

# A Study on Secure Online Voting System using Biometrics Face Detection and Recognition Algorithms

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## ABSTRACT

Voting is one of the social issues for recent self-governing country. Physical voting systems have been followed for election since many years. In case of conventional voting system, voters are given a ballot paper and they have to reach the places they are allotted such as polling booths to cast their votes. This conventional method of voting have certain drawbacks such as lack of security, huge manpower is needed to retain discipline, large amount of time consumption to cast vote. To overcome these problems in conventional voting system Electronic Voting System is introduced and the voting data is stored in digital format in database and the voting can be done either in online through internet or in offline using SMS. the intent of this study is to serve an electronic voting system along with biometric technology using face detection and recognition that produce high security by detecting , recognizing and verifying their faces as their authenticity and compare the face with the image and details of an individual already stored in the server database as well as in the PC and verify the match and if the face image is coincide or match with the image already stored in the database then the person is permit to cast their vote to the candidate they willing to choose. This study deals with various face detection and recognition algorithms and techniques to provide more reliable and securable user friendly system for E-Voting.

**Keywords:** Electronic Voting System, face detection, recognition and authenticity, high secure and reliable system.

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## I. INTRODUCTION

### 1.1 BIOMETRICS:

Biometrics system implies self executing detection and recognition of a person by their unique features as corporeal and etiquettes of an individual. This system provides an authentic system which detects and recognizes a person and confirms their authenticity. This system is extensively used in different applications such as schools, colleges, office for security purpose and it is also used in E-voting system in various countries such as America, France etc. It uses a variety of

unique features of an individual's to provide authenticity. The various commonly used unique features in biometrics and comparison of various biometric technologies are tabulated below

BIOMETRIC FEATURES	DESCRIPTIONS
Infrared thermo gram (facial, hand or hand vein)	It is feasible feature to trap the sample of heat exhausted from the body of an individual using an infrared camera. Then that sample is taken as a unique feature for each individual.

Gait	It is the unusual way which specifies the style of walking and it is a difficult spatial-temporal biometrics.
Keystroke	It depends on the persons typing characteristics on keyboard. Keystroke is a behavioral biometric; for several persons, one could look forward to examine huge difference in classical typing patterns.
Fingerprint	Fingerprint is a blueprint of ridges and furrows positioned resting on the tip of every finger. Fingerprints were worn in favor of own Identity of an individual for several decades and the identical precision was very high
Face	Face is the unique biometric feature of a person or an individual which uses face for personal recognition and identification, therefore the suggestion is to use facial biometric in technology.
Retina	Retina creates an "eye signature" from the vascular pattern of the retina that is thought to be a unique feature of each human being and each eye, respectively. so it is not simple to modify or duplicate the retinal vasculature and it is one of the most secure biometric.
Iris	The iris starts that outward appearance at the third month of development and the structure making its outline are mostly full at the eighth month. Iris scanning is not as much of interfering than retinal scanning because the iris is simply detectable from some meters away and it is different for identical twins so it is used in biometric identification.
Palm print	Like fingerprints, palms of an individual's hands having distinctive sample of ridges and valleys. While palm is bigger than a finger, palm print is probable to be constant and more reliable than fingerprint.
Voice	The characteristic of an individual's voice depend on corporal features such as vocal tracts, mouth, nasal cavities and lips which cause sound. These features of human speech are constant for an individual, but the etiquette component varies over time due to age, medical condition and emotional state.

Signature	Signature is a easy, tangible expression of the exceptional variations in person hand geometry. The manner an individual signs his or her name is identified to be feature of that person. Signatures are the behavioral biometric that transform over a era of instance and are inclined by objective and emotional situation of a theme.
DNA	Deoxyribonucleic acid (DNA) is possibly the most consistent biometrics. a one-dimensional code that is different for each person except for the identical twins. The DNA matching are widely used in forensic applications.

## II. VARIOUS ALGORITHMS USED FOR FACE DETECTION AND RECOGNITION

### 2.1 FACE DETECTION:

The most important purpose of face detection is given in two steps as follows.,

1. Whether human faces appear in a given image.
2. Where these faces are located at.

The anticipated yield of these means is check that contains every single part face in the information picture. With a specific end goal to make additionally confront acknowledgment framework more powerful and simple to configuration, confront arrangement are per shaped to legitimize the scales and introductions of these patches. Other than filling in as the pre-preparing for face acknowledgment, confront identification could be utilized for region-of-intrigue discovery, retargeting, video and picture arrangement, and so on.

