**Thisal’s Ideas**

**Moving Around Campus Efficiently**

Motivation/Interests

I see a lot of students on campus move on the walkways of campus using different methods. I’d like to see what is the best way to move around campus (preserving the most metabolic energy)?

Significance

Students use different modes of transportation on the campus walkways/paths. The main ones being walking, running, biking, skateboarding, and rollerblading/skating. Knowing which mode of transportation is uses less energy may encourage more students to use it.

Hypothesis

Students that rely on mobile transportation (uncertain which type) will save more energy than those that move on foot

Approach

Test how much energy is used for walking, running, biking, skateboarding, and rollerblading/skating by looking at metabolic energy expenditure and muscle activity for each type of action

**Injury Prevention While Blocking in Basketball**

Motivation/Interests

I used to play basketball a lot and one thing I notice is a lot of people end up tripping, falling, and in a lot of occasions, injuring themselves when the player they are guarding rapidly changes directions during motion. I’d like to look at what muscles most commonly get injured during this action and ways to protect or prevent those muscles from sustaining injury.

Significance

Identifying which muscles are at risk and how to protect them could help both players concerned with injury and may help children that are picking up the sport to know what to do to avoid injury in early practice.

Hypothesis

Muscle/tendons around the ankle joint are more prone to injury

Approach

Researching common injuries around guarding in basketball and identifying the most common muscle injuries. Developing proper stances or a brace to mitigate injury without decreasing performance

**Walking Up a Hill**

Motivation/Interests

Having to walk up the hill with while wearing a backpack on 17th Street/University Ave got me thinking, Is there an efficient way to walk up a hill while carrying a load on your back? Do you increase your stride length, add some spring-like motion into your strides, adjust certain joint angles? What is the best way to walk up the hill without expending too much energy?

Significance

Students that learn what the best way to walk up the hill with a load on their back may be able to traverse it with less difficulty in the future.

Hypothesis

Increasing stride length may lead to lowered costs of energy

Approach

Calculate metabolic energy expenditure of someone walking up a steep incline with a load on their back while adjusting different parameters of the walking gait cycle (stride length, joint movement, etc.)

**Tejas’ Ideas**

**Testing the effectiveness of pre-season training programs in preventing overuse injuries in soccer athletes**

Significance

Impacts long term health of athletes and could be used to establish training in other fields where repetitive stress injuries are common

Approach

We take the men’s & women’s soccer teams (say CU Boulder’s teams for instance) as participants and divide them into a control and test group. The test group receives additional pre-season training aimed at improving joint strength and maybe different recovery programs. Then we evaluate their performance at the beginning of pre-season, end of pre-season and end of regular season while also tracking any injuries and the nature of those injuries during evaluations.

Unanswered Questions

What exercise to use; performance indicators used; data collection methodology

Additional Research Questions

Which load/moment indicators can be used to spot early signs of overuse?

What is being done to prevent the most common post-retirement disabilities?

**Colten’ Ideas** (out of my two ideas, I’d like to submit the first one, “Is timing everything?”)

1) Is Timing Everything?

2) We enjoy playing many sports, most of which require timed coordination. We are interested in the following question because we would like to improve our athletics as much as possible.

3) Athletics brings in many participants, and a lot of money. Athletes and coaches are always looking for ways to improve. If we could lay out a blueprint to calculate the ideal timing for various activities, that would be very beneficial to the sports arena.

4) We understand that F=ma, so to increase the force, we must maximize the acceleration for a constant mass. However, we also know that there is a force-velocity relationship in contracting muscles, where the faster the movement, the smaller the force. So, which is it? Do we maximize force through acceleration or by slowing down the contraction of our muscles? Our goal is to find the sweet spot of generating the maximum force of a dynamic movement.

5) For simplicity purposes, we are going to restrict the movement to a squat jump, without the aid of our arms. We will have trials of participants jumping at different speeds. For each trial we will collect data of their ground reaction forces.

1) Optimizing Catching Ability

2) It’s never fun to drop the ball, disk, or any object that’s coming towards you that you would like to catch, yet it happens to the best of us, even the professionals. We understand the importance of practice, but is there more to the story? The motivation for this proposal is from the frustration of dropping objects while playing pass.

3) Many sports require tracking an object, whether it’s to kick, catch, hit, or something else. The ability to optimize one’s tracking abilities is ideal in many sports and activities.

4) Tracking an object is a combination of using our senses, and predictions. This experiment will focus on our senses. We know that human’s visual tracking is better at tracking objects going from side to side compared to toward or away from the viewer. With this knowledge, would simply turning one’s body or head at an angle to an approaching object improve the ability to accurately track its position? And therefore improve the probability of making contact with the object?

5) To minimize variability, we would use some sort of ball launcher to send an object towards the participant. Each participant would get many attempts to catch the ball at each location. One would be directly in front of the oncoming ball, and the other would be slightly off line from the oncoming ball. We would calculate which orientation had a higher percentage of catches vs drops.

**Rohit’ Ideas**

**Classification of orthopedic patients with impairment such as Disk Hernia or Spondylolisthesis and minimization of joint dislocation after surgery.**

**Motivation:**

What are the criterias for identification of orthopedic impairment in an individual? And which implant positioning can be suggested to a surgeon for knee and hip joint replacements?

**Significance:**

The dynamic models developed by us will help to predict movement biomechanics before and after an orthopedic surgery and our objective will be to minimize the risk of joint dislocation or discomfort after surgery.

**Approach:**

Classification of patients into different orthopedic impairments using data sources available on the internet. The datasets consist of dynamic body features of hip and knee joint location. Developing multi-body dynamic models and algorithms to predict the best implant location after the classification of patients.

**Caveats:**

We should have good contextual knowledge for this idea and probably for other ideas as well which you guys have shared.

**Ranking for submission**: Choose top 3

Walking up a hill, Is Timing Everything, Optimizing Catching Ability

Thisal’s Ranking: 1) Walking Up a Hill

2) Timing is Everything

3) Effectiveness of Pre-Season Training

4) Optimizing Catching Ability

5) Moving Around Campus Efficiently

Colten’s Ranking: 1)

2)

3)

4)

5)

Rohit’s Ranking: 1) Classification of orthopedic patients and minimization of discomfort

2) Optimizing Catching Ability

3) Walking Up a Hill

4) Effectiveness of Pre-Season Training

5) Injury Prevention While Blocking in Basketball

Tejas’ Ranking: 1)

2)

3)

4)

5)