**Аномальные объекты.**

Объекты выборки описывается набором из количественных признаков . Требуется найти центр гипершара и радиус , охватывающего всю выборку кроме аномальных объектов-выбросов. Минимизация радиуса гипершара и суммы штрафов за выход из шара определяется по критерию

где расстояние по метрике Евклида, функция потерь , .

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**Anomal ob'ektlar.**

Obyektlari *n* ta miqdoriy alomatlar to‘plami bilan tavsiflangan tanlanma berilgan. Gipershar markazini va radius *r* ni topish talab qilinadi, bu anomal ob'ektlardan tashqari butun tanlanmani qamrab oladi. Gipershar radiusi *r* ning minimallashtirilishi va undan tashqariga chiqish uchun jarimalar yig‘indisi quyidagi mezon bo‘yicha aniqlanadi

bu yerda masofa Evklid metrikasiga ko‘ra, yo‘qotish funksiyasi , .

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**Anomalous objects.**

The objects of the sample are described by a set of *n* quantitative features . It is required to find the center of the hypersphere

and the radius *r*, covering the entire sample except for the anomalous outlier objects. Minimization of the radius of the hypersphere *r* and the sum of penalties for leaving the sphere is determined by the criterion

where is the distance according to the Euclidean metric, the loss function , .

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*English\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

This formulation describes an optimization problem to find the minimum enclosing hypersphere that covers most of the sample , except for potential anomalous outliers. The goal is to minimize both the radius and the penalty for points lying outside the sphere. Let's break it down:

**Problem Formulation**

1. **Given:**
   * A dataset in an -dimensional space.
   * Each object is described by quantitative features .
   * A hypersphere with center and radius needs to be determined.
2. **Objective:**
   * Find the optimal center and radius *r* such that most points are inside the hypersphere while minimizing the hypersphere radius and penalty for outliers.
   * The criterion function to minimize is:
   * where:
     + is the squared Euclidean distance.
     + The loss function is given by , meaning that points outside the sphere contribute negatively to the objective.

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*Uzbek\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

1. Berilganlarni tayyorlab olish. Normallashtirish. Ya’ni [-1, 1] oraliqqa tushirib olish.

Bunda – x qiynat joylashgan ustunning max va min qiymatlari. Normallashtirishdan so’ng berilgan tanlanmadagi alomatlar [-1, 1] oraliqqa o’tkaziladi.

1. Berilganlar bo’yicha gipersharning dastlabki markazini *C* topib olamiz. Bunda har bir obyekt alomatlari bo’yicha o’rtacha qiymatlari olib chiqiladi.
2. Topilgan dastlabki *C* markazdan barcha obyektlargacha bo’lgan Evklid masofalarni hisoblab olamiz . Bu masofalarning o’rtachasi dastlabki radius *r* ni hisoblaymiz.
3. Topilgan r va C bo’yicha optimallashtirish formulasi hisoblanadi:

bu mezon bo’yicha.

1. Gipersharni ichida() yotuvchi obyektlarga nisbatan markazni *C* qayta topamiz.
2. Yangi markaz C bo’yicha radius r qayta hisoblanadi.
3. Yana optimallashtirish formulasini hisoblaymiz. Bu jarayon keyingi qiymat avvalgisidan katta bo’lib qolguncha davom ettiramiz.