### 2.2 FACE RECOGNITION:

Face recognition is a task of identifying an already detected face as a known or unknown face and in more advanced cases telling exactly who it is..A facial acknowledgment calculation can likewise be utilized to do "lights-out" face distinguishing proof. This requires use of a high choice edge that actualizes a selectivity approach. Here an edge is received that gives, on the normal, a specific number of false hopefuls per seek. For the most precise face acknowledgment calculation tried here, on the off chance that one in two quests deliver a false applicant by and large, the hit rate will be 89%. In the event that workload requests on human adjudicators require that just a single in

ten ventures create a false applicant, the hit rate diminishes to 85% and an alternate calculation is best in this administration. These numbers apply to a populace of 1.6M. The limit should be evaluated over an adjustment procedure. This limit should be expanded as the enlisted populace increments. On these pictures, the face acknowledgment exactness comes announced here will be firmly prescient of those that would be experienced in any close term sending. In the wake of formulizing the portrayal of each face, the last stride is to perceive the characters of these countenances. Keeping in mind the end goal to accomplish programmed acknowledgment, a face database is required to manufacture.

### 2.3 FACTORS OF HUMAN APPEARANCE VARIATIONS:

There are a few figures those outcome challenges of face identification and face acknowledgment. But the conceivable low quality driven from the picture securing framework, we concentrate on the point of human appearances taken by the camera and the earth of photograph procurement. There are by and large six variables we have to concern: (1) illumination, (2) face pose, (3) face expression, (4) RST (rotation, scale, and translation) variation, (5) clutter background, and (6) occlusion. Table 6 lists the details of each factor.

Illumination	The enlightenment variety has been broadly talked about in many face location and acknowledgment looks into. This variety is brought about by different lighting situations and is said to have bigger appearance contrast than the distinction created by various identities. The case of light changes on pictures of a similar individual, and it's clearly that under some enlightenment conditions, we can neither guarantee the ID nor precisely bring up the places of facial elements.
Pose	The posture variety comes about because of various edges and areas during the picture procurement handle. This variety changes the spatial relations among facial components and causes genuine mutilation on the conventional appearance-based face

	acknowledgment calculations, for example, Eigen faces and fisher faces.
Expression	Human uses diverse outward appearances to express their emotions or tempers. The expression variety brings about the spatial relation change, as well as the facial-highlight shape change.
RST variation	The RST (turn, scaling, and interpretation) variety is likewise brought on by the variety in picture procurement prepare. It brings about troubles both in face location and acknowledgment, and may require comprehensive seeking in the recognition procedure over all conceivable RST parameters.
Cluttering	Notwithstanding the over four varieties which result in changes in facial appearances, we additionally need to consider the impact of environments and foundations around individuals in pictures. The jumbling foundation influences the exactness of face discovery, and face patches including this foundation additionally decrease the execution of face acknowledgment calculations.
Occlusion	The impediment is conceivably the most troublesome issue in face recognition and face discovery. It implies that a few sections of human countenances are in secret, particularly the facial elements.

### III. FACE DETECTION AND RECOGNITION ALGORITHMS

#### 3.1 GABOR FILTER:

Gabor channel calculation is a face perceiving algorithm is a direct channel utilized for edge location. Recurrence and introduction portrayals of Gabor channels are like those of the human visual framework, and they have been observed to be especially proper for surface portrayal and

separation. In the spatial area, a 2D Gabor channel is a Gaussian part work adjusted by a sinusoidal plane wave. Calculation is as per the following

1) The voter's image which is captured using a webcam is used as the input to the face detection algorithm.

2) Before entering image to Gabor filters, it must be normalized by three steps as show in Figure 2.

a) Input image is resized to  $128 \times 128$ .

b) Pixel adjustment, in this step, Image Pixel intensities are used, such that the standard deviation of Image Pixel is one.

c) Borders are smoothed, across band 30 pixels wide and they are weighted by an aspect  $d = 30$ , where  $d$  is distance of image edge.

