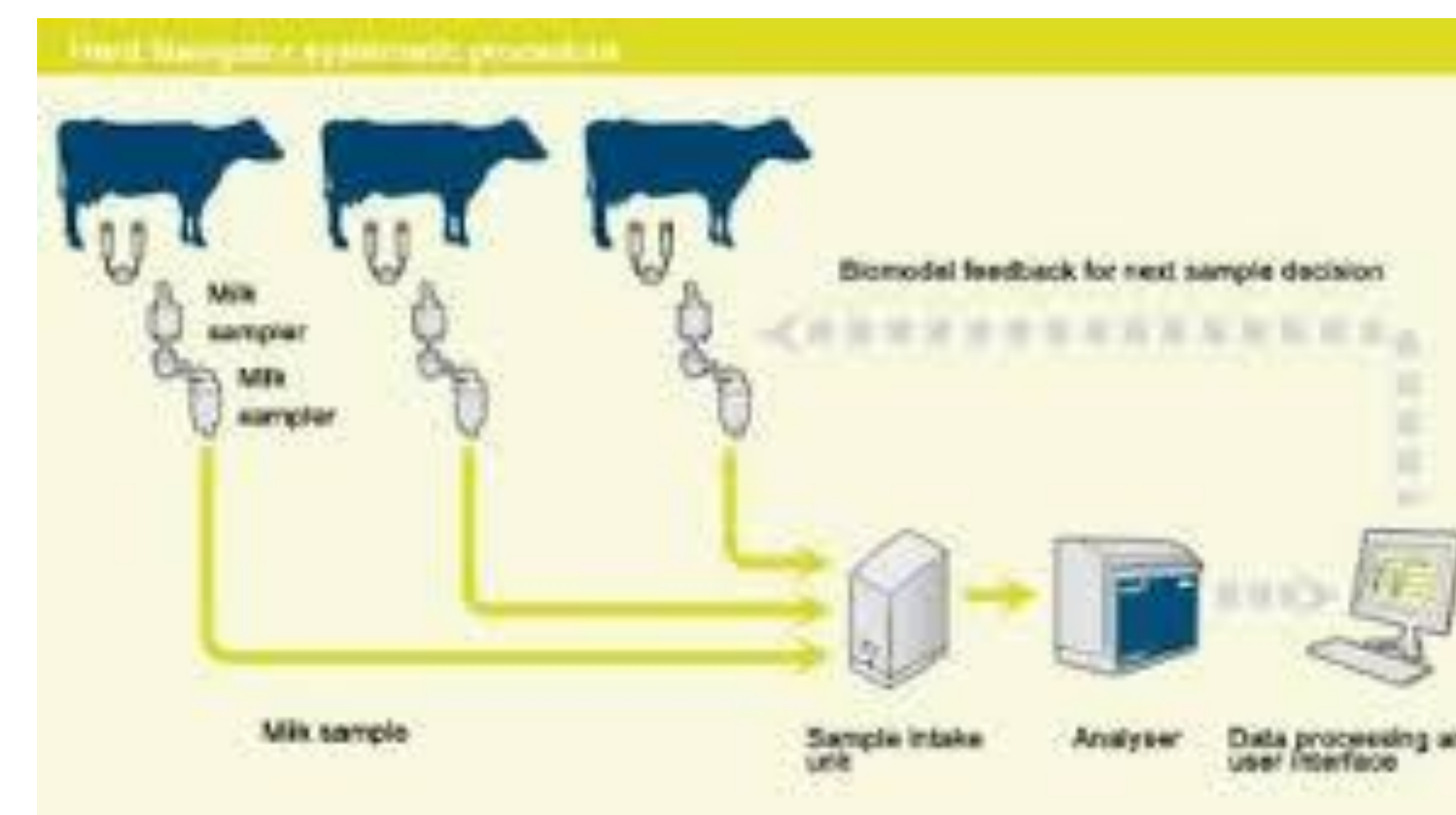


Technologies relay data to a software, many also have systems for sending mobile alerts right to a producer's cell phone

Other Systems



Current research is being conducted to determine the potential of thermal imaging as a body condition scoring tool.



On-farm milk analyzing technologies provide information that was previously only gathered once a month by third party milk testers. New systems provide milk data on a daily basis.



Getting the most out of a technology portfolio requires proper integration of the systems.

Objectives:

- Precision Dairy Farming is the integration of technologies to measure physiological, behavioral, and production indicators for individual animals to improve management strategies.
- This study has two different objectives.
 - Develop different technology portfolios. These portfolios will be designed with the help of technology experts and allow for the full spectrum of technologies to be evaluated and that are compatible with one another.
 - Modify the portfolio analysis approach to evaluate the portfolio of technologies that maximizes profit for the dairy operation.

Data and Methods:

- The University of Kentucky dairy is a testing and proving ground for many of these technologies that are currently available to producers in the US. There are also some technologies being evaluated that are not on the market yet.
- One of the complication with this data set is that each manufacturer has proprietary softwares which make them difficult to integrate. We are still working on the integration process.
- Additionally, each technology has a different sensitivity and specificity that we will account for in the weight for each technology.
- We propose to model this problem using a mean-variance approach where the expected return is:

$$R = \sum_{i=1}^n R_i w_i$$

- R is the total return, i represents each of the technologies, and w is the weight of each technology

Discussion and Future Work:

- Many companies in the dairy industry offer similar technologies. Investing in separate technologies that may have overlapping capabilities will not add to decision making capability.
- Investing in technologies that compliment each others' capabilities will add value to the dairy operation. In addition, daily herd management decisions will be more informed than pre-technology adoption.
- Current research evaluates technology investment one at a time. Producer's will need to evaluate technology investment looking at combinations.
- There are some compatability limitations with these technologies today. This issue is challenging companies to create technology that can be combined with current technology.