3) Gabor filter algorithm consists of 40 filter used to detect faces from the captured image; the proposed system applied different Gabor filters on the image to generate 40 images with different angles and orientation.

4) Next, maximum intensity points in each filtered image are calculated and marked as fiducial points. If the distance is minimum between these face points then system reduces the points. The next step is calculating the distances between the reduced points using distance formula. At last, the calculated distances are compared with Gabor database. If match occurs, it means that the image is recognized as a face.

5) Then, Gabor filters are applied on the input images

### **3.2 EIGEN FACE:**

Eigen faces is the name given to an arrangement of eigenvectors when they are utilized as a part of the PC vision issue of human face recognition. The eigenvectors are gotten from the covariance lattice of the likelihood circulation over the high-dimensional vector space of face pictures. The Eigen faces themselves frame a premise set of all pictures used to develop the covariance lattice. This produces measurement diminishment by permitting the littler arrangement of premise pictures to speak to the first preparing pictures. Grouping can be accomplished by looking at how countenances are spoken to by the premise set.

Eigen face gives a simple and modest approaches to acknowledge confront acknowledgment in that:

- Its preparing procedure is totally programmed and simple to code.
- Eigen face satisfactorily diminishes factual many-sided quality in face picture portrayal.

• Once Eigen faces of a database are computed, confront acknowledgment can be accomplished progressively.

• Eigen face can deal with extensive databases.

Be that as it may, the inadequacies of the Eigen face strategy are likewise self-evident:

• Very touchy to lighting, scale and interpretation; requires an exceedingly controlled condition.

• Eigen faces experiences issues catching expression changes.

The most critical Eigen faces are overwhelmingly about lighting up encoding and don't give profitable information as for the genuine face. To adapt to brightening diversion practically speaking, the Eigen face strategy more often than not disposes of the initial three Eigen faces from the dataset. Since enlightenment is generally the cause behind the biggest varieties in face pictures, the initial three Eigen faces will chiefly catch the data of 3-dimensional lighting changes, which has little commitment to face acknowledgment. By disposing of those three Eigen faces, there will be a fair measure of lift in precision of face acknowledgment, yet different strategies, for example, Fisher faces and Straight space still have the preferred standpoint.

### **3.3 PCA :( Principal Component Analysis)**

Principal Component Analysis (PCA) is a measurable method that uses an orthogonal change to change over an arrangement of perceptions of potentially corresponded factors into an arrangement of estimations of directly uncorrelated factors called vital segments (or once in a while, primary methods of variety). The quantity of foremost segments is not exactly or equivalent to the littler of (number of unique factors or number of perceptions). This change is characterized such that the primary essential part has the biggest conceivable fluctuation (that is, records for however much of the inconstancy in the information as could reasonably be expected), and each succeeding segment thus has the most elevated difference conceivable under the imperative that it is orthogonal to the former segments. The subsequent vectors are an uncorrelated orthogonal premise set. PCA is delicate to the relative scaling of the first factors. PCA is for the most part utilized as an apparatus in exploratory information examination and for making prescient models. PCA should be possible by Eigen value disintegration of an information

covariance (or relationship) framework or solitary esteem deterioration of an information network, for the most part after mean focusing (and normalizing or utilizing Z-scores) the information grid for each attribute.[4] The aftereffects of a PCA are generally talked about as far as segment scores, some of the time called consider scores (the changed variable qualities comparing to a specific information point), and loadings (the weight by which each institutionalized unique variable ought to be duplicated to get the segment score).[5] PCA is the least complex of the genuine eigenvector-based multivariate investigations. Regularly, its operation can be considered as uncovering the inner structure of the information in a way that best clarifies the difference in the information. On the off chance that a multivariate dataset is envisioned as an arrangement of directions in a high-dimensional information space (1 hub for every variable), PCA can supply the client with a lower-dimensional picture, a projection or "shadow" of this protest when seen from its (in some sense; see underneath) most useful perspective. This is finished by utilizing just the initial few important segments so that the dimensionality of the changed information is decreased.

### **3.4 NHA:**

This Standardization is a procedure that progressions the scope of pixel power values. Applications incorporate photos with poor complexity because of glare, for instance. Standardization is at times called differentiate extending or histogram extending. In more broad fields of information preparing, for example, advanced flag handling, it is alluded to as dynamic range expansion. The motivation behind element run development in the different applications is more often than not to bring the picture, or other sort of flag, into a range that is better known or ordinary to the faculties, subsequently the term standardization. Frequently, the inspiration is to accomplish consistency in element extend for an arrangement of information, flags, or pictures to stay away from mental diversion or weariness. For instance, a daily paper will endeavor to make the majority of the pictures in an issue share a comparative scope of grayscale. The histogram of arranged angles (Hoard) is an element descriptor utilized as a part of PC vision and picture handling with the end goal of question recognition. The system includes events of inclination introduction confined bits of a picture. This technique is like that of edge introduction histograms,

scale-invariant component change descriptors, and shape settings, yet varies in that it is registered on a thick framework of consistently dispersed cells and utilizations covering neighborhood differentiate standardization for enhanced precision. Histogram evening out frequently creates implausible impacts in photos; be that as it may it is exceptionally valuable for logical pictures like warm, satellite or x-beam pictures, regularly a similar class of pictures to which one would apply false-shading. Additionally histogram adjustment can deliver undesirable impacts (like noticeable picture inclination) when connected to pictures with low shading profundity. For instance, if connected to 8-bit picture showed with 8-bit dark scale palette it will additionally lessen shading profundity (number of interesting shades of dim) of the picture. Histogram evening out will work the best when connected to pictures with considerably higher shading profundity than palette estimate, as consistent information or 16-bit dim scale pictures.

### **3.5 FISHER FACES:**

The Fisher faces got with the approach portrayed so far depend on the direct suspicion specified previously. This supposition holds when the classes are homoscedastic Normal's. When all is said in done, this suspicion is disregarded. To determine this issue, one can include another metric into the condition. The objective of this new metric is to outline unique heteroscedastic (which means with various covariance) issue into a homoscedastic one. This mapping capacity can be changed over into a piece mapping because of the Representer's Hypothesis. What's more, the metric is given by the Gram (or Bit) framework. Thus, this option strategy is called Piece LDA (or, KLDA for short). A few creators have additionally characterized heteroscedastic measures of inside and between-class contrasts. However, another contrasting option to decrease the Typical supposition is to speak to the examples in each class as a blend of Ordinary dispersions. In this approach, the trap is the means by which to decide the quantity of blends per class. A prevalent arrangement is given by the calculation Subclass Discriminant Investigation (SDA) and its part augmentation KSDA. Piece strategies are by and large favored when the quantity of preparing tests is adequately vast to encourage the learning of the nonlinear mapping.

### **3.6 ICA:**

Free part examination (ICA) is a computational technique for isolating a multivariate flag into added substance subcomponents. This is finished by accepting that the subcomponents are non-Gaussian signs and that they are factually autonomous from each other. ICA is a unique instance of visually impaired source partition. A typical case application is the "mixed drink party issue" of tuning in on one individual's discourse in a loud room. Free segment examination endeavors to deteriorate a multivariate flag into autonomous non-Gaussian signs. For instance, sound is typically a flag that is made out of the numerical expansion, at each time  $t$ , of signs from a few sources. The question then is whether it is conceivable to isolate these contributing sources from the watched add up to flag. At the point when the factual freedom supposition is right, dazzle ICA detachment of a blended flag gives great results.[citation needed] It is additionally utilized for signs that shouldn't be produced by a blending for examination purposes. A straightforward use of ICA is the "mixed drink party issue", where the basic discourse signs are isolated from specimen information comprising of individuals talking at the same time in a room. Normally the issue is streamlined by accepting no time delays or echoes. An essential note to consider is that if  $N$  sources are available, at any rate  $N$  perceptions (e.g. mouthpieces) are expected to recuperate the first flags. This constitutes the square case ( $J = D$ , where  $D$  is the info measurement of the information and  $J$  is the measurement of the model). Different instances of underdetermined ( $J > D$ ) and over determined ( $J < D$ ) have been examined.

That the ICA detachment of blended signs gives great outcomes depends on two suppositions and three impacts of blending source signals. Two suspicions:

1. The source signs are free of each other.
2. The values in each source flag have non-Gaussian circulations.

Three impacts of blending source signals:

1. Independence: according to supposition 1, the source signs are autonomous; notwithstanding, their flag blends are definitely not. This is on account of the flag blends have a similar source signals.
2. Normality: As per As far as possible Hypothesis, the dispersion of a whole of autonomous irregular factors with limited change tends towards a Gaussian circulation. Freely, a whole of two autonomous irregular factors for the most part has a conveyance that is nearer to Gaussian than any

of the two unique factors. Here we consider the estimation of each flag as the irregular variable.

3. Complexity: The transient many-sided quality of any flag blend is more noteworthy than that of its least difficult constituent source flag. Those standards add to the fundamental foundation of ICA. On the off chance that the signs we happen to separate from an arrangement of blends are autonomous like sources flags, or have non-Gaussian histograms like source flags, or have low many-sided quality like source signs, then they should be source signals

### 3.7 VIOLA JONES:

The Viola-Jones question discovery structure is the principal protest recognition system to give aggressive protest identification rates progressively proposed in 2001 by Paul Viola and Michael Jones.[1][2] In spite of the fact that it can be prepared to distinguish an assortment of protest classes, it was persuaded essentially by the issue of face location. The attributes of Viola-Jones calculation which make it a decent recognition calculation are:

- Robust - high discovery rate (genuine positive rate) and low false-positive rate dependably.
- Real time - For down to earth applications no less than 2 outlines for each second should be handled.
- Face identification just (not acknowledgment) - The objective is to recognize faces from non-confronts (discovery is the initial phase in the acknowledgment procedure).

The calculation has four phases:

1. Haar Component Choice
2. Creating a Necessary Picture
3. Ada lifts Preparing
4. Cascading Classifiers

The components looked for by the recognition system generally includes the wholes of picture pixels inside rectangular regions. Thusly, they look to some extent like Haar premise capacities, which have been utilized already in the domain of picture based question detection.[3] In any case, since the components utilized by Viola and Jones all depend on more than one rectangular region, they are for the most part more perplexing. The figure on the privilege outlines the four unique sorts of components utilized as a part of the system. The estimation of any given component is the aggregate of the pixels inside clear rectangles subtracted from the total of the pixels inside shaded rectangles. Rectangular elements of this sort are primitive when contrasted with choices, for example, steerable channels. Despite the fact that they are touchy to vertical and

level components, their input is impressively coarser.

1. Haar Features – All human faces share some similar properties. These regularities may be matched using **Haar** Highlights.
2. A couple of properties basic to human appearances:

- The eye area is darker than the upper-cheeks.

- The nose connect district is brighter than the eyes.

Structure of properties framing match able facial elements:

- Location and size: eyes, mouth, scaffold of nose

- Value: situated angles of pixel forces

The four components coordinated by this calculation are then looked for in the picture of a face (appeared at left).

Rectangle features:

- Value =  $\Sigma$  (pixels in dark zone) -  $\Sigma$  (pixels in white range)
- Three sorts: two-, three-, four-rectangles, Viola and Jones utilized two-rectangle highlights
- For illustration: the distinction in splendor between the white & black rectangles over a particular zone
- Each highlight is identified with an extraordinary area in the sub-window

3. A picture portrayal called the vital picture assesses rectangular elements in steady time, which gives them an extensive speed advantage over more advanced option highlights. Since each component's rectangular range is constantly nearby no less than one other rectangle, it takes after that any two-rectangle highlight can be figured in six exhibit references, any three-rectangle include in eight, and any four-rectangle include in nine. The basic picture at area (x, y), is the entirety of the pixels above and to one side of (x, y), comprehensive.

### 3.8 LOCAL BINARY PATTERN:

The first LBP administrator names the pixels of a picture with decimal numbers, called Nearby Parallel Examples or LBP codes, which encode the

neighborhood structure around every pixel. It continues hence, as represented in Fig.1: Every pixel is contrasted and its eight neighbors in a 3x3 neighborhood by subtracting the inside pixel esteem; The subsequent entirely negative qualities are encoded with 0 and the others with 1; A parallel number is gotten by connecting all these twofold codes in a clockwise course beginning from the upper left one and its relating decimal esteem is utilized for naming. The determined twofold numbers are alluded to as Nearby Double Examples or LBP codes.

### 3.9 ADAPTIVE BOOST ALGORITHM:

Ada Boost, another way to say "Versatile Boosting", is a machine learning meta-calculation planned by You Freund and Robert Schapire who won the Gödel Prize in 2003 for their work. It can be utilized as a part of conjunction with numerous different sorts of learning calculations to enhance their execution. The yield of the other learning calculations ('feeble learners') is joined into a weighted whole that speaks to the last yield of the helped classifier. Ada Boost is versatile as in consequent powerless learners are changed for those occasions misclassified by past classifiers. Ada Boost is touchy to loud information and anomalies. In a few issues it can be less vulnerable to the over fitting issue than other learning calculations. The individual learners can be feeble, yet the length of the execution of everyone is somewhat superior to anything irregular speculating (e.g., their blunder rate is littler than 0.5 for parallel order), the last model can be demonstrated to focalize to a solid learner. While each learning calculation will tend to suit some issue sorts superior to others, and will ordinarily have various parameters and setups to be balanced before accomplishing ideal execution on a dataset, Ada Boost (with choice trees as the frail learners) is frequently alluded to as the best out-of-the-crate classifier.

### 3.10 KERNEL METHOD:

Portion strategies are a class of calculations for example examination, whose best known part is the bolster vector machine (SVM). The general undertaking of example examination is to discover and concentrate general sorts of relations (for instance groups, rankings, key segments, connections, arrangements) in datasets. For some calculations that comprehend these assignments, the information in crude portrayal must be expressly changed into highlight vector portrayals by means of a client indicated include delineate: differentiate, piece strategies require just a client

determined bit, i.e., a similitude work over sets of information focuses in crude portrayal. Piece techniques owe their name to the utilization of bit capacities, which empower them to work in a high-dimensional, certain component space while never figuring the directions of the information in that space, yet rather by essentially processing the internal items between the pictures of all sets of information in the element space. This operation is regularly computationally less expensive than the unequivocal calculation of the directions. This approach is known as the "part trap". Part works have been presented for arrangement information, charts, content, pictures, and additionally vectors. Calculations fit for working with parts incorporate the piece perception, bolster vector machines (SVM), Gaussian procedures, chief segments investigation (PCA), sanctioned connection examination, edge relapse, otherworldly grouping, direct versatile channels and numerous others. Any direct model can be transformed into a non-straight model by applying the portion trap to the model: supplanting its elements (indicators) by a bit work.

### **3.11 HIDDEN MARKOV MODEL**

A concealed Markov show (Well) is a measurable Markov display in which the framework being demonstrated is thought to be a Markov procedure with in secret (shrouded) states. A Well can be exhibited as the least difficult element Bayesian system. In less difficult Markov models (like a Markov chain), the state is straightforwardly obvious to the onlooker, and in this manner the state move probabilities are the main parameters. In a concealed Markov show, the state is not straightforwardly obvious, but rather the yield, reliant on the state, is unmistakable. Each state has likelihood dissemination over the conceivable yield tokens. Accordingly, the succession of tokens produced by a Well gives some data about the arrangement of states. The descriptor "concealed" alludes to the state succession through which the model passes, not to the parameters of the model; the model is still eluded to as a "shrouded" Markov show regardless of the possibility that these parameters are known precisely. Concealed Markov models are particularly known for their application in fleeting example acknowledgment, for example, discourse, penmanship, motion recognition, grammatical form labeling, melodic score following, incomplete discharges and bioinformatics. A shrouded Markov model can be viewed as a speculation of a blend model where the

concealed factors (or inactive factors), which control the blend segment to be chosen for every perception, are connected through a Markov procedure as opposed to free of each other. As of late, concealed Markov models have been summed up to pair wise Markov models and triplet Markov models which permit thought of more mind boggling information structures and the demonstrating of no stationary information.

### **IV. CONCLUSION**

Several algorithms for online voting system are studied related to E-Voting using biometrics. Among these above studied algorithms the efficiency of Eigen face algorithm is better than other algorithms. So I here conclude this study by using Eigen face algorithm for my proposed voting system for better efficiency. This give powerful and dependable easy to understand encoded secure framework for E-Voting which permit the perceived voter to cast their votes through cell phone and also through PC associated in system. Here Eigen face efficiency demonstrate procedures are recommend to give exceedingly secured, more dependable and vigorous E-Voting Framework. It likewise enhances proficiency of the framework and to give easy to understand condition to voters to cast their profitable votes.

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